

## Critical Education: Navigating Misinformation and Controversial Issues

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**Abstract:** In a world increasingly shaped by misinformation and polarization, education should equip individuals to critically engage with sensitive and controversial issues (SCI). This symposium addresses key challenges in navigating these, offering innovative frameworks and strategies to enhance critical thinking, foster resilience against misinformation, and promote constructive dialogue. Contributions explore the role of social identity in shaping openness to diverse perspectives, the productivity of non-convergent discussions in fostering deeper understanding, and the impact of group membership on attitude change and argument evaluation. Additionally, the symposium examines the tension faced by educators in addressing SCIs and provides actionable insights to transform challenges into opportunities for meaningful engagement.

### Introduction

In a world increasingly marked by misinformation and polarization, education faces the crucial challenge of preparing individuals to navigate sensitive and controversial issues (SCIs). These issues span diverse domains, from social-scientific topics like climate change and nuclear energy to ethical debates on gender orientation and cultural identity. Unlike subjects with clear-cut answers, SCIs often require engagement with multifaceted perspectives and critical evaluation of complex evidence. Arising under conditions of heightened societal tension, SCIs highlight the need for deeper understanding and effective educational approaches for sustainable solutions.

A key challenge in SCIs is that evaluating complex evidence often exceeds an individual's expertise. As our knowledge is limited, we rely on experts and their epistemic judgements (Nichols, 2017). The central challenge for non-experts is whom to trust. This is amplified by the rapid spread of misinformation on social media, where false information travels faster than truth (Vosoughi et al., 2018). Solutions lie beyond generic critical tools, but in equipping “competent outsiders” with strategies and an understanding of social practices of science to navigate a misinformation-saturated environment.

Another challenge is that polarization stems not just from a lack of scientific understanding but from conflicts of cultural values and group interests. This is worsened by individuals' ability to interpret science to align with their group's beliefs, making purely informational communication strategies insufficient. Paradoxically, greater scientific literacy can exacerbate polarization, as literate individuals are more adept at selectively interpreting information to support their group's beliefs (Kahan et al., 2012). Group affiliations strongly shape openness to different perspectives, reinforcing existing beliefs and hindering dialogue, thus exacerbating polarization (Social Identity Theory; Tajfel & Turner, 1979). Therefore, there is a need to better understand ingroup-outgroup effects on attitude change and evaluation of arguments.

SCIs often involve non-convergent discussions that allow multiple conflicting perspectives to coexist without aiming for consensus. In these contexts, disagreement can foster deep exploration of ideas, dialogic agency, and the appreciation of diverse viewpoints, but it can also escalate social tensions and reduce discussion quality (Wise & Chiu, 2011). Importantly, convergence is not necessarily a measure of productive interaction in these discussions, as productive outcomes can include enhanced understanding or co-construction of knowledge without agreement (Parker, 2023). Despite this potential, there is a lack of robust frameworks to measure the productivity of such discussions, particularly how specific disagreement strategies influence cognitive-epistemic and socio-emotional dimensions of interaction (Asterhan, 2013). Addressing this gap requires analytical tools to

evaluate how disagreement unfolds and impacts learning and attitudes, fostering more constructive engagement in SCIs.

In different countries, students learn to debate on a voluntary basis, parallel to the main curriculum. When addressing such topics in the classroom, educators face unique challenges, as these issues often generate significant classroom tension, particularly in diverse classrooms. Teachers frequently experience pedagogic frailty, adopting avoidance strategies to minimize discomfort and tension, which can hinder meaningful engagement with SCIs (Kinchin et al., 2016). This difficulty stems from the inherently sensitive and multifaceted nature of SCIs, which encompasses scientific, personal, and societal dimensions, such as religion, cultural identity, and ethical dilemmas (Geldof, 2018). Educators try to leverage SCIs to foster multiperspectivism and argumentation skills; however, lacking comprehensive frameworks, they often rely on ad hoc methods, limiting opportunities to transform tension into productive engagement. This symposium brings together four contributions that address these challenges from diverse perspectives, offering insights into fostering critical thinking, resilience against misinformation, constructive engagement with controversial issues. To this end, we pose the following questions: How can education equip individuals to critically evaluate complex scientific information in an age of misinformation? How do group identities influence attitude change and the evaluation of arguments in controversial debates? How do specific disagreement strategies impact the productivity of non-convergent discussions? What are the determinants of classroom tension when teaching SCIs, and how can educators transform this tension into productive engagement?

## Science education in an age of misinformation

Jonathan Osborne

Across the globe, there is an increasing concern about the way the internet can be used to spread false information to undermine trust in science. To date, science education has taken the view that an internal understanding of “How Science Works” (Lederman, 2007; Sinatra & Hofer, 2021) is sufficient for informed evidence-based judgements. However, our knowledge is bounded (Simon, 1966), making us intellectually dependent on the expertise of others (Hardwig, 1985; Nichols, 2017). Thus, we are forced to place our trust in experts and their epistemic judgments. In the case of science, it is scientists who “are our designated experts” (Oreskes, 2019).

For the scientific community, despite 400 years of the Enlightenment project which has seen enormous advances in our understanding of the material world, our health, lifespan and material comfort (Pinker, 2018), the calling into question of evidence-based beliefs is both problematic and puzzling. As Siegel argues, “the rationality of science is secured by its commitment to evidence; the fostering of a commitment to evidence is a fundamental educational aim... and science education can and should be seen as a central component of an education dedicated to the fostering of rationality and critical thinking” (Siegel, 1989). One explanation is that elite groups use mass culture to impose a set of corrupting beliefs on uncritical masses (Reid & Norris, 2016). Another argument is that such beliefs are a measure of identity and essential for acceptance within a community (Kahan et al., 2012). Faced with a choice between rational belief and exclusion from a community, individuals behave rationally and accept a seemingly irrational belief.

Underlying this growing concern is the use of social media to present and circulate false beliefs. Traditional sources of information, which historically had gatekeepers, have been displaced by unregulated open access on the Internet and social media which bypasses experts and certified authorities (Höttecke & Allchin, 2020; Kozyreva et al., 2020; Vosoughi et al., 2018). Vosoughi et al. found that “it took the truth about six times as long as falsehood to reach 1500 people” and 20 times as long as falsehood to reach the same audience”. In short, misinformation spreads faster and is more novel. How then does the individual sort truth from falsehood or deceptive half-truth? Particularly as knowledge becomes actively transformed, reconfigured, and recontextualized as it travels through communication networks.

There are currently two extant approaches to addressing the challenge of misinformation. One is rooted in the belief that students need to be educated with a set of generic epistemic tools to protect themselves against misinformation or disinformation which is false and spread deliberately to deceive (Kozyreva et al., 2024). This is the approach of Wineburg and his collaborators who, having shown empirically that students lack the requisite skills to identify false information, and who then developed a set of generic approaches to evaluating information – particularly that obtained from web searches. This approach consists of asking students to take bearings about the landscape of information they find; reading laterally by leaving any page and checking its credibility from other pages; and scrolling judiciously through search results to identify what might be the most relevant and salient known as “click restraint”. All of these help to gain a sense of the information neighborhood in which students have landed. These authors prioritize three questions: “Who’s behind the information?”; “What’s the evidence?”; and “What do other sources say?” (Wineburg & McGrew, 2019). Such approaches are seen as the foundations of

digital media literacy which is required in Finnish education and a growing number of US states (Neuvonen et al., 2018; Zucker & McNeill, 2023).

The alternate approach is based on the concept of pre-emptive inoculation – essentially the idea that individuals can be primed in advance to the likely dangers of shared information. Such approaches can be based on online videos or games and rely on refutation strategies or de-bunking (Lewandowsky et al., 2020; van der Linden, 2023). The challenge for these methods is that they take a more topic-specific approach but can explore more logical and generic issues by highlighting a misleading argumentation strategy. One difficulty inherent to this approach is its core metaphor which suggests that it is possible to build immunity to a range of the challenges of misinformation when each one is both distinct and varied.

### Becoming a “competent outsider”

The primary issue confronting the non-expert is not one of evaluating the evidence directly. They simply do not have sufficient expertise or training to spot experimental flaws, to recognize cherry-picked data, to detect unsound statistical analyses, to consider unstated alternative hypotheses, and more.

Given the science-related focus of many of these issues, the question must be asked what can science education do to improve students’ ability to make good critical evaluations of the flood of information, much of it scientific, that pervades daily life. As Ryder has shown, many of the contemporary issues of a science-related nature require a knowledge of aspects of science that school science does not afford (Ryder, 2001). Moreover, in an age of increasing specialism, even experts are epistemically dependent on others. The standard focus of all forms of contemporary science education is on the cognitive tools required to decide whether the conclusions are justified by the data and the evidence. Yet, in everyday life, few of us have the ability or time to read the evidence and evaluate its merits. For instance, the majority of the public believe that climate change is happening – very few have read the substantive IPCC reports. Thus, the belief that a formal science education can attain the necessary knowledge and skills to become “a critical consumer” (National Research Council, 2012) of scientific knowledge is at best misplaced and, at worst, naïve. Rather, what is needed is the competencies and knowledge required to be a ‘competent outsider’ (Feinstein, 2011). But what might these be?

To answer these questions, a group of 10 leading experts from science, science education and psychology, many of whom had already written extensively on the topic of misinformation convened over a period of 6 months to present their work and explore what priorities for the field were. Emerging from this work was a series of publications (notably Osborne & Allchin, 2024; Osborne & Pimentel, 2022; Osborne et al., 2022). The work argued that becoming a competent outsider depended on a combination of the acquisition of specific digital media literacy strategies coupled with a knowledge of the social practices of science that enable the production of reliable knowledge (Höttecke & Allchin, 2020; Ziman, 1968). Specifically, the latter requires an understanding that the production of reliable scientific knowledge depends on the work of a collaborative community for which peer review, in its broadest sense, is a fundamental requirement; a knowledge of the criteria that define scientific expertise; and the significance of consensus. Current forms of science education are notably failing to attend to any of these needs – which are essential for the overwhelming majority who will not pursue scientific careers. Formal science education, therefore, has an important contribution to make to building the capabilities needed to evaluate the source as those outside of science cannot evaluate the content. In addition, it needs to recognize the importance of developing a sense of epistemic humility. This paper will present these arguments in a fuller form for discussion.

### Impact of group membership on attitude change and argument evaluation in controversial debates

Paulo J. M. Santos, Dimitra Tsovaltzi, Armin Weinberger

In controversial issues, which often lead to the formation of socially defined or polarized groups, the interpretation of “who is talking to me”, i.e. the source of an argument is a critical element in the evaluation process.

Evaluating the argument source serves as an initial filter, establishing parameters for judgments of trustworthiness and relevance (Osborne & Pimentel, 2022). These judgments are rarely neutral, as individuals often interpret sources through the lens of their social identities, aligning with groups that shape how they perceive arguments. Individuals derive part of their identity from the groups to which they belong, potentially leading to different consequences, such as ingroup favoritism and outgroup discrimination (Social Identity Theory; Tajfel & Turner, 1979).

Evidence shows that persuasive messages originating from ingroup members are perceived as more valid and trustworthy, often resulting in greater attitude change compared to those delivered by outgroup members (Hogg & Smith, 2007). This trust in ingroup sources shapes how individuals process and integrate new

information, and even subtle cues about group affiliation can have significant effects on how knowledge is integrated into prior knowledge ( $d = 0.62$ ) and improve factual learning about the topic ( $d = 0.51$ ) (Matschke et al., 2013).

In collaborative learning environments, biases in information evaluation often limit critical engagement and reinforce confirmation tendencies. Arguments consistent with initial preferences are systematically evaluated as stronger, particularly when they originate from ingroups, while outgroup perspectives are more readily dismissed. Additionally, individuals prioritize familiar and socially validated information over novel or contradictory inputs, further constraining the integration of diverse perspectives and hindering critical engagement in group settings (e.g. Mojzisch et al., 2010).

Despite substantial research on ingroup favoritism and its impact on information processing, the extent to which perceptions of shared group affiliation influence the objective evaluation of arguments and facilitate attitude change remains underexplored. Specifically, it is unclear whether group affiliation alters individuals' critical assessment of arguments and evidence or if attitude changes occur independently of such cognitive re-evaluation. Given the tendency to favor arguments that align with one's own group, we aim to investigate whether perceived group membership affects how arguments are evaluated and whether this, in turn, is associated with changes in attitudes. Therefore, this study examines: (a) how perceptions of the arguer as an ingroup or outgroup member affect individual attitude change towards a controversial issue in a debate, (b) how these perceptions influence participants' evaluation of arguments, and (c) the association between argument evaluation and attitude change in this context.

## Methods

This study took place in Brazil, focusing on the topic of gun control, which, in recent years, has become a divisive issue there, with attitudes toward gun control emerging as a normative marker of major political and social groups. Participants ( $N = 24$ ; 62.5% women,  $M = 32.0$ ,  $SD = 17.4$  years) were recruited from three diverse institutions: a secondary school, a psychology postgraduate program, and an adult recreation center. They were randomly assigned to either the ingroup ( $n = 11$ ) or outgroup ( $n = 13$ ) condition.

Attitudes toward gun control were measured using items adapted from Taber and Lodge (2006), four items assessed attitude strength on a 100-point scale ( $\alpha = 0.91$ ), six items measured attitude position pre- and post-debate on 9-point scales ( $\alpha = 0.75$ ), and one item captured self-reported attitude post-debate. Evaluation of arguments was assessed with 10 items featuring balanced pro and contra gun control arguments (adapted from Taber & Lodge, 2006), and participants rated the strength of each argument on a 100-point scale.

Participants engaged in one-on-one debates with an arguer either portrayed as an ingroup member (aligned with the participant's stance) or an outgroup member (opposed to the participant's stance). In both conditions, the arguer challenged the participant's views using scripted arguments. This approach aligns with the concept of productive controversy (Johnson & Johnson, 2009), which suggests that cognitive conflict and the exchange of opposing viewpoints are essential for promoting deeper understanding and critical engagement.

## Results

A repeated-measures ANCOVA was conducted with pre- and post-debate attitude scores as within-subjects variables, group membership perception as the between-subjects factor, controlling for attitude strength. The analysis revealed a statistically significant effect of group membership on attitude change,  $F(1, 21) = 6.23$ ,  $p = 0.02$ ,  $\eta^2 = 0.21$ , with greater attitude shifts observed in the ingroup condition.

Analysis of participants' evaluations of arguments showed no statistically significant differences between the groups in their ratings of preference-consistent arguments:  $F(1, 22) = 0.78$ ,  $p = 0.39$ ,  $\eta^2 = 0.03$ , or preference-inconsistent arguments:  $F(1, 22) < 0.01$ ,  $p = 0.97$ ,  $\eta^2 < 0.01$ .

## Discussion

Our findings indicate that participants who perceived the arguer as an ingroup member exhibited greater attitude change compared to those who perceived the arguer as an outgroup member. This aligns with prior research suggesting that messages from ingroup sources are more persuasive and can lead to significant shifts in attitudes (Hogg & Smith, 2007). The ingroup arguer, despite challenging the participants' initial stance, appeared to facilitate a more open reception to opposing viewpoints, possibly due to increased trust and perceived shared identity.

Interestingly, the evaluation of arguments did not significantly differ between the ingroup and outgroup conditions. Participants rated preference-consistent and preference-inconsistent arguments similarly, regardless of the perceived group membership of the arguer. This suggests that the attitude change observed was not directly mediated by a reevaluation of the strength of the arguments presented. Instead, the change may have been

influenced by relational factors associated with group identity rather than cognitive reassessment of the arguments themselves.

The lack of significant differences in argument evaluation raises questions about the mechanisms underlying the observed attitude changes. It is possible that participants felt more comfortable reconsidering their positions when challenged by someone they identified with, even if they did not perceive the opposing arguments as stronger. This points to the role of social identity in fostering openness to alternative perspectives, independent of the content or quality of the arguments presented.

## **Disagreement: A key to understanding the productivity of non-convergent discussions**

Yifat Ben-David Kolikant, Asaf Salman

### **Non-convergent discussions**

Much effort has been devoted to gaining a deep understanding of the dynamics of discussions and developing computerized tools to support participants. However, most of this work has been tailored to *convergent collaborative learning*—activities where discussants are expected to reach a consensual answer through a constructive and critical evaluation of all ideas. In contrast, *non-convergent discussions* have received far less attention, despite their prevalence in educational settings and on social media, such as debates on morality, historical interpretations, and politically charged issues. Unlike convergent discussions, non-convergent discussions do not aim for a single consensual answer but can still foster dialogic agency, a deeper appreciation for the complexity of the social world, and an understanding of its multiple perspectives (Parker, 2023).

Despite their value, the analysis of productive, non-convergent discussions—and the development of coding schemes for them—remains largely unexplored, with only a few exceptions (Wagner & Cheng, 2011). Our work seeks to bridge this gap.

### **Disagreement: a key to understanding discussions**

Disagreement “can act as a pivotal post that radically changes the mode of discussion” (Wise & Chiu, 2011, p. 448). Its impact is multidirectional. On the one hand, it enables a critical exploration of diverse viewpoints, the elaboration of ideas, and the creation of new knowledge. However, on the other hand, disagreement can also lead to animosity, escalate social tensions, and deteriorate the quality of a discussion.

Therefore, how we choose to disagree—the Disagreement Strategies (DS) we employ—is crucial. Discussions are inherently social events, encompassing both cognitive-epistemic and social-emotional dimensions (Asterhan, 2013). A speaker responds to the whole utterance, hence a fusion between the dimensions is naturally made, realizing a trade-off between the dimensions (Leslie, 2021). The DS chosen may cause one dimension of the discussion to diminish, amplify, or overshadow the other. Hence, DS are key to understanding and forecasting discussion productivity.

Various types of DS have been investigated and ranked based on their intent or potential impact on an individual’s public self-image, or *face* (e.g. Goffman, 1955). This body of work underscores the nuanced effects that DS can have on the social-emotional dimension of discussions (e.g., Shum & Lee, 2013). Research has also examined the impact of disagreement on the cognitive-epistemic dimension. Empirical evidence indicates that *grounded disagreement*—disagreements that are supported by reason and evidence—fosters greater engagement and knowledge construction in collaborative settings compared to other types of disagreement (De Kock & Vlachos, 2021; Dubovi & Tabak, 2020). Some schemes that are focused on learning also capture the social-emotional dimension. Yet, the framing is often binary (or trinary), such as the impact on the group’s social climate—positive, negative (and neutral) (Asterhan, 2013)—or the tone of disagreements, whether polite or rude (Chiu, 2008). In summary, these works do not address the correspondence between the productivity of a discussion in terms of learning and the DS employed by the participants.

### **A temporal definition of productive discussion**

Taking a dialogical stance (Bakhtin, 1981), the premise underlying our work is that when new knowledge is offered and is connected to previous utterances while posing the necessary minimum threat to the face, it will encourage individuals or groups to examine, to further elaborate, i.e. promote the discussion productively. A discussion might potentially move towards unproductivity if at least one of the two conditions mentioned above is unfulfilled; Specifically, when interlocutors (I) do not add new knowledge (e.g., repetition, agree to disagree), or (II) add or elaborate on knowledge albeit in low responsiveness to preceding utterances. Responsiveness, as we

define it, reflects the degree to which a speaker embeds or builds on the voice of another interlocutor, not only to the arguments in previous utterances, but also to the social cues provided.

## A taxonomy of DS

In the symposium, we will present a taxonomy of DS we have developed, through a systemic literature review of studies on DS and a qualitative meta-analysis of the DS dataset we had extracted from the manuscripts. We manually analyzed the impact of each DS on the cognitive-epistemic and social-emotional dimensions. Utilizing cluster analysis and statistical testing, we categorized them into four clusters according to their potential impact on discussion productivity. These efforts have culminated in narrowing down the DS and eliciting 18 primary forms. Additionally, we employed statistical and manual analysis to examine whether the differences among the clusters are significant as well as to characterize their unique profiles.

## Towards a nuanced analysis of discussions

We will discuss the taxonomy's pedagogical and scientific significance, including its usefulness for AI-based real-time analysis and prediction of discussion in various contexts. There is a mutual interplay between discussions and the context within which they occur. The context frames the ways participants choose to express themselves, their interpretations of and responses to other interlocutors' utterances, in particular how disagreement is expressed and understood (Leslie, 2021; Kompa, 2015). Reciprocally, the interlocutors' utterances shape the context. Specifically, the utterances sustain or alter the cognitive-epistemic and the social-emotional dimensions of the discussion. Therefore, the same DS may have a different impact in different contexts, depending (also) on what preceded their occurrences, that is, sequences of discourse moves and DS embedded in them. Correspondingly, we aim to develop an AI agent that will be able to capture in real-time such substantial sequences and discourse patterns in order to predict the course of the discussion.

## What causes classroom tension when teaching sensitive and controversial topics?

Virginie Lemmens, Leonie Vanhove, Jan Sermeus, Machteld Vandecandelaere

Introducing sensitive and controversial issues (SCIs) in educational settings can lead to classroom tension (CT), a dynamic that, according to Geldof (2018), is further complicated by the increasing diversity of students, encompassing a wide range of ethno-cultural backgrounds, religious beliefs, media consumption habits, and social statuses. To alleviate CT and discomfort, teachers often adopt protective teaching strategies, such as avoidance, due to pedagogic frailty (PF) (Kinchin et al., 2016).

SCIs encompass several domains and disciplines. In the social sciences and humanities (SSH), topics become sensitive when they relate to personal aspects of the teacher's or students' lives, mental health, or identities, such as discussions on suicide, cultural identity, or gender orientation. In the natural sciences (NS), issues that spark ethical, political, or moral debates, known as socio-scientific issues (SSI) (Chen & Xiao, 2021), can create CT. Examples include the role of nuclear energy in addressing climate change. Additionally, science educators face the challenge of teaching societally denied science (SDS), including scientifically accepted ideas that are rejected by parts of society, such as the theory of evolution, the origins of the universe, or vaccine efficacy (Borgerding & Dagistan, 2018).

The current literature on SCIs is fragmented, often limited to specific disciplines. It lacks a comprehensive framework that identifies domain-specific and domain-general determinants contributing to CT and PF. In a previous study, we developed a tentative framework of determinants of tension based on a systematic review study (Lemmens et al., 2024), outlining the domain-specific and domain-general determinants of CT and PF in secondary education. To refine this framework within the context of Flemish (Belgium) secondary education, we conducted concept map-mediated interviews with teachers from four subjects: biology, physics, history, and 'psychology and sociology'. Our study aims to gain a deeper understanding of the domain-specific and domain-general determinants that contribute to CT when teaching SCIs and to provide actionable insights for teachers.

## Method

We enlisted 34 teachers from Flanders and Brussels, with an equal split of 17 from the NS and 17 from the SSH. Recruitment was carried out through emails to schools, LinkedIn, and educational Facebook groups. Some teachers (three from NS and one from SSH) taught multiple subjects and participated in two interviews each, resulting in 38 interviews. These teachers represented a range of teaching environments, from rural to urban, and had varying years of experience ranging from 1 to 31 years ( $M = 11.15$ ,  $SD = 7.64$ ).

We received ethical approval from KU Leuven to video and audio-record the interviews and to address any potential psychological distress. During the concept map-mediated interviews, teachers mapped out SCIs and their determinants, which facilitated the interviews and helped identify connections between topics and determinants of CT and PF. Additional information from the interviews was used to supplement the concept maps.

The concept maps and interview transcripts were analyzed to generate initial codes, ensuring an inductive approach to the data. SCIs were then categorized according to the quadrants of the classification model.

## Results

Findings indicate that domain-general determinants of CT when teaching SCIs are more prevalent than domain-specific ones. These determinants include personal experiences, religion, and cultural identity, which are more context-related than topic-related.

Teachers often avoid sharing personal information with students to prevent CT. For instance, a history teacher chose not to reveal her Russian heritage when discussing the conflict between Russia and Ukraine. Many teachers also refrained from expressing their political views to avoid influencing students and to maintain personal boundaries. Despite these challenges, teachers did not shy away from teaching SCIs. In some cases, particularly in the SSH, teachers intentionally use SCIs and their understanding of students to provoke CT. This approach aims to encourage multiperspectivism, enhance argumentation skills, and promote critical thinking.

In NS, a biology teacher faced difficulties teaching evolution and the origins of the universe due to students' religious beliefs. As SCIs are more commonly linked to the topics concerning living systems, physics has fewer SCIs, likely due to its focus on non-living systems.

## Discussion

Secondary education teachers, whether in the NS or SSH, face significant challenges when teaching SCIs. Our interviews indicate that teachers encounter similar determinants of CT across different domains. As a consequence, future research needs to go beyond domain boundaries and classroom settings to understand why certain topics generate tension and to identify actionable determinants. Without this comprehensive understanding, teachers will continue to make slow progress, relying on strategies that manage symptoms rather than addressing the root causes.

Despite the challenges in teaching SCIs, the teachers in our study remain dedicated to addressing SCIs, employing safe and sustainable teaching strategies to adapt to an evolving educational environment. A key limitation of this study is the type of teachers who participated. We believe that the participants were those who are confident and experienced in teaching SCIs, which may not represent the broader population of Flemish secondary education teachers. Future research should aim to be more inclusive and lower the participation threshold to encourage a more representative sample of all secondary education teachers.

## General discussion

From examining the role of group identities in shaping attitudes and argument evaluation to analyzing the dynamics of non-convergent discussions, this symposium emphasizes the critical importance of understanding both the social and cognitive dimensions of learning. In the context of rapid technological advancements and shifting societal norms, the need to prepare individuals to critically evaluate evidence, navigate diverse perspectives, and engage productively in discussions about controversial topics becomes increasingly relevant. By fostering dialogue and collaboration among educators, researchers, and practitioners, this symposium seeks to advance educational practices that equip individuals with these competencies, contributing to the development of a future-oriented and inclusive global citizenry.

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