Perspective Taking Interventions and Socioscientific Issues: The Case for Cautious Optimism

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**Abstract:** Perspective taking has been identified as a key skill in navigating the contentious socioscientific issues that threaten society. There has recently been a surge in interest in understanding how best to support perspective taking in science classrooms. This paper advocates for an optimistic, but cautious approach to the design and evaluation of perspective taking interventions. Although there is reason to be enthusiastic about the future of these interventions, there are also pitfalls associated with perspective taking in contexts like socioscientific issues. This paper concludes with recommendations to help address those concerns.

# Introduction

The world is facing grand challenges like climate change, the COVID-19 pandemic, and environmental degradation. These issues (i.e., socioscientific issues) have profound social implications and adequately addressing these issues requires the understanding and application of scientific knowledge (Sadler, 2004; Zeidler, 2014). Because of the complex nature of these issues, straightforward solutions are rare if not non-existent, as they implicate a wide variety of people and institutions (i.e., stakeholders), often with competing interests (Sadler, 2004; Zeidler, 2014). Simple solutions that appear optimal may, in fact, present grave consequences for others implicated in the issue. For example, whereas moving away from coal is an important step in addressing climate change, it also necessarily involves taking away the livelihood of entire communities. Advocating for the divestment in fossil fuels without considering and constructing a means of addressing the economic strife it will create is myopic at best, cruel at worst. As a result, these issues are inherently moral and often politically fraught. Addressing socioscientific issues necessarily requires engagement with the ethical considerations when designing just solutions (Sadler & Zeidler, 2004; Zeidler, 2014).

Science education is well positioned to address these issues. Science learning experiences can be structured to create a supportive environment for students to engage with these issues and develop the skills needed to apply scientific knowledge to improve the lives of others (Sadler, 2009). However, traditional science instruction can miss the social context that is critically important to understand when navigating socioscientific issues. If the knowledge is to be applied, it is not enough to simply use these issues to generate superficial interest in the science content: students must actively engage in the sociocultural practices of science and civic discourse that are required to navigate these issues beyond classroom walls (Sadler, 2009; 2011). Thus, the dual goals of socioscientific issues-based education should be to help students learn about the issue and prepare them to engage in civic discourse that leads to solutions that improve society (Sadler, 2009; 2011; Zeidler, 2014).

Perspective taking is thought to be a crucial skill in these contexts. Recent studies suggest that perspective taking may be a prerequisite to higher-order reasoning about socioscientific issues (Romine et al., 2017; 2020). Perspective taking has also been explored as a way of promoting empathy for disagreeing others (Herman et al., 2020, 2021), something that feels to be in increasingly short supply in the current sociopolitical context. Perhaps unsurprisingly, there has been a recent movement to more deliberately explore how perspective taking occurs in socioscientific issues-based contexts, and how it may be supported during instruction (e.g., Herman et al., 2020, 2021; Kahn & Zeidler, 2016, 2019; Newton & Zeidler, 2020). Doing so will not be without challenges, however. Herman and colleagues (2020) have noted the need for more a rigorous approach to understanding how students engage in perspective taking in authentic contexts, acknowledging the limitations of self-report measures and fictitious contexts that are often used in research and instruction.

The purpose of this conceptual paper is to argue that perspective taking interventions should be subject to a high level of scrutiny due to the high stakes, contentious nature of these issues. I begin by discussing the role of perspective taking in reasoning about socioscientific issues. Next, I discuss promising examples of perspective taking interventions in the context of contentious social issues. I then qualify this optimism, identifying several potential challenges that may hinder the success of these interventions in socioscientific issues-based contexts. In doing so, I advocate for particular attention to be paid to the accuracy of inferences made by students, and the pragmatic consequences of those inferences. I conclude this paper with recommendations for future directions, focusing on how we might design and evaluate perspective taking interventions in educational contexts.

# Literature Selection

Although I argue that the studies presented in this paper raise concerns worthy of our attention, this paper should not be taken as a systematic review. The purpose of this search was not to provide a comprehensive overview of perspective taking research. Instead, I present select studies outside the field of science education that illustrate challenges associated with perspective taking that may be of interest to the science education community. Articles were identified through database searches and bibliography mining. During this process, I paid close attention to studies and lines of research that illustrate challenges associated with perspective taking in contexts like those covered in socioscientific issues-based instruction. Articles that fit these criteria were evaluated closely, with articles whose methods were either unclear or lack in rigor being excluded.

# Socioscientific reasoning and perspective taking

Sadler and colleagues (Sadler et al., 2007) have identified socioscientific reasoning as a key construct that underlies engagement with these issues in the real world. This construct is comprised of four key competencies:

* understanding and appreciating the inherent *complexity* of the issue that must be considered when designing solutions,
* engaging in apt *perspective taking*: identifying and considering the positions, interests, and concerns of stakeholders who are implicated,
* recognizing the need for ongoing *inquiry*, noting where more information is needed and re-evaluating positions as new knowledge is constructed,
* and exhibiting *skepticism* towards new information, evaluating it for potential biases and the overall quality of the arguments supporting the knowledge claims made by the authors.

Kirk & Sadler (2023) argue that for perspective taking to be aligned with the goals of socioscientific issues-based education (i.e., promoting civic discourse and solution finding), it must honor the experiences of potentially disagreeing others, establish genuine understanding, and orient students towards finding common ground and ethical solutions. Perspective taking is positioned both as a practice for learning about the issue in question as well as a skill to develop for navigating these issues beyond the classroom. In the classroom, when students learn about the experiences of various stakeholders from their perspectives, it helps them understand the challenges of finding a solution (Sadler et al., 2007; Sadler & Zeidler, 2005). Outside of the classroom, simulating other perspectives can be used to anticipate counterarguments and craft rebuttals when engaged in civic discourse, argumentation, and advocacy (Sadler & Donnelly, 2006), as well as promote the moral and emotional sensitivity needed to engage in productive dialogue around the issue (Fowler et al., 2009; Zeidler, 2014).

Kahn & Zeidler (2017; 2019) argue that apt perspective taking involves not only identifying where one stands on an issue, but also the reasons behind that stance. By their definition, it is entirely possible to predict where an individual stands on an issue without meaningfully engaging in perspective taking. For example, one could rightfully predict the position an individual would hold on fossil fuel divestment based solely on the information that they live in a coal-mining town, and geopolitical stereotypes. However, in doing so one omits the visceral experience of managing the anxieties that come with financial hardship, and uncertainty about what that decision means for the future of themselves, their family, and their neighbors. Perspective taking in the context of socioscientific issues necessarily involves engaging with the cognitive and affective experiences of others (Kahn & Zeidler, 2019). Doing so contextualizes the positions of others they may disagree with. Supporting students in grounding their perceptions of others in the legitimate concerns of stakeholders through perspective taking invites the understanding needed to make compassionate decisions.

Although perspective taking interventions should result in accurate inferences about the positions stakeholders are likely to take on an issue, this information is not sufficient to evaluate the quality of an intervention. Perspective taking interventions should also be evaluated based on how closely insights from student perspective taking aligns with the experienced reality of a target-other (i.e., the reasons behind the position). Additionally, researchers should attend to whether an intervention results in behaviors that support the pragmatic goal of preparing students to positively transform society (Zeidler, 2014).

# Perspective taking interventions: The case for optimism

Because perspective taking interventions have not received much attention to the science education community until recently, Kahn and Zeidler (2016) have noted the need to attend to research on these interventions beyond science education contexts. Indeed, there is a growing body of empirical evidence that demonstrates the value of perspective taking interventions in the context of pressing social issues (e.g., Shachnai et al., 2022; Todd et al., 2011; Tompkins et al., 2015). For example, Shachnai and colleagues (2022) found that engaging in perspective taking through pretend play may help address gender disparities in science fields by supporting young girls’ persistence in difficult science tasks. Children were assigned to one of three groups, a control group, a group where they were exposed to descriptions of a gender-matched science role-model, and a condition where they were asked to pretend they were the scientist they had just learned about. The children then participated in a challenging science game. Persistence was measured based on how many trials of the game children were willing to participate in before expressing the desire to “do something else.” Although boys persisted longer in the game, girls in the pretend-play condition persisted significantly longer than girls in the other two conditions. Perspective taking, not simply learning about role models, helped young girls persist in a field that continues to grapple with representation issues. The findings presented in this study demonstrate that meaningful behavioral change can be obtained as the result of perspective taking.

Perspective taking can also help increase empathy for others in the context of potentially divisive social issues. For instance, Tompkins and colleagues (2015) explored how perspective taking interventions can be used to shape beliefs about outgroups. Specifically, they set out to study whether perspective taking interventions can be leveraged to reduce prejudice against transgender persons. Participants in the perspective taking condition watched a 15-minute documentary of a transgender child before being asked to imagine that they were themselves transgender and craft a letter coming out to their parents. In the comparison condition, participants were educated on the diagnostic criteria for gender-identity disorder followed by an interview with an expert in gender identity disorder in an intervention that lasted 15 minutes. Following this, comparison-group participants were asked to write down all the information they could recall about gender identity disorder. Individuals in the perspective taking condition demonstrated a significant decrease in their levels of genderism and transphobia, whereas those in the education condition increased in this measure. Individuals in the perspective taking condition also reported being significantly more willing to have transgender persons in their close social network following the intervention, whereas those in the education condition exhibited no change. Decreases in prejudice and willingness to include outgroup members in one’s social network are indeed desirable outcomes that are aligned with the goal of promoting civic discourse around contentious issues.

Perspective taking has also been explored as a way of disrupting implicit racism. Todd and colleagues (2011) asked participants to clearly visualize the experience, thoughts, and feelings of a Black man experiencing discriminatory treatment while watching a short video or participating in a short writing task. These participants demonstrated a reduction in measures of implicit racism in comparison to control groups and groups who were asked to evaluate the situation objectively. These differences were observed through a diverse array of instruments, including computer-based measures (e.g., Implicit Attitudes Test), self-reports (e.g., feeling thermometers), behavioral measures (e.g., seating distance), and the subjective experience of Black experimenters in interaction with participants. These findings suggest that not only did the perspective taking intervention result in measurable shifts, but also that those shifts translate to positive, real-world behaviors that can be felt by others.

Interventions that positively shape the ways people persist in difficult tasks and orient towards outgroup members are desirable and present promise for supporting outcomes aligned with the goals of socioscientific issues-based instruction. It is particularly promising that the interventions presented in the preceding papers echo some of the recommendations made by scholars advocating for perspective taking in science classrooms (e.g., Kahn & Zeidler, 2016; Newton & Zeidler, 2020). Taken together, these papers suggest that perspective taking presents unique benefits that may not be felt through approaches which emphasize objectivity (Todd et al., 2011) and knowledge alone (Shachnai et al., 2022; Tomkins et al., 2015).

# Challenges in contentious contexts: The case for caution

Despite the promising findings outlined in the previous section, it should be noted that these results may not readily translate to other contexts that are, perhaps, more analogous to the socioscientific issues that are commonly addressed in science classrooms. Whereas the studies above certainly involved participants engaging with politicized social issues through perspective taking, they did so outside of a competitive context. Participants were not engaged in debate with the individuals they were assuming the perspective of. These contexts present different environmental cues that have the potential to shape the ways perspective taking occurs and the associated outcomes. The often competitive, politicized, and moral dimensions of socioscientific issues are important for students to directly engage with during instruction (Zeidler, 2014). Thus, it is important to consider how perspective taking interventions behave in these contexts specifically.

## Accuracy matters

Apt perspective taking involves being able to accurately infer the content of another person’s psychological experience (i.e., empathic accuracy; Ickes, 1993; Myers & Hodges, 2008). It is important to note that empathic accuracy should be differentiated from empathic concern, a construct that has been better explored in the context of science education (e.g., Herman et al., 2020, 2021). Although empathic concern may motivate an individual to help others (indeed a positive outcome), empirical studies suggest that these two constructs are uncorrelated (Myers & Hodges, 2008). Just because an individual demonstrates concern for the wellbeing of another does not mean they are generating accurate inferences about the thoughts and feelings of that person.

Despite empathic accuracy research suggesting we are far from expert mind-readers, Myers and Hodges (2008) argue that in most situations, our reliance on stereotypes and heuristics leads to accurate-enough inferences. There are times when this approach results in problematic outcomes, however. Perspective taking that is grounded in inaccurate representations of the target-other can have damaging repercussions. For example, Lees and Cikara (2020) demonstrated that in competitive political disagreements, people tend to hold overly negative, inaccurate judgements of the perceptions and motivations of outgroups. It is important to note that participants in this study were not necessarily failing to predict the attitudes held by outgroup members. Rather, they were over-estimating the extent to which the outgroup harbored negative feelings towards the participants’ ingroup, and over-estimating the motivation of the outgroup to engage in obstructive behavior. These misconceptions can further the divides that make conflicts intractable. As such, ensuring that perspective taking interventions are grounded in accurate knowledge should be of paramount importance. Failing to do so can lead to results that are antithetical to the mission of preparing students to engage in discourse that supports the design of equitable solutions to problems facing society.

## Accuracy: Necessary but not sufficient

Even if perspective taking is grounded in accurate representations and yields accurate predictions, it may not lead to desirable outcomes (Epley & Caruso, 2008; Epley et al., 2006). In a study of how participants engage in resource allocation tasks, Epley and colleagues (2006) found that asking participants to adopt the perspectives of others exacerbated selfish behavior in competitive contexts. It is worth noting that one experiment in this study leverages a dilemma where individuals are asked to determine how to manage harvests in a stressed fishery. Wildlife and water management issues are examples of typical socioscientific issues taught in environmental science contexts (e.g., Newton & Zeidler, 2020), suggesting a degree of ecological validity despite its laboratory context. Although participants demonstrated a decrease in egocentric framing when evaluating fairness, participants in competitive contexts ended up taking *more* resources when given the opportunity than their non- perspective taking counterparts. Despite participants articulating an understanding of fairness, their behaviors were incongruent with sustainability goals. These results were then replicated using different contexts through four other studies.

Epley and colleagues (2006) attribute this to *reactive egoism* whereby perspective taking leads people to infer self-serving motives of competitors, driving self-serving behaviors regardless of fairness. Reactive egoism is diminished in cooperative contexts, but these findings point out the dangers of treating perspective taking as a goal in itself. Although participants did indeed engage in perspective taking, the repercussions of doing so actively worsened outcomes. Many socioscientific issues are experienced as zero-sum games rife with politicization and partisanship. Perspective taking in these contexts may occur with fidelity, but at the expense of positive outcomes. As such, evaluations of perspective taking interventions should consider whether those interventions result in pragmatic actions that impact society in desirable ways, not simply whether participants can predict and articulate the position of others.

# Future directions: Evaluating perspective taking within the classroom

Currently, there is a dearth of instruments designed to measure perspective taking in educational contexts to the extent discussed above. As noted by Herman and colleagues (2020), self-report measures and assessments that rely on students taking the perspective of invented characters omit critically important facets of the perspective taking experience. How well these assessments speak to students’ ability to engage with the perspectives of real-world stakeholders is unclear. Invented characters are themselves abstractions, devoid of the depth that makes perspective taking such a challenging yet impactful experience. They reflect the biases and assumptions of the creators, not necessarily the populations they aim to represent. If we wish to understand how well students’ inferences reflect the nuanced concerns and experiences of real-world people, we should strive to co-construct perspective taking assessments with actual stakeholders. Likewise, we should pay particular attention to whether these predictions translate into behaviors conducive to civic discourse and solution finding.

Addressing the concerns outlined above certainly poses a genuine measurement challenge, but not one that is insurmountable. For example, the methods used to assess empathic accuracy developed by Ickes and colleagues (Ickes, 2001; Ickes et al., 1990) holds promise for educational research. This approach compares the actual thoughts and feelings of a target person with the inferences about those thoughts and feelings made by the perspective-taker. To do so, a target person is videotaped in an interaction. The target person then watches the videotape, pausing the tape when they remember having a particular thought or feeling and recording that experience. The perspective-taker then watches the video. The tape is paused at each point where the target other recorded their experience and the perspective-taker is asked to infer what the target other is thinking (Ickes et al., 1990; Myers & Hodges, 2008).

Although this method has been shown to be both reliable and valid (Ickes et al., 1990; Myers & Hodges, 2008), these methods are highly labor-intensive, require careful planning and multiple, trained coders to successfully implement, and require direct collaboration with stakeholders whose perspectives one wishes to foreground. Likewise, this laboratory-based approach can rightfully be critiqued for being removed from the sociocultural context these perspective taking experiences are situated within. Thankfully, this is not a new problem for educational research. It is not uncommon for design studies to involve both laboratory and naturalistic components, placing these findings in conversation with one another to refine both the product and theory (Brown, 1992; McKinny & Reeves, 2018).

 The approach detailed by Ickes and colleagues (Ickes, 2001; Ickes et al., 1990) is well suited to inform design studies. Socioscientific issues-based research and instruction often incorporates partnerships with stakeholders (e.g., Newton & Zeidler, 2020). Because much of the infrastructure and rapport already exists, the additional work required of stakeholders to craft these assessments is relatively small compared to situations where these partnerships may not already exist. Additionally, this approach also grounds evaluations of these interventions in the real-world thoughts and feelings of stakeholders, rather than fictitious, abstract characters that emerged from the researchers’ own biases and assumptions. The act of interviewing and co-constructing the instrument can itself yield valuable data that can inform curricular design decisions. Researchers will have an instrument that was co-created with real stakeholders that can help ensure curriculum honors their experiences and attitudes. Stakeholders are given agency over their story, and how that story is used for research.

Observational studies of students engaged in learning experiences can be used in tandem with the laboratory-based studies outlined above to explore how students approach the solution-finding process. Particular attention should be paid to student discourse as students engage in authentic culminating activities. Are students using deficit framing and stereotypes when discussing the perspectives of others? Or are they demonstrating empathic concern, exploring the genuine concerns of disagreeing others, and appreciating the reasoning that led to those positions? Similarly, do students adopt a “scorched earth” or “zero sum” approach to solution-finding whereby they attempt to maximize immediate returns for those who share their position? Or do students attempt to understand the needs of other stakeholders, working to find a solution that satisfies the needs of many while minimizing collateral damage? These findings could be placed in conversation with laboratory-generated data using methods like those detailed by Ickes and colleagues (Ickes, 2001; Ickes et al., 1990) and the resource allocation games used by Epley and colleagues (2006). Doing so can refine our understanding of how, when, and why the phenomena observed in the lab are likely to replicate in the real world.

# Conclusion

Given its central role in socioscientific reasoning, the current calls to better understand how perspective taking can be supported in socioscientific issues-based learning experiences are well-justified. Perspective taking interventions present promising opportunities to enrich our students understanding of the world as well as prepare them to rise to the challenge of addressing pressing issues that face society. However, due to the nature of the issues at hand, perspective taking interventions may not result in the outcomes they intend to support; in some contexts, these interventions may actively go against those outcomes. Special attention must be paid to the accuracy of knowledge recruited by students when engaging in perspective taking, as well as whether perspective taking results in behavioral outcomes aligned with the pragmatic goals of socioscientific issues-based instruction.

# References

Brown, A. L. (1992). Design Experiments: Theoretical and Methodological Challenges in Creating Complex Interventions in Classroom Settings. Journal of the Learning Sciences, 2(2), 141–178. https://doi.org/10.1207/s15327809jls0202\_2

Epley, N., & Caruso, E. M. (2008). Perspective Taking: Misstepping Into Others’ Shoes. In K. D. Markman, W. M. P. Klein, & J. A. Suhr (Eds.), Handbook of Imagination and Mental Simulation (pp. 295–309). Psychology Press.

Epley, N., Caruso, E. M., & Bazerman, M. H. (2006). When perspective taking increases taking: Reactive egoism in social interaction. Journal of Personality and Social Psychology, 91(5), 872–889. https://doi.org/10.1037/0022-3514.91.5.872

Fowler, S. R., Zeidler, D. L., & Sadler, T. D. (2009). Moral Sensitivity in the Context of Socioscientific Issues in High School Science Students. International Journal of Science Education, 31(2), 279–296. https://doi.org/10.1080/09500690701787909

Herman, B. C., Newton, M. H., & Zeidler, D. L. (2021). Impact of place-based socioscientific issues instruction on students’ contextualization of socioscientific orientations. Science Education, 105(4), 585–627. https://doi.org/10.1002/sce.21618

Herman, B. C., Zeidler, D. L., & Newton, M. (2020). Students’ Emotive Reasoning Through Place-Based Environmental Socioscientific Issues. Research in Science Education, 50(5), 2081–2109. https://doi.org/10.1007/s11165-018-9764-1

Ickes, W. (1993). Empathic Accuracy. Journal of Personality, 61(4), 587. https://doi.org/10.1111/j.1467-6494.1993.tb00783.x

Ickes, W. (2001). Measuring empathic accuracy. In J. A. Hall & F. J. Bernieri (Eds.), Interpersonal Sensitivity: Theory and measurement (pp. 219–241). Lawrence Erlbaum Associates Publishers.

Ickes, W., Stinson, L., Bissonnette, V., & Garcia, S. (1990). Naturalistic social cognition: Empathic accuracy in mixed-sex dyads. Journal of Personality and Social Psychology, 59(4), 730–742. https://doi.org/10.1037/0022-3514.59.4.730

Kahn, S., & Zeidler, D. L. (2016). Using our Heads and HARTSS\*: Developing Perspective-Taking Skills for Socioscientific Reasoning (\*Humanities, ARTs, and Social Sciences). Journal of Science Teacher Education, 27(3), 261–281. https://doi.org/10.1007/s10972-016-9458-3

Kahn, S., & Zeidler, D. L. (2017). A case for the use of conceptual analysis in science education research. Journal of Research in Science Teaching, 54(4), 538–551. https://doi.org/10.1002/tea.21376

Kahn, S., & Zeidler, D. L. (2019). A Conceptual Analysis of Perspective Taking in Support of Socioscientific Reasoning. Science & Education, 28(6–7), 605–638. <https://doi.org/10.1007/s11191-019-00044-2>

Kirk, E. A., Sadler, T. D. (2023). Ditch the Debate: Preparing Pre-Service Teachers to Nurture Productive Discourse About Controversial Issues. Innovations in Science Teacher Education.

Lees, J., & Cikara, M. (2020). Inaccurate group meta-perceptions drive negative out-group attributions in competitive contexts. Nature Human Behaviour, 4(3), 279–286. https://doi.org/10.1038/s41562-019-0766-4

McKenney, S., & Reeves, T. C. (2018). About educational design research. In S. McKenney & T. C. Reeves, Conducting Educational Design Research (2nd ed., pp. 5–33). Routledge. https://doi.org/10.4324/9781315105642-3

Myers, M. W., & Hodges, S. D. (2008). Making It Up and Making Do: Simulation, Imagination, and Empathic Accuracy. In K. D. Markman, W. M. P. Klein, & J. A. Suhr (Eds.), Handbook of Imagination and Mental Simulation (pp. 281–294). Psychology Press.

Newton, M. H., & Zeidler, D. L. (2020). Developing socioscientific perspective taking. International Journal of Science Education, 42(8), 1302–1319. https://doi.org/10.1080/09500693.2020.1756515

Romine, W. L., Sadler, T. D., Dauer, J. M., & Kinslow, A. (2020). Measurement of socio-scientific reasoning (SSR) and exploration of SSR as a progression of competencies. International Journal of Science Education, 1–22. https://doi.org/10.1080/09500693.2020.1849853

Romine, W. L., Sadler, T. D., & Kinslow, A. T. (2017). Assessment of scientific literacy: Development and validation of the Quantitative Assessment of Socio-Scientific Reasoning (QuASSR). Journal of Research in Science Teaching, 54(2), 274–295. https://doi.org/10.1002/tea.21368

Sadler, T. D. (2004). Informal reasoning regarding socioscientific issues: A critical review of research. Journal of Research in Science Teaching, 41(5), 513–536. https://doi.org/10.1002/tea.20009

Sadler, T. D. (2009). Situated learning in science education: Socio‐scientific issues as contexts for practice. Studies in Science Education, 45(1), 1–42. https://doi.org/10.1080/03057260802681839

Sadler, T. D. (2011). Situating Socio-scientific Issues in Classrooms as a Means of Achieving Goals of Science Education. In T. D. Sadler (Ed.), Socio-scientific Issues in the Classroom: Teaching, Learning and Research (pp. 1–9). Springer Netherlands. https://doi.org/10.1007/978-94-007-1159-4\_1

Sadler, T. D., Barab, S. A., & Scott, B. (2007). What Do Students Gain by Engaging in Socioscientific Inquiry? Research in Science Education, 37(4), 371–391. https://doi.org/10.1007/s11165-006-9030-9

Sadler, T. D., & Donnelly, L. A. (2006). Socioscientific Argumentation: The effects of content knowledge and morality. International Journal of Science Education, 28(12), 1463–1488. https://doi.org/10.1080/09500690600708717

Sadler, T. D., Foulk, J. A., & Friedrichsen, P. J. (2017). Evolution of a Model for Socio-Scientific Issue Teaching and Learning. International Journal of Education in Mathematics, Science and Technology, 5(1), 75. https://doi.org/10.18404/ijemst.55999

Sadler, T. D., & Zeidler, D. (2005). Patterns of informal reasoning in the context of socioscientific decision making. Journal of Research in Science Teaching, 42, 112–138. https://doi.org/10.1002/tea.20042

Sadler, T. D., & Zeidler, D. L. (2004). The morality of socioscientific issues: Construal and resolution of genetic engineering dilemmas. Science Education, 88(1), 4–27. https://doi.org/10.1002/sce.10101

Shachnai, R., Kushnir, T., & Bian, L. (2022). Walking in Her Shoes: Pretending to Be a Female Role Model Increases Young Girls’ Persistence in Science. Psychological Science, 09567976221119393. https://doi.org/10.1177/09567976221119393

Todd, A. R., Bodenhausen, G. V., Richeson, J. A., & Galinsky, A. D. (2011). Perspective taking combats automatic expressions of racial bias. Journal of Personality and Social Psychology, 100(6), 1027–1042. https://doi.org/10.1037/a0022308

Tompkins, T. L., Shields, C. N., Hillman, K. M., & White, K. (2015). Reducing stigma toward the transgender community: An evaluation of a humanizing and perspective-taking intervention. Psychology of Sexual Orientation and Gender Diversity, 2(1), 34–42. https://doi.org/10.1037/sgd0000088

Zeidler, D. (2014). Socioscientific Issues as a Curriculum Emphasis: Theory, Research and Practice. In N. G. Lederman & S. K. Abell (Eds.), Handbook of Research on Science Education (Vol. 2, pp. 697–726). Routledge.

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