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Research Article

Drawing the Boundaries of Controversy: Justifying the Inclusion and Exclusion of Climate Change Perspectives in Geography Teacher Education

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Abstract: Teaching controversial issues is a central yet challenging task in geography education, especially regarding climate change, where scientific consensus on causation coexists with contested responses to addressing climate change. Although controversy is widely regarded as essential for fostering judgment and democratic engagement, empirical research on how teacher educators, as models of professional judgment, justify decisions about the inclusion or exclusion of perspectives in classroom discussions as a relevant part of planning the teaching of controversial issues remains limited. This study investigates how such decisions are justified and to what extent participants' justifications can be analytically related to established theoretical criteria for controversy. Group discussions with teacher educators, in which participants engaged with materials designed to prompt discussion about the inclusion and exclusion of perspectives on addressing climate change, were analysed using qualitative content analysis. The findings reveal that participants' justifications are pluralistic and context-dependent, drawing on multiple considerations that can be analytically related to different theoretical criteria. By analysing these patterns, the study offers empirical insight into how the boundaries of controversy are drawn in practice and discusses implications for teacher education and classroom practice. It thus advances the "controversy over controversies" debate by demonstrating how theoretical criteria are reflected in situated justificatory practices through which inclusion and exclusion decisions are negotiated in context. The study indicates that geography education, particularly in times of socio-spatial transformation and uncertainty, can benefit from approaches that support reflective, criteria-aware professional judgment rather than prescriptive decision rules when addressing controversial issues.

Keywords: climate change education; controversial issues; justifications; professional judgment; geography teacher education

Highlights:

- Inclusion and exclusion are justified by multiple considerations, not a single criterion.
- Reflective use of controversy criteria can support geography teacher education.
- Climate change highlights risks of relying solely on public debate to determine controversy.

1. Introduction

Geography education increasingly takes place within contexts shaped by societal change, spatial intricacies, and debates over knowledge. Consequently, controversy is regarded as essential for high-quality geography teaching (Biddulph et al., 2015; Hopwood, 2021; Slater, 1996; Standish, 2024), especially in a world in transition where uncertainty and contestation remain dominant elements of public discourse. Key topics such as climate change, migration, and

resource management are marked by conflicting perspectives, ongoing negotiation, and the absence of definitive solutions (Mitchell, 2017). Engaging with these controversies supports students in developing judgment (Standish, 2024) and enhances their ability for informed democratic participation in pluralistic societies (Hess, 2009; Mitchell, 2017).

Despite the acknowledged importance of addressing controversial issues within geography education, empirical studies indicate that teachers often experience uncertainty and tend to avoid such topics. Oulton et al. (2004), using focus groups and questionnaire data, found that numerous teachers feel inadequately prepared and constrained in their ability to incorporate controversial topics into classroom instruction. Subsequent research in geography and social studies education further underscores these challenges, highlighting persistent difficulties in addressing controversial issues and deficiencies in teacher preparation (Hintermann et al., 2021; Nganga et al., 2020; Smit et al., 2024; Yaar-Waisel & Leininger-Frézal, 2025). In Germany, investigations on Education for Sustainable Development (ESD) reveal similar uncertainty and discomfort when engaging with controversial issues (Weselek & Wohnig, 2021), indicating a need to strengthen teacher education concerning the handling of controversial issues. Collectively, these studies point to a persistent gap between the expectation that teachers address controversial issues and their perceived readiness to do so in practice, underscoring the critical role of teacher education in fostering professional capacities for teaching controversial topics.

A central component of such capacities involves professional judgment regarding what is legitimately controversial within the classroom (Hess, 2009). This includes framing issues, selecting perspectives, and determining which positions should be open to deliberation and which should be regarded as settled (Hess & McAvoy, 2015). These questions are central to the interdisciplinary debate known as the controversy over controversies in Anglophone philosophy of education (Warnick & Smith, 2014), which discusses criteria for classifying topics or stances as (non-)controversial in educational contexts. While this debate provides important theoretical insights, its criteria have not been systematically examined or explicitly connected to geography education. Teacher educators are particularly pertinent in this regard, as they model professional judgment and influence how (prospective) teachers approach controversial issues (McAvoy & Ho, 2020). Nevertheless, there is limited understanding of how teacher educators justify such boundary-drawing decisions in specific instances.

In this context, the present study investigates how teacher educators in Germany justify decisions regarding the inclusion or exclusion of perspectives on addressing climate change. This theme is employed as an exemplary context of notable significance for geography education. The research addresses the following question: How do teacher educators justify the inclusion or exclusion of perspectives on addressing climate change, and how can these justifications be related to established theoretical criteria for controversy? Focusing on justifications is analytically productive because it provides insight into the criteria and warrants underlying boundary-drawing decisions, thereby facilitating an empirically grounded comparison with established theoretical criteria for controversy. In doing so, the study responds to calls to complement general theoretical debates on controversy with empirically grounded, case-sensitive analyses that consider subject-specific logics and help bridge the normative–empirical divide in research on controversial issues in education (Drerup, 2023). Drawing on group discussions with German teacher educators from diverse disciplinary backgrounds, the analysis prioritises justificatory practices over the evaluation of individual decisions. By empirically examining how climate change serves as a context for reasoning about controversy, the study aims to contribute to ongoing discussions in geography education on teaching controversial issues and to strengthen connections between subject-specific research and interdisciplinary debates in the philosophy of education. The findings indicate that participants employ pluralistic, context-dependent patterns of justification that can be analytically related to established theoretical criteria for controversy in determining whether to include or exclude perspectives on addressing climate change.

2. Theoretical Background

The question of when a topic should be considered controversial in the classroom and when it should not be is part of a broad scholarly debate about the criteria for determining controversy, often referred to as the controversy over controversies (Warnick & Smith, 2014). This discourse is grounded in the assumption that topics considered controversial in educational settings should be approached in a non-directive manner, implying an open-ended discussion. Conversely, non-controversial topics should be delivered with a directive approach, emphasising a specific educational goal. Accordingly, this does not suggest that a topic regarded as non-controversial should be entirely excluded from the classroom. Instead, it indicates that such a topic should not be treated as controversial, recognising the existence of

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multiple, equally valid, and legitimate perspectives (Drerup, 2021a; Hess, 2009). In this study, the criteria used to determine controversy are regarded as different ways of justifying the inclusion or exclusion of perspectives within educational settings. Consequently, they establish a conceptual framework for analysing how teacher educators classify certain perspectives as either legitimate or illegitimate in classroom discussions, thereby drawing the boundaries of controversy. The subsequent section outlines the primary criteria from this debate to serve as analytical reference points for examining participants' justificatory practices.

The behavioural criterion derives from the work of Charles Bailey (1975). According to this criterion, any topic that is controversially discussed within society and public discourse should also be debated controversially in the classroom. This approach is supported by the recognised need to provide students with opportunities to engage with real-world scenarios, which they would encounter outside the classroom regardless (Drerup, 2021b). From this perspective, inclusion is justified by the presence of disagreement in public discourse, irrespective of the epistemic or normative status of the perspectives involved.

The epistemic criterion, on the other hand, proposed by Dearden (1981) and supported by Hand (2007, 2008), is grounded in the premise that a topic "is controversial if contrary views can be held on it without those views being contrary to reason" (Dearden, 1981, p. 38). Unlike the behavioural criterion, it is insufficient for a topic to be merely the subject of controversy within society; the disagreement must be reasonable, meaning that different positions must be justifiable through rational argumentation (Hand, 2007). Consequently, perspectives are included only if they can be justified through rational argumentation, whereas perspectives contradicting established knowledge may be excluded.

Another proposed standard is the political criterion, which is founded on the fundamental values of liberal democracy (Yacek, 2018). Compared to the behavioural criterion, the political criterion is less comprehensive, restricting contentious debates to moral questions, "where public values are silent" (Hand, 2008, p. 222). Matters for which public values such as human rights, social justice, or tolerance (Hand, 2008) provide a definitive answer must therefore be addressed non-controversially. From this perspective, inclusion depends on whether perspectives are compatible with democratic values, while perspectives that violate these values may be excluded.

An additional effort to delineate the scope of themes and issues to be considered as controversial in educational settings is represented by Hess and McAvoy's (2015) politically authentic criterion. According to this, topics should be debated controversially in the classroom if they are also subjects of controversy within "the authentic political sphere of democratic decision-making" (Hess & McAvoy, 2015, p. 168). In this context, inclusion is justified by the presence of perspectives within the political sphere, even if this might conflict with epistemic or normative considerations.

From the perspective of religious education, Cooling (2012, 2014) proposes a diversity criterion, criticising the epistemic criterion's "over-reliance on the decisiveness of reason and failure to attend to the need for fairness" (Cooling, 2012, p. 169). Issues should therefore be discussed controversially if there are significant differences of opinion between different belief communities within society and if these communities value stating reasons and are committed to peaceful coexistence.

Anders and Shudak (2016) advocate for an approach that rejects the notion of relying solely on a single criterion to determine which topics should be regarded as controversial. Instead, they aim to incorporate various aspects into the criteria debate. In addition to the behavioural criterion, the epistemic criterion, and the political criterion, they propose the inclusion of a social criterion and a theoretical criterion. The social criterion stipulates that an issue should be regarded as controversial when it is relevant to students' lives. By introducing a theoretical criterion, they direct attention toward authoritative experts. If consensus cannot be reached among experts on an issue, it should be deemed controversial. Accordingly, inclusion of a perspective may be additionally justified either by relevance to students' lifeworlds or by the absence of expert consensus.

Similarly, Drerup (2021a) advocates against relying solely on a single criterion to determine whether a topic should be addressed controversially. Instead, he proposes a combined approach that integrates both a political and a scientific criterion. This proposal aims to foster an epistemic and political civilisation of debates by aligning with subject-specific standards of rationality, as well as boundaries of tolerance and pluralism. From this perspective, inclusion is justified when perspectives meet both epistemic standards of rationality and align with the fundamental political values that underpin liberal democracies, whereas perspectives that fail to satisfy either dimension may be excluded.

Yacek (2018) investigates the necessary conditions for students to perceive a question as controversial and formulates a psychological criterion based on this investigation. According to this criterion, only topics capable of generating constructive intellectual tension, serving as an entry point to controversy, can and therefore should be taught in a

controversial manner. Here, inclusion of a perspective can be justified by the potential to stimulate engagement and reflection.

Finally, May (2022) emphasises the specificity of concrete situations by proposing a pedagogical criterion as a supplement to existing criteria. The benchmark should be the learning opportunities that can be augmented through controversy in a particular context. When the topic is better learned through controversial debate, the boundaries of the epistemic and the political criterion may be expanded (May, 2022; May & Hameister, 2023). From this perspective, inclusion of a perspective is justified when engaging with this perspective enhances learning in a given context.

Taken together, these criteria articulate different ways of justifying the inclusion or exclusion of perspectives in educational settings. They may lead to conflicting conclusions, as perspectives can be included according to one criterion while being excluded according to another. In this study, these criteria are therefore treated as a conceptual framework that guides the analysis of teacher educators' justificatory practices.

Deciding what counts as a controversial issue is not only a theoretical problem, but also a matter of professional judgment in educational practice. Research has highlighted that teachers—and, by extension, teacher educators—play a central role in framing issues, selecting perspectives, and determining how controversies are presented in the classroom (Hess, 2009; Hess & McAvoy, 2015). These decisions involve navigating competing criteria and balancing different considerations when including or excluding perspectives. Teacher educators, in particular, can be understood as models of such professional judgment, as they not only make these decisions themselves but also shape how future teachers learn to approach controversial issues (McAvoy & Ho, 2020).

Debates about strategies for addressing climate change provide a particularly suitable example for illustrating how different criteria lead to divergent boundaries of controversy. From the perspective of the epistemic and theoretical criteria, the broad expert consensus on anthropogenic climate change (Lynas et al., 2021; IPCC, 2023) renders denial rationally indefensible and therefore non-controversial in an epistemic sense (Dearden, 1981). By contrast, applying the behavioural criterion could be used to argue for including denial simply because it appears in public discourse, thereby risking what has been described as false balance by treating any public dispute as a classroom controversy (Hand, 2007). The politically authentic criterion intensifies this tension: climate denial in far-right parties suggests democratic 'authenticity,' though Drerup (2021a) argues political presence alone does not legitimise epistemic falsehoods. The pedagogical criterion introduces nuance: engaging with denial can be didactically valuable if it creates context-specific learning opportunities, for example by analysing denial texts to identify misinformation strategies, link them to political–economic interests, and foster media literacy and epistemic vigilance (Rabe & Paz, 2025). Finally, the psychological criterion focuses on learners' experience: discussions of denial can generate intellectual tension as an entry point into controversy, yet not all forms of tension are regarded as pedagogically desirable, which has led authors to emphasise the need for careful judgment about whether and how to engage with denial in specific classrooms (Nygren & Elfimova, 2025; Kutney, 2025).

While causation represents an epistemically settled issue, debates about response strategies reveal further tensions. In climate strategy debates – mitigation and adaptation (Wang et al., 2023), alongside civic engagement, technical, economising, transformative and post-growth approaches (Grassinger, 2018) – from an epistemic perspective, both mitigation (e.g. carbon pricing) and adaptation (e.g. climate-resilient infrastructure) remain rationally justifiable. The political criterion introduces boundaries: strategies systematically marginalising groups – such as externalising environmental burdens onto formerly colonised regions or individualising responsibility in ways criticised as classist (Otto, 2025) – collide with liberal-democratic values of equality and non-discrimination (Hand, 2008) and could thus be excluded as illegitimate controversies. By contrast to the political criterion, the social criterion emphasises relevance to students' lifeworlds: such individualising approaches could be included precisely because they substantially affect students' personal realities, rendering them suitable for controversial classroom discussion. These tensions form our analytical framework for analysing participants' justificatory practices.

3. Materials and Methods

Building on these theoretical considerations, the question is not only how the boundaries of controversy can be defined conceptually, but also how they are drawn in practice through the inclusion and exclusion of perspectives on specific topics. While existing research has elaborated various criteria for determining controversy, there is limited empirical insight into how such criteria are reflected in justificatory practices in educational settings. Against this back-

ground, this article addresses the following research question: How do teacher educators justify the inclusion or exclusion of perspectives on addressing climate change, and how can these justifications be related to established theoretical criteria for controversy?

The methodological setting for answering the research question belongs to the field of qualitative methodological research. Data collection took place in interdisciplinary workshops on dealing with controversial issues in the context of ESD at a university in Germany in May 2025. The participants are teacher educators of different stages of teacher education within a federal state. This included teacher educators working in initial teacher education as well as those involved in later phases, such as in-service teacher education. A total of 23 people took part in the workshops on dealing with controversy, organised into five groups of four to five participants. The participants represented a range of subject backgrounds, with a majority from STEM-related disciplines. When forming the groups, care was taken to distribute participants across groups to ensure a mix of subject backgrounds within each discussion. The workshops lasted 60 - 90 minutes, and the discussions lasted 30 - 45 minutes. These were recorded with recording devices and then transcribed for data analysis.

Participants received short texts representing diverse perspectives on addressing climate change (see the Appendix – Table A1). Participants were asked to sort the perspectives using the following task prompt: *"You will receive various perspectives on dealing with climate change. Categorise these perspectives into two groups: Within the red line – perspectives that are considered equally valid and should be discussed in class. Outside the red line – perspectives that can be excluded."* Moreover, participants were instructed: *"Discuss together which criteria you use to organise the perspectives."*

The texts were developed to represent real-world climate strategies and discourses from research, media, and policy debates. The texts were developed through a multi-step process to represent central strands of climate-related debates. First, widely discussed climate strategies and discourses were identified by drawing on research literature, policy documents, and media coverage. Particular attention was paid to capturing positions that reflect different approaches to addressing climate change (e.g. mitigation, adaptation, technological, economic, or transformative strategies). Based on this review, a set of perspectives was constructed that exemplifies these positions in a condensed format. The formulation of the texts aimed to balance authenticity and analytical usability: while the perspectives draw on real-world arguments, they were adapted and anonymised to ensure clarity and accessibility, while preserving their distinct argumentative structures and emphases. In addition, the selection and formulation were guided by the aim of eliciting justificatory reasoning, meaning that the perspectives were designed to allow for multiple considerations in participants' reflections on their inclusion or exclusion in classroom contexts. Accordingly, a perspective may be considered excludable from an epistemic or political perspective, while being included based on pedagogical or behavioural considerations. Although the perspectives are grounded in internationally discussed strategies, their selection and formulation were informed by debates prevalent in Germany and the German-speaking context to ensure contextual relevance for participants. Table 1 presents an overview of the perspectives included in the material and the corresponding climate strategy types addressed.

The data were analysed using qualitative content analysis following Kuckartz and Rädiker (2024). The analysis focused on participants' justificatory practices regarding the inclusion and exclusion of perspectives. In line with the theoretical framework, which conceptualises criteria of controversy as different ways of justifying the inclusion or exclusion of perspectives, the coding process was guided by deductively derived categories corresponding to these criteria (behavioural, epistemic, political, politically authentic, diversity, theoretical, social, psychological, and pedagogical). The coding was conducted by two researchers with expertise in geography education, using paragraphs as the coding units. In an initial step, both researchers independently coded a subset of the material to apply and test the category system. The coding was then compared and discussed, leading to a shared understanding of the categories and, where necessary, refinement of their application. Subsequently, the complete data material, consisting of five transcripts of the group discussions, was coded independently. The intercoder agreement was 81.86 per cent. Coding discrepancies were then discussed and resolved through consensus.

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Table 1. Overview of the perspectives and strategies addressed in the workshop material.

Perspective	Strategy addressed in the perspective
Climate Money – A Socially Just Carbon Pricing System: Proposes socially just CO_2 pricing with full per-capita refunds, benefiting low-income households disproportionately (Deutscher Ethikrat, 2024)	Mitigation, Green growth, Economising strategy
Climate Hysteria and Gender Distribution – A Critical Perspective: Pathologises Fridays for Future protesters as hysterical/mentally ill, denying climate crisis reality (Klein, 2019)	Civic Engagement
Energy Transition?: Human climate causation unproven, CO_2 beneficial, opposes energy transition (Alternative für Deutschland, 2025)	Mitigation, Green growth, Technical strategy
Influencing the radiation balance (Solar Radiation Management – SRM): Geoengineering to reflect sunlight and cool the planet through technical interventions (Wessel, 2023)	Green growth, Technical strategy
Important tips for saving CO_2: Individual lifestyle changes for CO_2 reduction through daily habits (Greenpeace, 2025)	Mitigation, Technical strategy
Ecopop Initiative: Advocates population control via family planning in the Global South as a climate solution (Schweizerische Bundeskanzlei, 2014)	Mitigation
Constitutional Reform for the Rights of Nature: Constitutional reform granting legal personhood and rights to nature (Netzwerk Rechte der Natur, n.d.)	Transformative
Degrowth – Sustainability Instead of Growth: Degrowth advocates sufficiency, reduced Global North consumption, and democratic self-determination (Redaktion des Degrowth Webportals, n.d.)	Mitigation, Post-growth
The ban on plastic straws – A step for the environment: EU single-use plastics ban targeting straws as environmental protection measure (Presse- und Informationsamt der Bundesregierung, n.d.)	Mitigation, Technical strategy, Green growth
Save lives with your donation: Welthungerhilfe donation appeal for food security and resilience training in drought areas (Deutsche Welthungerhilfe e. V., n.d.)	Adaptation, Charity

4. Results

4.1. Patterns in Participants' Justifications Related to Theoretical Criteria of Controversy

This section presents the results of the analysis by focusing on recurrent patterns in participants' justifications for including or excluding perspectives on how to address climate change. Drawing on the theoretical criteria of controversy outlined above, participants' statements were analytically related to different types of considerations that correspond to these criteria. It is important to note that the criteria function here as analytical categories rather than as actors' categories; participants did not explicitly refer to them, but articulated justificatory patterns that can be interpreted in light of the theoretical debate on controversy. To provide an overview of the relative prominence of these patterns across the group discussions, Table 2 summarises the frequency of coded segments that were analytically related to the

different criteria. The frequency of codes is reported to provide an overview of patterns in the data; however, the analysis focused on qualitative aspects. The following subsections, therefore, examine each criterion in turn, illustrating how these considerations were mobilised in participants' reasoning.

Table 2. Frequency of coded segments that were analytically related to theoretical criteria of controversy across group discussions.

Criterion	Total coded references	Participants with coded references (n = 23)[1]
Behavioural	66	18
Epistemic	23	12
Political	24	13
Politically authentic	26	14
Diversity	0	0
Theoretical	59	18
Social	21	12
Combined political-scientific	1	1
Psychological	8	6
Pedagogical	51	15

[1] *The criteria function as analytical categories applied ex post; participants did not explicitly refer to these criteria in the discussions.*

4.1.1. Behavioural criterion

Across the dataset, the behavioural criterion was coded most frequently. Patterns related to this criterion were identified in the contributions of 18 of 23 participants. The designation of participants within the evaluated discussion groups always starts at 1 (e.g. group 1, participant 1, group 4, participant 1). A recurring rationale was that perspectives present in societal discourse "just have to be discussed in class" (group 1, participant 1), as otherwise teachers "could be accused of (...) indoctrination or something like that, since science is also being questioned by some sections of society" (group 1, participant 1). Another justification for including perspectives, which can be related to the behavioural criterion, was the assumption that students would encounter these positions outside the school environment regardless. This argument was frequently supported by references to media and social media, described as platforms where such viewpoints circulate broadly. Furthermore, one participant, a geography teacher, emphasised the spatial perspective by highlighting the importance of "the spatial context" (group 2, participant 3), asserting that a topic "will be discussed differently" (group 2, participant 3) across various regions, with specific reference to coal mining areas in Germany. The analysis further indicates that reasoning aligned with the behavioural criterion was also employed to justify the exclusion of certain perspectives. In these instances, participants either assumed a broad societal consensus or characterised a position as a "side issue" (group 1, participant 2), to which they did not wish to "attach too much importance" (group 1, participant 2). In the latter case, participants also invoked the term "false balance" (group 1, participant 2).

4.1.2. Epistemic criterion

Epistemic considerations for justifying the inclusion or exclusion of perspectives on addressing climate change that can be related to the epistemic criterion were identified in the contributions of 12 of 23 participants. In these instances, participants maintained that a topic should be considered controversial only if opposing viewpoints can be regarded as rationally justifiable and grounded in evidence. A recurring pattern in the discussions was the distinction between empirically settled issues and questions pertaining to political measures or implementation strategies. While statements referring to the anthropogenic nature of climate change or the unequal global distribution of responsibility and impacts were described as non-controversial, with participants stating that "there is no question that this is a fact" (group 3,

participant 2) or that it represented a clear "right and wrong" (group 4, participant 1), debates concerning policy responses (such as bans, regulations, or economic instruments) were regarded as appropriate subjects for controversial classroom discussion.

At the same time, participants employed epistemic reasoning to advocate for the exclusion of certain perspectives from controversial treatment. Positions perceived as lacking a rational foundation - such as climate change denial, conspiracy-like arguments, or claims based on stigmatising or pseudoscientific reasoning - were dismissed as "nonsense" (group 5, participant 2, participant 4; group 4, participant 3) or "esoteric" (group 2, participant 2). In these instances, participants highlighted that the absence of plausible counterarguments rendered controversial discussion inappropriate, as exemplified by the question, "What counterargument would you find for this?" (group 5, participant 1).

Even when participants acknowledged that such views circulate in public discourse, they emphasised that their mere presence in society is insufficient to justify controversial treatment in the classroom. Instead, perspectives were required to meet a minimum epistemic threshold, as otherwise, one might include "all kinds of nonsense" (group 2, participant 3).

4.1.3. Political criterion

In the group discussions, normative considerations corresponding to the political criterion played a role in the justifications of 13 of 23 participants. In these instances, the boundaries of legitimate classroom debate were delineated with reference to public values of liberal democracy, such as human dignity, equality, and non-discrimination. This was particularly evident in the rejection of sexist or stigmatising framings of climate engagement, which participants explicitly dismissed, stating, for example, "that is a sexist quote, I would not use it" (group 1, participant 5).

Participants also invoked constitutional-democratic principles as a boundary marker when discussing positions related to the Basic Law and the democratic order. Arguments were considered excludable if they were directed against fundamental rights or the liberal-democratic framework itself, as participants emphasised the need to "be careful whether statements are directed against fundamental rights" (group 3, participant 1). While political justifications were sometimes intertwined with epistemic considerations, the decisive warrant in these passages was normative: classroom controversy was judged inappropriate when positions undermined public values for which liberal democracy provides a clear orientation.

4.1.4. Politically authentic criterion

Throughout the group discussions, the justifications of 14 of 23 participants can be related to considerations that conform to the politically authentic criterion. In these instances, perspectives were deemed appropriate for controversial classroom discussion when they were situated within authentic political decision-making processes, such as governmental debates, legislative procedures, or international negotiations. Participants either made general references to "politics," for example, when advocating that climate dividends should be included in classroom discussions because "this is being discussed in politics" (group 2, participant 1), or cited more specific political arenas. These included national and supranational legislation, such as references to EU-wide bans on single-use plastics (group 2, participant 1, participant 5), constitutional and legal frameworks, or international climate conferences, where, as one participant remarked, "responsibility is shifted back and forth" (group 1, participant 5).

At the same time, in other group discussions, participants invoked political authenticity to justify acts of exclusion, asserting that perspectives should not be subject to controversy once a binding political decision had been made. This was exemplified, for instance, in conversations regarding the prohibition of single-use plastics, which was exempted from debate due to its prior resolution at the European Union level. One participant questioned, "What do you want to discuss controversially there?" (group 5, participant 1). Throughout different group discussions, the same political measure (a ban on single-use plastic) could serve as both an inclusion and an exclusion reference point, depending on whether participants perceived the political process as ongoing or already concluded.

4.1.5. Diversity criterion

None of the justificatory patterns can be related to the diversity criterion.

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4.1.6. Theoretical criterion

Throughout the group discussions, the justifications of 18 of 23 participants can be related to considerations that align with a theoretical criterion. In these sequences, judgments regarding inclusion and exclusion were oriented towards the state of expert discourse rather than merely public disagreement. Participants repeatedly raised questions about source credibility, research validity, and scholarly debate, emphasising the need to evaluate whether a particular perspective was supported by scientific studies, discussed within relevant academic communities, and traceable to identifiable sources. This was evident through recurring concerns such as uncertainty about "where this comes from" (group 2, participant 5), as well as explicit references to "studies" (group 2, participant 2), "the literature" (group 2, participant 5), and "scientific discourse" (e.g. group 2, participant 2).

In some instances, participants articulated a structured process for determining whether an issue should be treated as controversial, emphasising the importance of consulting academic articles and reviews to gain an overview of the current research landscape. As one participant stated, they "would systematically look for articles, reviews" to "get an overview" (group 3, participant 4). This expert-oriented justification also influenced participants' differentiation between teaching a topic and teaching it controversially. Claims perceived as consistent with expert consensus were regarded as appropriate for classroom instruction, but not as subjects for controversy; "So it belongs in the classroom, but not because it is controversial, but simply because it is consensus" (group 3, participant 2).

Notably, the same perspective may either be incorporated or omitted on theoretical grounds. For example, geoengineering was characterised by some participants as controversially teachable specifically because it is "discussed in scientific circles" (group 1, participant 5), whereas others advocated its exclusion, highlighting the lack of sufficiently "scientifically grounded approaches" (group 1, participant 1) or of credible sources.

4.1.7. Social criterion

Justifications related to the social criterion were identified in the contributions of 12 of 23 participants. In these contexts, perspectives were deemed appropriate for controversial classroom discussion when they were perceived as closely linked to students' everyday experiences, social encounters, or personal concerns. Rather than referencing scientific disagreements or formal political decision-making processes, participants underscored that controversy was understood to originate from learners' social positioning and personal involvement. Topics such as climate dividends, social inequality, consumption practices, employment concerns, and technologically mediated lifestyles were considered particularly appropriate because students were assumed to "have an opinion on that" (group 1, participant 04) or because these topics are "closer to the everyday lives of students" (group 4, participant 2).

This emphasis on lived relevance was expressed through references to tangible social practices and societal pressures. For instance, one participant identified consumption and technology as socially charged topics because "everyone, especially at that age, always wants to have the coolest, newest, and best, including digital devices" (group 1, participant 3), thereby emphasising peer pressure and group norms as sources of tension and discord. Others highlighted that the socio-economic dimensions of climate-related issues strongly resonate with students' realities, particularly when discussions involve unequal burdens, livelihoods, or anxieties about job losses: "It is also about jobs, it is about fears" (group 1, participant 3). From this perspective, controversy was deemed justified not because an issue remains unresolved in science or politics, but because it pertains to social experiences students regularly encounter in their daily lives.

4.1.8. Combined political-scientific criterion

Within the group discussions, the justification of one of the 23 participants can be analytically related to a combined political-scientific approach. In this context, decisions regarding inclusion and exclusion arose from the explicit combination of epistemic and political considerations. Importantly, the political reference did not concern liberal-democratic basic values, but rather the political authenticity of the position, understood as its occurrence in actual political debates and among political actors. This tension was articulated explicitly in the statement: "If we look at both criteria, it would be out. But if we say that there are people who bring similar arguments politically, then it would be in" (group 3, participant 4). Rather than resolving this tension, the participant left the inclusion decision open, indicating uncertainty about how epistemic legitimacy and political relevance should be weighted in classroom contexts.

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4.1.9. Psychological criterion

Throughout the group discussions, the justifications of six out of 23 participants can be related to a psychological criterion. In these instances, perspectives were deemed appropriate for controversial classroom discussion when they were anticipated to be "stimulating discussion" (group 4, participant 4). Controversy was thus regarded less as an inherent property of the topic itself than as a function of anticipated discussion dynamics and learner responsiveness. Participants highlighted that such issues are particularly suitable when students feel personally addressed, for example, in socio-economic contexts, with one participant noting that "with money, you always get them" (group 1, participant 4).

4.1.10. Pedagogical criterion

Pedagogical reasoning, which can be analytically related to the pedagogical criterion, was used by 15 of 23 participants to justify the inclusion or exclusion of perspectives. In these exchanges, decisions regarding inclusion and exclusion were justified based on didactic considerations and expected learning opportunities, rather than on controversy as an intrinsic characteristic of the issue. Participants assessed perspectives based on whether they were perceived to promote the development of independent judgment, critical reflection, and competence development within specific classroom contexts.

A central concern was whether a perspective allowed space for students to develop their own judgments. Statements were dismissed when perceived as excessively directive or as prematurely closing off deliberation, for example when presented as unequivocal instructions for action: "It is just like a sledgehammer: do that." (group 4, participant 2), or when considered as "anticipating your judgment, which I should form myself" (group 5, participant 3). Pedagogical reasoning was also connected to contextual factors such as age, prior knowledge, and instructional objectives. One participant observed that the perspective claiming climate hysteria is female is "very demanding" and should be excluded because "the foundation simply does not exist" (group 3, participant 4). Conversely, assertions that participants themselves did not regard as epistemically, normatively, or politically legitimate were explicitly defended as instructional material when they served higher-order learning aims, such as analysing argumentation strategies or identifying misinformation: "Personally, I find it exciting to include quotes like this in class and discuss them, because it leads to self-awareness and perhaps to the realisation that it is nonsense" (group 1, participant 1). Overall, this form of justification reflects a pedagogical orientation towards controversy, in which perspectives are evaluated primarily in terms of their didactic potential and situational appropriateness, allowing participants to justify both inclusion and exclusion depending on anticipated learning outcomes.

4.2. Synthesis of Criterion-Related Justifications and Their Relative Weighting

While the previous section analysed justificatory patterns in relation to individual theoretical criteria of controversy, this section synthesises how these justifications were combined, prioritised, or left unarticulated in participants' discussions. Throughout the group discussions, participants' justifications for including or excluding perspectives followed recurring patterns that can be analytically related to different theoretical criteria. In many sequences, more than one form of reasoning was expressed within a single decision-making episode, demonstrating that inclusion and exclusion decisions were seldom grounded in a singular consideration. Instead, participants combined different lines of reasoning, which were activated at different stages of the discussion. These combinations did not occur arbitrarily but exhibited systematic tendencies across different groups.

In particular, epistemic and theoretical considerations were frequently invoked during the initial stages of deliberation, delineating which perspectives were deemed appropriate for further engagement at all. Pedagogical considerations, by contrast, frequently appeared at later stages, influencing decisions regarding whether and how a perspective could be incorporated within classroom settings, through means such as contextualization, reframing, or analytical methods. References to social relevance or anticipated classroom dynamics generally served as supplementary considerations, refining or clarifying these judgments rather than overriding epistemic exclusions.

Regarding political and normative considerations, the analysis indicates that these were addressed selectively in the participants' justifications. Even in instances where perspectives could plausibly have been dismissed by invoking

public values of liberal democracy - such as equality, non-discrimination, or human dignity - participants did not consistently articulate these considerations explicitly. Rather, exclusion decisions were mainly justified by alternative reasoning, such as limited relevance. This selective articulation underscores how different criteria were not only integrated but also prioritised differently within the participants' reasoning process.

5. Discussion

This study aimed to investigate how teacher educators justify their decisions regarding the inclusion or exclusion of perspectives on addressing climate change, thereby drawing the boundaries of controversy. It also sought to determine the extent to which these justifications align with established theoretical criteria for controversy. The analysis of group discussions among teacher educators at different stages of teacher education and from diverse disciplinary backgrounds focused on justificatory practices rather than on evaluating the correctness of individual decisions. The findings offer empirical insights into how controversy is negotiated in educational practice and how participants' justificatory practices can be analytically associated with theoretical criteria. This study contributes to the existing body of literature in two main ways. First, it provides empirical insight into how teacher educators—an actor group that has received limited attention in this debate—justify the inclusion and exclusion of perspectives when addressing controversial issues. By focusing on those involved in preparing (preservice) teachers, the study highlights how professional judgment is shaped at a critical interface between theoretical debate and educational practice. Second, the study advances the "controversy over controversies" debate by examining how theoretical criteria are reflected in situated justificatory practices. Rather than treating these criteria as prescriptive rules, the findings show how considerations that can be analytically related to different criteria are mobilised, combined, and weighted in context-specific decision-making. In this way, the study bridges the gap between abstract theoretical debates about criteria and the practical reasoning through which the boundaries of controversy are drawn in educational contexts.

Throughout the group discussions, participants consistently drew on multiple forms of justification within the same decision-making episode. Behavioural references to societal debates, epistemic distinctions between settled facts and contestable claims, authentically political considerations related to democratic decision-making, and pedagogical reflections on learning opportunities frequently appeared together rather than in isolation. This pattern challenges approaches that prioritise a single dominant criterion - such as the epistemic criterion (Dearden, 1981; Hand, 2007) - as sufficient for determining controversy. Instead, the findings suggest that criteria-related considerations are dynamically combined, depending on the perspective under discussion. They were not applied uniformly but were often implicitly ordered and weighted. Epistemic and theoretical considerations frequently served as initial filters, shaping which perspectives were treated as legitimate candidates for classroom engagement, while pedagogical considerations became particularly salient at later stages of reasoning, informing judgments about whether and how a perspective could be addressed within instructional contexts. Other considerations, such as relevance to students' lives or anticipated discussion dynamics, generally served to contextualise or refine these decisions rather than to supersede epistemic exclusions.

At the same time, the analysis highlights the difficulty of clearly distinguishing certain considerations in participants' reasoning. In particular, behavioural references to societal debate, social relevance for students, and pedagogical reflections on classroom dynamics frequently overlapped in practice and were not always clearly separable. References to what is publicly discussed often simultaneously invoked assumptions about students' everyday experiences or anticipated learning processes, blurring the boundaries between behavioural, social, and pedagogical considerations. This overlap indicates that these criteria are better understood as interrelated dimensions of reasoning rather than as strictly separable categories.

Taken together, these patterns align more closely with multi-criteria approaches proposed in the literature than with models that seek a single sufficient criterion. In particular, they resonate with Anders and Shudak's (2016) argument that controversy emerges at the intersection of behavioural, epistemic, political, social, and theoretical dimensions, as well as with Drerup's (2021a) call for combining scientific and political considerations to civilise classroom debates, both epistemically and politically. Moreover, the strong role of pedagogical reasoning observed in the dataset reflects May's (2022) proposal to treat controversy as context-dependent and oriented towards concrete learning opportunities, rather than as an abstract property of topics.

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Furthermore, these patterns can be linked to typologies of controversial issues that distinguish, for instance, between "maximally controversial" topics, expert–public disagreements, and disagreements solely among experts (Zimmerman & Robertson, 2017). Perspectives such as climate change denial can be understood as resembling expert–public disagreements, in which broad expert agreement coexists with sustained public contestation. Such cases help explain why behavioural considerations related to public visibility were often combined with epistemic or theoretical restrictions. Conversely, perspectives concerning political responses, trade-offs, or questions of justice more closely resemble maximally controversial issues, in which disagreement is present both among knowledgeable persons and among the general public, thereby combining epistemic and behavioural considerations in a complementary manner. Other perspectives, such as solar radiation management, resemble disagreements primarily among experts, where epistemic uncertainty and theoretical complexity are salient despite limited public controversy. Seen in this light, the findings suggest that different perspectives within climate change elicited different constellations and weightings of criteria, particularly in the relation between behavioural and epistemic or theoretical considerations.

A particularly noteworthy finding concerns the prominent role of justification, which can be related to the behavioural criterion. Throughout the group discussions, references to societal debates, media presence, or the likelihood that students would encounter specific positions outside school were frequently cited as justifications for considering perspectives suitable for a controversial classroom discussion. This pattern reflects the intuitive appeal of the behavioural criterion articulated by Bailey (1975), highlighting the significance of engaging with publicly contested issues in the classroom. At the same time, participants rarely problematised the conditions under which such debates emerge or whose perspectives are represented within them. Public discourse thus appeared to function as an implicit and largely unexamined reference point in justificatory practices. From a theoretical perspective, this supports critiques of the behavioural criterion that caution against equating public controversy with educational legitimacy (Dearden, 1981; Hand, 2007). As one of the most expansive criteria, the behavioural criterion has been criticised for its lack of specificity, as it may suggest that all publicly contested issues should be treated as controversial in the classroom (Hand, 2007). Such an approach risks blurring the distinction between empirically well-established knowledge and contestable claims, potentially fostering forms of epistemic relativism (Dearden, 1981). Moreover, it may lead to the inclusion of positions that reject scientific evidence or reproduce discriminatory assumptions as equally valid contributions to classroom discussion (Drerup & Yacek, 2020). In this sense, treating empirically settled issues as open to controversy may be miseducative, as it obscures established knowledge and undermines students' understanding of evidence-based claims (Hess & McAvoy, 2015).

In light of the present findings, these critiques are particularly relevant, as participants frequently invoked societal debate without systematically reflecting on its conditions or limitations. For example, one participant argued for including certain perspectives, even when they question scientific knowledge, because they are present in public discourse. From this perspective, a reliance on public discourse as a primary criterion—if not accompanied by explicit reflection—can be considered problematic, as it risks reproducing unexamined assumptions about relevance and legitimacy. This becomes evident not only in the inclusion of perspectives based on their public visibility, but also in their exclusion, for instance, when participants characterised certain positions as marginal or sought to avoid giving them undue attention to prevent "false balance". Such reliance may obscure asymmetries in representation, as public debates do not necessarily reflect the plurality of affected perspectives but may privilege dominant voices (Achiume, 2022). In the context of climate change education, this observation is particularly relevant, as public debates may include positions that diverge from established scientific knowledge or marginalise certain perspectives. The findings therefore suggest a need for more explicit reflection within teacher education on how references to societal debate are used as criteria for inclusion and exclusion, and on the limitations of such criteria.

The reliance on societal debate was also linked to concerns about professional legitimacy, particularly the avoidance of perceived indoctrination, and to the assumption that students would encounter such positions outside school. In this regard, the findings may also be interpreted in light of the broader German context, in which public and political debates about teacher neutrality have gained prominence in recent years, including initiatives encouraging reporting perceived violations of neutrality (Cremer, 2019; Däuble, 2019). Such developments may heighten sensitivity among teachers as well as teacher educators regarding the justification of their instructional decisions and may make references to societal debate a particularly salient resource for legitimising the inclusion of perspectives.

At the same time, these findings point to a tension between concerns about neutrality and the role of normative commitments in professional judgment. From the perspective of political education in Germany, however, teaching

controversial issues cannot be understood as value-neutral, but must be oriented towards democratic and human rights principles (Christensen & Grammes, 2020). This suggests that participants' concern with avoiding accusations of indoctrination may obscure the normative foundations that inevitably shape decisions about the inclusion and exclusion of perspectives. Teacher education may therefore benefit from supporting future teachers in reflecting more explicitly on these normative foundations.

In this regard, the study also emphasises the need to address forms of discrimination that remain implicit or unacknowledged in discussions of controversy. Participants seldom explicitly problematised the possibility that perspectives might be marginalised or absent in societal debate. Consequently, geography teacher education could enhance controversy-centred reflection by incorporating additional analytical frameworks that highlight social positioning and power dynamics. Instruments such as the wheel of privilege may serve as exemplars for examining which perspectives are represented, which forms of discrimination are implicitly normalised, and how decisions about inclusion and exclusion intersect with broader patterns of privilege and marginalisation, especially within the context of climate change topics influenced by structural inequalities and global power relations (Abimbola et al., 2021).

Notably, none of the justificatory patterns identified in the data could be analytically related to the diversity criterion (Cooling, 2012, 2014). This absence may be interpreted in light of existing critiques of the diversity criterion, particularly those articulated by Hand (2014), who argues that the concept lacks sufficient clarity and practical applicability. In particular, the criterion raises unresolved questions about what constitutes a "belief community" and how teachers might determine whether such communities meet the required standards of rational justification. From this perspective, the absence of references to the diversity criterion in participants' reasoning may reflect not only the specific characteristics of the topic, but also the conceptual and practical difficulties associated with applying this criterion in educational contexts. At the same time, this finding does not imply that considerations of diversity are irrelevant to teaching controversial issues, but rather suggests that they were not explicitly mobilised as a distinct basis for inclusion or exclusion decisions in the present study.

The findings not only address whether perspectives were deemed includable or excludable but also demonstrate that participants considered how perspectives should be pedagogically staged, framed, and weighted once introduced in the classroom. This indicates a broader understanding of directivity, as articulated by Hand (2008), wherein directivity encompasses not merely the explicit definition of classroom boundaries but also the guidance of students towards specific judgments through various pedagogical decisions. Directive teaching can therefore also be realised when including a perspective in the classroom by using non-visible forms, such as discussing it with varying intensity, framing it in particular ways, or employing more or less compelling examples to support a given perspective. This interpretation is further substantiated by the observed sequencing of criterion-related justifications. Participants' reasoning frequently moved from initial epistemic or theoretical filtering to pedagogical decisions about how a perspective might be incorporated through contextualisation, reframing, or critical analysis. Such sequences imply that professional judgment regarding controversial issues extends beyond mere decisions of inclusion and exclusion; it also encompasses choices about modes of presentation and the degree of discursive openness afforded to different perspectives.

Against the background of these tensions—particularly the strong reliance on public discourse, the risk of equating visibility with legitimacy, and the limited explicit reflection on how problematic perspectives should be handled pedagogically—the findings have important implications for geography teacher education and classroom practice. Given the broader understanding of directivity shown, teacher education should help future teachers identify and evaluate different forms of directivity. Professional judgment includes deciding which forms and degrees of directivity are appropriate for different kinds of perspectives—for example, whether a perspective should be treated as an object of open deliberation, as a claim to be critically scrutinised, or as a position requiring clear epistemic or democratic boundary-setting. Perspectives that fall outside an epistemically defensible controversy may still have pedagogical value if they are introduced in a directive way as objects of critical examination, through which students can identify conflicts with scientific standards, evidentiary reasoning, or democratic principles (Honey, 2015).

The objective of teacher education should therefore be to cultivate professional judgment as the capacity to determine when a perspective requires non-directive or directive teaching, and to identify the appropriate form of directive instruction in specific circumstances. To facilitate the development of this type of professional judgment, teacher education may incorporate the concept of committed balancing, as proposed by Kindlinger and Hahn-Laudenberg (2023). This approach offers an alternative to misconceptions about neutrality, in which educators believe they must

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provide equal consideration and validity to every societal position expressed. Conversely, committed balancing combines openness to controversy with "a very specific form of privileging, namely the privileging of democratic and rationally defensible positions" (Kindlinger & Hahn-Laudenberg, 2023, p. 199). Consequently, it avoids the criticised both-sidesism where unequal positions, such as scientific consensus and conspiracy theories, are presented as equivalent alternatives (Brüggemann & Engesser, 2017). In the context of a topic such as climate change, this approach entails creating space to examine competing political responses and social interests, while refraining from presenting scientifically unsupported claims or discriminatory framing as equally valid alternatives.

The materials used in this study proved effective at eliciting justificatory practices around the inclusion and exclusion of perspectives. Rather than guiding participants towards predefined positions, they enabled the articulation of multiple, and at times competing, considerations, thereby making visible how the boundaries of controversy are constructed in practice. This suggests that teacher education can benefit from deliberately designed, case-based materials that juxtapose different perspectives and require participants to justify decisions about inclusion and exclusion. Such formats create structured opportunities to engage with professional judgment in situations where no single criterion provides a clear answer, aligning with calls for case-sensitive approaches to controversy (Drerup, 2023).

Moreover, the findings indicate that discussions can be deepened by explicitly introducing theoretical criteria as reflective tools. Although participants did not explicitly refer to these criteria, their reasoning could be systematically related to them. This suggests that teacher education can productively introduce criteria after initial discussions, for example, by asking participants to revisit their decisions and examine how different criteria (e.g. epistemic, political, or pedagogical) would support or challenge their justifications. Such an approach enables the identification of tensions between criteria, reflection on their implicit weighting, and the uncovering of potential blind spots—such as the limited role of the diversity criterion observed in this study. This is particularly relevant given the strong reliance on references to public discourse, which may obscure underlying power asymmetries and structural inequalities. The findings also suggest that such reflection should be considered relevant not only for (prospective) teachers but also for teacher educators themselves, as actors who model professional judgment. This includes critically examining underlying assumptions, implicit weightings of criteria, and their own positionality when engaging with controversial issues.

The limitations of this analysis are evident in the following aspects. The workshops examined took place at a single German university over a relatively short period, with only a relatively small number of teacher educators from one federal state participating. Furthermore, the workshops were designed to elicit spontaneous reactions from participants, with climate-related statements to be included or excluded to address controversy. There was no specific content preparation for the participants, and they drew on their everyday and scientific experiences when making their decisions. There was no explicit discussion or preparation on dealing with complexity in educational contexts. The predominance of participants from STEM-related disciplines may have influenced the justifications observed in the data. Participants frequently prioritised scientific validity as a basis for inclusion or exclusion decisions, which may reflect disciplinary norms that privilege evidence-based reasoning. This suggests that justificatory practices might differ in samples with stronger representation from other subject areas, pointing to the need for future research to examine how such patterns vary in relation to participant characteristics, such as disciplinary background or professional experience. Moreover, only the topic of 'climate change' was addressed in the workshops. The perspectives provided in the material were situated within a specific national discourse context, which may have influenced how controversy was negotiated in the discussions. Due to the limited number of group discussions, the restriction of data collection to one region, and the limitation to one topic, statements on the scope, validity in terms of generalisation, and transferability of the results obtained are limited. Furthermore, the question of the evaluation method arises; the qualitative content analysis according to Kuckartz and Rädiker (2024) is certainly very well suited to obtaining an overview of the inclusion and exclusion criteria used and thus to answering the research question to a sufficient degree. The extent to which a reconstructive evaluation method (e.g., grounded theory) would yield expanded, deeper insights into the examination of the criteria and the negotiations conducted in the group discussions remains open. However, these limitations also offer approaches for future research.

For future research, this study emphasises the need to empirically analyse justificatory practices before implementing theoretical frameworks. Further investigations could examine how different materials evoke distinct justificatory patterns in response to controversy, or how deliberate engagement with criteria and power-sensitive analytical tools affects teachers' professional judgment over time. Comparative research across topics, subjects, educational environments, or socio-political contexts may further enhance understanding of how controversy is negotiated under diverse

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conditions, and how interdisciplinary theoretical debates can be effectively integrated with subject-specific research. Future studies using more reconstructive approaches, such as grounded theory or discourse analysis, could deepen the analysis of implicit orientations in justificatory practices. To deepen understanding of directive teaching beyond the mere selection of perspectives in lesson planning, it is advisable to explore how controversy is managed in geography classroom practice and how diverse forms of directive and non-directive teaching are integrated. In addition, the findings point to the relevance of spatial context as a potentially underexplored dimension in subject-specific research on controversial issues. Participants justified inclusion or exclusion decisions by referring to regional, local, or place-based conditions—for example, by emphasising that climate-related issues would be discussed differently in coal-mining regions than in other contexts. This highlights a distinctly geographical dimension of controversy, insofar as inclusion and exclusion decisions are also shaped by spatial contexts, regional economic structures, and place-based experiences. Future research in geography education could therefore examine more systematically how spatial settings shape perceptions of controversy and influence teachers' justificatory practices. Such work could contribute to a distinctly geographical perspective on controversy by analysing how specific spatial contexts shape decisions about what is treated as controversial in the classroom.

Situated within the broader context of a world in transition, characterised by socio-spatial transformations, epistemic uncertainty, and contested futures, this study emphasises the role of teacher educators in preparing teachers to exercise professional judgment in situations where knowledge claims, values, and power relations intersect as part of powerful teaching. Climate change, as a paradigmatic geographical issue, underscores both the necessity and the challenge of drawing the boundaries of controversy in ways that avoid epistemic relativism while remaining attentive to democratic plurality and social justice. From a geographical perspective, the findings indicate that controversy is not only epistemic or political, but also spatially situated, encompassing place-based experiences, regional inequalities, and uneven socio-spatial transformations. This highlights the potential of geography education to contribute to controversial discussions by systematically engaging with spatial relations, scale, and power. In periods of transition and uncertainty, fostering reflexive, criteria-aware reasoning about controversial issues emerges as a crucial task for geography teacher education and research dedicated to supporting critical and resilient citizenship.

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Contribution to the Special Issue Topics: This article contributes to the Special Issue by addressing the teaching of controversial issues and epistemic uncertainty in geography education in a world

in transition. Through an empirical analysis of how teacher educators justify the inclusion and exclusion of perspectives on addressing climate change, it advances understanding of how the boundaries of controversy are drawn in practice and highlights the importance of reflective, criteria-aware professional judgment.

Appendix

Table A1. Perspectives on addressing climate change and corresponding texts used in the workshop materials.

Perspective	Workshop text[1]
Climate Money – A Socially Just Carbon Pricing System: Proposes socially just CO_2 pricing with full per-capita refunds, benefiting low-income households disproportionately (Deutscher Ethikrat, 2024)	**Climate Money – A Socially Just Carbon Pricing System** Climate money is intended to fairly distribute the burden of carbon pricing. Revenues from carbon taxes or emissions trading are paid out as a lump sum to all residents. Since lower-income households often produce fewer emissions, they benefit particularly from this reimbursement. This ensures that climate protection is socially just and avoids financial disadvantages.
Climate Hysteria and Gender Distribution – A Critical Perspective: Pathologises Fridays for Future protesters as hysterical/mentally ill, denying climate crisis reality (Klein, 2019)	**Climate Hysteria and Gender Distribution – A Critical Perspective** The Fridays for Future demonstrations reveal a striking pattern: up to 70% of participants are female. According to the WHO, these activists' truancy from school is a sign of disrupted daily life behaviour, which could indicate a mental disorder or an irrational belief. Historically, hysteria has been primarily attributed to women, and this phenomenon is now reflected in the climate movement – young women portray themselves as victims of the climate crisis, thereby gaining public attention. Despite the lack of scientific evidence for anthropogenic climate change, these activists behave as if the threat were real and imminent. Positive effects of global warming, such as improved agricultural yields and fewer cold-related deaths, are ignored. Those who nevertheless believe in the climate catastrophe are acting irrationally and are swept away by an ideologically driven zeitgeist that makes young women particularly vulnerable.
Energy Transition?: Human climate causation unproven, CO_2 beneficial, opposes energy transition (Alternative für Deutschland, 2025)	**Energy Transition?** Climate change has occurred throughout Earth's history. The extent of human influence on it has not been conclusively established by science. An energy transition requiring enormous financial resources cannot be justified on this basis. Nor is there any reason to restrict or ban the use of fossil fuels such as coal, natural gas or oil, for example by phasing out combustion engines. Instead, CO_2 acts as a factor that enhances global plant growth and thus improves the food supply.
Influencing the radiation balance (Solar Radiation Management – SRM): Geoengineering to reflect sunlight and cool planet through technical interventions (Wessel, 2023)	**Influencing the radiation balance (Solar Radiation Management – SRM)** The aim of such approaches is to reduce the amount of sunlight reaching the Earth and thereby lower the global average temperature. This includes proposals such as installing mirrors in space or increasing the reflectivity of sunlight (albedo) by brightening settlements (e.g., whitewashing roofs). The most frequently discussed approach in the literature is the dispersal of gases with suspended particles (aerosols) into the stratosphere to scatter sunlight and thus result in less solar radiation reaching the Earth's surface.
Important tips for saving CO_2: Individual lifestyle changes for CO_2 reduction through daily habits (Greenpeace, 2025)	**Important tips for saving CO_2** 1. Use green electricity. 2. Be sustainable and mobile – use a bicycle, bus, or train instead of a car or plane. 3. Eat fewer animal products and buy regional and seasonal food. 4. Regulate your heating consciously. 5. Use your washing machine efficiently – washing in cold water and filling it to capacity saves energy. 6. Choose energy-efficient appliances. 7. Reduce data usage – streaming and cloud services consume a lot of energy. 8. Buy secondhand items and use them for longer. 9. Avoid waste and recycle.
Ecopop Initiative: Advocates population control via family planning in Global South as climate solution (Bundeskanzlei, 2014)	**Ecopop Initiative** To secure the natural foundations of life in developing countries, the Ecopop Initiative in Switzerland calls for investments of 150 million Swiss francs in voluntary family planning. This can help reduce birth rates and combat climate change.
Constitutional Reform for the Rights of Nature: Constitutional reform granting legal personhood and rights to nature (Netzwerk Rechte der Natur, o. J.)	**Constitutional Reform for the Rights of Nature** The "Rights for Nature" initiative calls for a constitutional reform to grant nature independent rights and strengthen its protection. It criticises the fact that existing environmental laws are often subject to economic interests and fail to prevent environmental destruction. The proposed reform adds the

	dignity of nature to human dignity and obligates the state to preserve the natural foundations of life. Furthermore, nature is to be granted legal capacity and better protected under the law. The constitutional amendment stipulates that every living being has a right to a life in accordance with its natural environment.
Degrowth – Sustainability Instead of Growth: Degrowth advocates sufficiency, reduced Global North consumption, democratic self-determination (Redaktion des Degrowth Webportals, o. J.)	**Degrowth – Sustainability Instead of Growth** Degrowth describes a society that moves away from constant economic growth and instead focuses on well-being and ecological sustainability. The movement emphasises solidarity, cooperation, and sufficiency instead of competition and overproduction. Practical measures include reduced consumption, democratic participation, and regional economic cycles. The complete decoupling of growth and resource consumption is rejected. Degrowth distances itself from discriminatory critiques of growth and calls for a just transformation.
The ban on plastic straws – A step for the environment: EU single-use plastics ban targeting straws as environmental protection measure (Presse- und Informationsamt der Bundesregierung, o. J.)	**The ban on plastic straws – A step for the environment** Since July 3, 2021, plastic straws have been banned in the EU to reduce the environmental impact of single-use plastics. Millions of plastic straws were thrown away every day, contributing to the pollution of seas and landscapes. The ban is part of a comprehensive strategy against plastic waste, which also includes other single-use products such as plastic cutlery and to-go packaging. Businesses and consumers are increasingly turning to sustainable alternatives such as paper, glass, or stainless steel straws. Despite some challenges in the transition, the ban is seen as an important step towards a more environmentally friendly future.
Save lives with your donation: Welthungerhilfe donation appeal for food security and resilience training in drought areas (Deutsche Welthungerhilfe e. V., o. J.)	**Save lives with your donation** Your regular donation enables reliable aid and sustainable improvements for people in need. Through targeted initiatives, families receive vital food and learn to grow their own food despite drought and prolonged dry seasons. Many affected individuals report that these programs have given them new hope. Together, we can help even more people and give them a future free from hunger.

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