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Integrating perspectives on reasoning about controversial issues: mapping research directions for secondary education

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Reasoning about controversial issues is an essential skill for navigating the complexities of modern society, making its inclusion in secondary education vital. While each discipline and its corresponding school subjects approach controversies through unique content, traditions, and epistemological foundations, significant commonalities also exist. This article builds on insights from a two-day workshop involving five disciplines that explored how controversial issues and related reasoning processes are understood across these fields. Despite disciplinary differences, multiperspectivity emerges as a unifying principle in teaching and learning about controversial issues. The discussion highlights disciplinary approaches to controversial issues and introduces a research agenda inspired by the workshop's findings. This agenda calls for the development of shared vocabulary, a comparison of design criteria, and deeper insights into the roles of emotions, values and student experiences. By fostering interdisciplinary collaboration, the aim is to enhance teaching strategies and equip students with critical thinking and reasoning skills to address controversial issues effectively.

KEYWORDS

scientific reasoning and argumentation, social controversies, societally denied science, scientific controversies, secondary education

Introduction

In secondary education, teaching complex cognitive skills is essential to enable students to deal critically with societal challenges (OECD, 2022). Reasoning about controversial issues is part of this, because such issues, often characterized by a lack of consensus or clear solutions, require students to consider and evaluate differing perspectives.

Various school subjects address these reasoning skills and attitudes, and understanding their similarities and differences is essential for designing effective teaching strategies. However, research has primarily been focused on individual disciplines and related school subjects, limiting opportunities for collaboration and interdisciplinary insights. To fill this gap, we organized a two-day interdisciplinary workshop that included researchers from history, social sciences, psychology, natural sciences and philosophy education. The workshop explored how controversial issues and reasoning processes are conceptualized across these disciplines. It aimed to develop a shared understanding and establish an interdisciplinary research agenda on reasoning about controversies in secondary education. By fostering interdisciplinary

approaches, research can be optimized to equip students with the tools necessary for critically and empathetically addressing controversial issues in a complex world.

Approach to the workshop

The meeting was organized by the three authors, representing two Dutch universities (University of Amsterdam and Radboud University) and one Belgian university (KU Leuven). To extend the expertise, the consortium was expanded to include researchers from two more Belgian universities (Ghent University and University of Antwerp) and two universities of applied sciences (Hogeschool van Amsterdam and Odisee). The invitation was specifically aimed at researchers actively studying reasoning about controversial topics in the context of secondary education.

The meeting took place in April 2024 in Leuven, Belgium. The discussions began with an exchange of central questions and conceptual definitions derived from ongoing projects in each institution. Throughout the discussions, we completed a matrix to make explicit the conceptualization of both controversy and reasoning within the five participating disciplines.

The discussions formed the basis for the research agenda presented below. The focus was on secondary education. Thus, the controversies discussed below within disciplines are those that characterize the curricula of the respective subjects in secondary education.

Conceptualization of controversy and reasoning

Teaching and learning about controversial issues has been extensively studied in the various represented disciplines, often using different terms and conceptual frameworks. These variations reflect the distinct traditions and epistemological foundations of each discipline. The following sections discuss similarities and differences in approaches to controversial issues and related reasoning.

Multiperspectivity as a constant across types of controversy and disciplines

In a controversial issue, different viewpoints can always be discerned. The workshop participants grouped authentic examples of controversies in various school subjects around the source of disagreement, producing three clusters: scientific controversies, social controversies and societally denied science (SDS). Each type can be observed in all represented school subjects, and addressing them highlights the importance of multiperspectivity. We conceptualize multiperspectivity as a key capacity for engaging with controversial issues, involving both a cognitive and a relational-motivational component. The cognitive component refers to analyzing, evaluating and synthesizing arguments and evidence from multiple perspectives. This aligns closely with what Klopp and Stark (2022) describe as epistemological reasoning at the evaluativist level. This involves systematically weighing knowledge claims based on available evidence and contextual factors. In addition, multiperspectivity also has a relational and motivational component. As explained by Gehlbach (2004), reasoning about controversial issues not only requires cognitive skills, but also the willingness and motivation to actively put oneself in the perspective of others, taking into account attitudes and social context. Thus, to reason effectively about controversial issues, it is necessary to combine cognitive skills with an open and empathetic attitude toward different viewpoints or underlying values and identities.

Scientific controversies arise when there is no consensus among experts within the scientific community. The differing viewpoints are rooted in competing theories, methodologies, or interpretations (Borgerding and Dagistan, 2018). Examples include differing views on the causes of social inequality (Rustin, 2018), differing interpretations of important historical events such as the causes of the First World War (Stoel et al., 2015), and differing approaches to determining the effectiveness of treatments for mental disorders (Leichsenring et al., 2022). Reasoning about scientific controversies involves evaluating evidence, comparing competing perspectives, and understanding the methodological approaches underlying the discipline. Learning to deal with multiperspectivity, especially its cognitive component, plays a central role here. Students must learn to critically engage with multiple theories and concepts in order to analyze and compare conflicting, overlapping, or complementary perspectives. This is consistent with the idea that adopting multiple perspectives can help improve knowledge construction, recognizing that knowledge is formed through theories, arguments and interpretations (Klopp and Stark, 2022). Teaching about scientific controversies therefore requires explicit attention to the nature of science and the epistemological activities of generating and evaluating evidence (Oulton et al., 2004).

Social controversies arise when societal, cultural or ethical considerations ignite a debate about the application of scientific insights. The differing viewpoints are rooted in ideology, culture, values or emotions. Examples include the ethical debate on the use of nuclear power as a sustainable solution (Chen and Xiao, 2021), and the impact of the slavery past on present societies (Immler, 2023). Reasoning about social controversies integrates scientific understanding with social, political, and ethical dimensions and thus appeals to both the cognitive and the relational-motivational component of multiperspectivity. Students must weigh perspectives, reflecting on diverse viewpoints while addressing the complexity and uncertainty of social issues. By critically analyzing values and assumptions against evidence, students learn to transform subjective views into informed arguments, preparing them for thoughtful societal debates. In the context of social scientific reasoning, Klijnstra et al. (2023) emphasize the challenges posed by indirect and ambiguous evidence in social controversies, highlighting epistemic activities such as causal analysis; the use of social scientific concepts, models, and theories; the use of evidence; and comparing. While Klijnstra et al. focused on social sciences, reasoning about social controversies extends to natural sciences, like socio-scientific issues (Chowdhury, 2016), and humanities, such as debates on monuments, commemorations, or public representations of the past (Goldberg and Savenije, 2018; KNAW, 2023).

Societally denied science (SDS) differs fundamentally from the other two types because it involves the rejection of established scientific consensus by certain groups in society (Borgerding and Dagistan, 2018). This rejection stems from ideological, cultural, or societal resistance that directly denies the validity of scientific findings

(Jylhä et al., 2023), unlike debates concerning scientific application or internal scientific disagreements. Examples include rejecting established knowledge about evolutionary theory in biology class (Stahi-Hitin and Yarden, 2022), skepticism about mental health diagnoses such as ADHD or depression in psychology (Stein and Illes, 2015), or denial of the Holocaust in history class (Ensel and Stremmelaar, 2013). Fostering epistemic resilience against SDS requires students to develop epistemological knowledge, critically evaluate evidence, recognize misinformation, and understand how scientific consensus is established. In the context of SDS, the role of multiperspectivity shifts towards encouraging students to critically scrutinize dissenting views and differentiate between legitimate perspectives and those based on misinformation or ideological bias. Dealing with SDS requires teaching strategies that help students recognize misinformation and deconstruct denialist reasoning and argumentation, and understand the sociocultural drivers of science denial (Jylhä et al., 2023; Osborne et al., 2022).

The tripartite division (scientific controversies, social controversies, SDS) bears similarities to what the literature calls the "criterion debate," referring to the question of under what conditions a topic should be taught as controversial within the curriculum. Hand (2008) contrasts three main criteria: the epistemic (controversial if rationally defensible opposing views exist), the behavioral (controversial if factual societal disagreement exists) and the political (controversial if no single position is dictated by liberal-democratic public values, often linked to cultural or religious diversity). Although there are similarities in content, our workshop-based classification is not grounded in normative curriculum choices but in the perceived source of disagreement within classroom contexts. This source-based division offers a more pedagogically useful basis for tailoring teaching strategies to the nature of the challenges students and teachers encounter. In sum, reasoning about all three types of controversies is characterized by engaging with multiperspectivity. While the relative importance of the cognitive and relational-motivational components may vary according to the type of controversy, reasoning about all three always involves the ability to step back from intuitive judgments and to engage thoughtfully and reflectively with different perspectives.

Disciplinary differences in reasoning about controversies

Although the three controversy types can be addressed in all subject areas, there are differences based on the respective subject content, as well as on the epistemological foundations of each subject. These differences shape the controversy types that are primarily addressed in the secondary school curriculum, the most relevant reasoning processes, and the types of evidence that are considered valid. Multiperspectivity, in other words, is a core element, but its content and application may vary from context to context.

Disciplinary emphasis on controversy types

Compared to the natural sciences, scientific controversies are more explicitly present in the secondary school curricula of social and behavioral sciences and the humanities. In social and behavioral sciences, this reflects the empirical and exploratory nature of the field, with competing theories, methodologies, and interpretations, such as causes of behavior in psychology or the effectiveness of social policy in sociology. This pluralism underscores the abstract and context-dependent nature of these disciplines (Sanbonmatsu and Johnston, 2019). Within the humanities, the focus lies on narrative interpretation, value conflicts, and ethical dilemmas, reflecting their interpretive and normative foundations. History reconstructs past events based on sources that are often fragmented or biased (Tosh, 2015), while philosophy focuses on questioning assumptions and fostering critical reflection (Bleazby, 2020). For both fields, addressing perspective pluralism is challenging. Indeed, teachers often struggle to balance diverse perspectives (Evers et al., 2025). Additionally, teachers face challenges from societal and institutional pressures, which can influence how perspectives are prioritized in education (Goldfarb and Lieberman, 2021; Smets, 2024). Although scientific controversies are also present in the natural sciences, they are less frequently addressed in secondary education. Examples include the lack of a clear theory on the origin of life or discussions on the long-term effects of genetic manipulation. Secondary science education often emphasizes topics with strong scientific consensus (Cofré et al., 2019), limiting students' exposure to science as a dynamic process shaped by discussion and disagreement.

Oulton et al. (2004) argue that the often one-sided and simplistic representation of knowledge within school subjects contributes to a lack of trust in scientific knowledge and scientists. This mistrust may foster relativistic attitudes and even denial of scientific consensus, contributing to SDS. Presenting science as absolute truth, while neglecting the nature of science (NOS), including its conditionality, complexity, and the human processes underlying its development, leaves students ill-prepared to critically evaluate conflicting claims or misinformation. While this dynamic is particularly evident in natural sciences education–for example, students often perceive biological knowledge as more objective than historical knowledge (Barzilai and Weinstock, 2015)- fostering epistemic thinking by engaging students with the processes of knowledge construction, justification, and critique, is essential across all fields to prevent relativism (Barzilai and Chinn, 2020). Further research is needed to explore whether limited attention to scientific controversies contributes to the prevalence of SDS and how fostering epistemic thinking can address these challenges. Comparing how controversies are addressed across school subjects may provide insights into how epistemological foundations influence students' reasoning and trust in knowledge.

Social controversies are addressed in all school subjects but manifest differently. In the social and behavioral sciences and humanities, these controversies often revolve around social, ethical, or cultural questions about scientific knowledge that itself is marked by pluralism or the absence of a dominant framework. This makes social controversies in these domains intertwined with aspects of scientific controversy. Within the natural sciences in secondary education, social controversies are extensively explored in the literature through the lens of *Socio-scientific issues* (SSIs) (Högström et al., 2024). SSIs refer to scientific topics that raise ethical, social or political questions about the implications or applications of established scientific knowledge. Examples include debates about how society should deal with climate change, the ethical considerations of vaccine development or the potential applications of CRISPR technology. In these issues, it is not so much the scientific knowledge itself that is at stake, but the social implications of this knowledge. The literature highlights the

relevance of integrating SSIs into the science curriculum as it contextualizes scientific content, making it more relevant and accessible to students. Moreover, SSIs bridge disciplinary boundaries by integrating perspectives from fields such as ethics, sociology and economics (Sadler et al., 2007).

How disciplines shape reasoning processes and the cross-disciplinary role of subjects

In natural, social and behavioral sciences education, multiperspectivity often involves the capacity for *scientific reasoning and argumentation*. This refers to the ability to understand and use scientific concepts, theories, methods, and findings to solve or explain problems. These processes are shaped by the characteristics and requirements of the discipline, integrating evidence and viewpoints to reach a solution (Fischer et al., 2014). Consequently, reasoning in these domains relies heavily on the ability to evaluate and interpret empirical evidence.

In humanities education, multiperspectivity often revolves around interpreting value-laden narratives and involves not only understanding and comparing different perspectives but also critically analyzing the ethical, moral, and epistemological assumptions that shape these views. This reflective process encourages students to question the construction of knowledge itself and fosters an awareness of complexity, ambiguity, and the limitations of objectivity. In particular, *philosophical reasoning* emphasizes engaging in moral and ethical dialogues and provides tools to critically examine the assumptions and values underlying different perspectives. This entails addressing moral values, fostering critical reflection, and encouraging the weighing of competing perspectives in classroom dialogues to enhance value-loaded critical thinking (Rombout et al., 2024). The reflective dimension makes philosophy uniquely positioned to support reasoning across disciplines by bridging theoretical, ethical and practical considerations. Philosophy equips students to understand the epistemological foundations of scientific consensus and critically reflect on denialist claims, enhancing their ability to see through misinformation and ideological biases (Blancke and Boudry, 2022).

From this perspective, history education appears to play a bridge function between the natural, social, and behavioral sciences on the one hand and the humanities on the other hand. Indeed, *historical reasoning* relies heavily on working with (source-)evidence, building on social and economic theories, and supporting claims with arguments, as well as on evaluating competing narratives to understand events in their broader context, helping students to deal with subjectivity and ambiguity (Epstein and Salinas, 2018; Van Boxtel and Van Drie, 2018). In history education, students learn to use analytical skills to understand how historical narratives are produced and consumed, both disciplinary and socially (Wertsch, 1997). Such understanding alerts students to the limits of evidential reasoning, particularly in contexts where narratives are closely tied to personal and collective identity, and makes them aware of their active role in shaping those narratives (Haste and Bermudez, 2017).

Discussion

The intersection of shared reasoning skills and disciplinary uniqueness highlights the potential for interdisciplinary collaboration. By exploring how different disciplines approach controversial issues, teachers and researchers can identify complementary strategies that enrich teaching across subjects (Journell, 2013). Students benefit from understanding the interconnectedness of knowledge, promoting critical thinking and adaptability. In other words, integrating expertise from different subjects can enhance reasoning about controversies. For instance, philosophy's focus on assumptions and values informs discussions in the natural sciences, while the rigor of natural sciences sharpens evidence evaluation in the social sciences.

Future agenda for interdisciplinary research and collaboration

Based on the insights from the two-day interdisciplinary workshop and the analysis of similarities and differences between disciplines and school subjects, the following research priorities were identified. These priorities reflect the need to deepen our understanding of reasoning about controversial issues, both in general and in subject-specific contexts. The common goal is to improve teaching practices and prepare students to engage in substantive reasoning about complex social, contemporary, and future challenges.

Developing a shared vocabulary for interdisciplinary collaboration

The workshop discussions revealed that differing terminology across research disciplines and school subjects complicates interdisciplinary collaboration on reasoning about controversial issues. Researchers and teachers often describe similar phenomena with varied terms, creating barriers to mutual understanding. Future research should focus on developing a shared vocabulary to enhance collaboration and communication. For example, Lemmens et al. (2025) created a framework to identify and describe the determinants of classroom tensions across disciplines, offering a shared language. Similarly, standardizing the conceptual framework for teaching controversial issues is essential, with the distinction between the sources of cross-disciplinary controversy types in this article serving as a starting point.

Identifying and comparing design criteria in different disciplines

Each discipline uses specific design principles and strategies to teach reasoning about controversial topics. Future research could compare these approaches to identify how disciplinary strategies can complement each other, particularly in fostering students' understanding of the nature of science (NOS). For instance, in natural sciences, instructional design frequently grapples with societally denied science. This necessitates specific strategies for addressing misinformation and ideological resistance, often by clarifying how scientific consensus is established and evolves. At the same time, the social and behavioral sciences have, due to their pluralistic nature, more experience in engaging with scientific controversies. Although this presents its own challenges for teachers, as Evers et al. (2025) highlighted for psychology education, the didactical approaches developed within these fields for managing pluralism could inform other disciplines, by offering insights into teaching how scientific understanding is formed,

debated, and refined, even in areas with established consensus. In other words, strategies from social and behavioral sciences can inspire the integration of NOS in science education, particularly its dynamic nature and the role of scientific discourse in reaching consensus. This might, in turn, help prevent relativistic attitudes and science denial. Furthermore, reasoning about social controversies is addressed across various disciplines, going from socio-scientific issues to historical debates with ethical dimensions. This type of controversy requires specific design criteria that integrate scientific understanding with social, political, and ethical dimensions. Ultimately, a comparative analysis of these distinct disciplinary approaches to controversy holds significant potential for developing robust, interdisciplinary instructional designs.

Integrating student perspectives and addressing the role of values and emotions

Understanding students' perspectives on controversial topics is crucial, as their attitudes, prior knowledge, emotions, values, and motivations shape their engagement. Some may find topics irrelevant or abstract, while others feel personally involved due to their background. More research is needed to examine how these factors affect participation, reasoning, and understanding in teaching controversial topics. Such insights can guide culturally responsive teaching strategies that address diverse needs. In particular, during the workshop, values and emotions were highlighted as crucial yet complex factors in teaching reasoning about controversial issues across disciplines. Future research should examine how these elements, in different subjects, influence the cognitive and relational-motivational component of multiperspectivity and vice versa. Indeed, values and emotions affect engagement and perceptions of topics. For example, positive emotions, like curiosity, can enhance reasoning, while negative emotions, such as frustration, may hinder it (Fischer et al., 2014).

From the teacher's perspective, emotional responses and tensions in controversial discussions challenge teachers to foster a safe environment that promotes critical evaluation of evidence and perspectives (Wansink et al., 2024). The diversity of emotional and value frameworks in classrooms complicates this task. Mesquita (2021) underscores the importance of recognizing the cultural diversity of emotions, advocating for teaching methods that are responsive to the emotional frameworks students bring to the classroom. Similarly, Hoffman and Verdooren (2018) highlight the value of a pluralistic stance toward values, which fosters inclusivity and encourages interaction between different worldviews. By adopting such an approach, teachers can facilitate open dialogues that promote mutual understanding and reduce polarization, science denial, and mistrust in science. These dynamics are relevant across all disciplines. Rawls (1997) conception of reasonable disagreement might provide valuable direction for future research here. It rests on his notion of the burdens of judgment: the inherent complexity of evidence, variations in the weight assigned to evidence, the indeterminacy and vagueness of key concepts, differing life experiences, and the challenge of balancing conflicting values. These factors make pluralism an unavoidable yet legitimate feature of democratic deliberation, clearly distinguished from relativism. Recognizing these burdens legitimizes emotional engagement while safeguarding epistemic rigor. Consequently, classroom dialogues that explicitly acknowledge rather than suppress emotions can foster a learning environment that is both emotionally safe and intellectually rigorous. Future research should therefore investigate empirically how such classroom strategies influence students' abilities to engage productively in reasoning and how the emotional and moral dimension might effectively complement cognitive approaches to reasoning about controversy.

Conclusion

Reasoning about controversial issues is a crucial skill for secondary school students. It prepares students to become critical citizens who can navigate the complexity of modern social and scientific challenges. In this contribution, based on a two-day workshop where five disciplines were represented, we demonstrated that, despite differences in disciplinary content and epistemological foundations, in all disciplines, reasoning involves understanding, evaluating, and synthesizing multiple perspectives, highlighting the importance of shared reasoning practices as a basis for addressing controversial issues.

The workshop discussions revealed that differences in reasoning about controversy are not solely tied to differences between disciplines but also stem from the distinct nature of the sources of controversies themselves. While there are discipline-specific variations, there are also clear differences in reasoning across the types of controversies we have identified. Scientific controversies focus on balancing competing empirical claims, social controversies require the integration of societal and ethical dimensions, and SDS demands a focus on defending the legitimacy of science against denial and misinformation, cutting across disciplinary boundaries.

The proposed research agenda builds on these findings, emphasizing key leads for future studies. Developing a shared vocabulary can enhance interdisciplinary collaboration and streamline efforts. Comparing design criteria across disciplines can identify effective practices for fostering reasoning skills. Additionally, exploring emotions, values, and students' perspectives offers insights into how students navigate controversial issues, aiding in the creation of teaching strategies that resonate both cognitively and emotionally.

Ultimately, addressing controversial issues in education is essential for preparing students to become informed, responsible, and engaged citizens capable of thoughtfully navigating diverse perspectives in a complex world. Integrating shared reasoning practices with discipline-specific approaches and fostering interdisciplinary collaboration equips students with critical thinking, empathy, and adaptability to engage constructively with controversies.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that Gen AI was used in the creation of this manuscript. Artificial Intelligence (AI) was utilized in this manuscript to assist in refining the language.

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