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Long-Term Effects of Paradoxical Thinking and Contradictory Information Interventions on Intergroup Bias against Vaccine-Hesitant Individuals: Perspectives from Educational Research

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Public discourse in the modern era compels individuals to align with societal values, leading to entrenched viewpoints and biases. Intergroup bias pervades discussions across domains, necessitating rigorous examination and proactive efforts to reduce them especially within the framework of education. Implementing interventions rooted in social psychology to combat intergroup bias in education holds significant promise. Having selected pragmatic tools to address intergroup bias is particularly important in education as a more inclusive learning environment scaffolds learning, promotes critical thinking, and improves academic achievement.

This study investigates the long-term effects of two intervention methods, paradoxical thinking and providing contradictory information, aimed at reduction of intergroup bias in the context of vaccine hesitancy. Paradoxical thinking involves presenting extreme or exaggerated viewpoints, while providing contradictory information highlights inconsistencies in held beliefs. Despite their potential efficacy in immediate contexts, the literature lacks holistic exploration into their long-term effects. To address this gap, 86 participants, with ages ranging from 18.9 to 55.3, were randomly divided into three groups, paradoxical thinking, contradictory information, and control group and each filled a survey before the intervention and the same survey six to nine months after the interventions. During the intervention statements designed on the tenets of paradoxical thinking and contradictory information concepts were read to the participants while generic sentences were read to the participants of the control group. The collected data of this longitudinal study was interpreted employing a mixed ANOVA analysis to assess changes in intergroup bias over time.

One of the central findings of the study is the lack of significant differences in intergroup bias scores between the intervention groups and the control group. These findings highlight the complexity of addressing intergroup bias and suggest that while these interventions may not yield lasting effects, they can elicit subtle shifts in attitudes over time. While these interventions may not independently lead to substantial changes in attitudes over extended periods, they can provide valuable insights and opportunities for integration into educational practices, thereby cultivating a more inclusive and empathetic learning environment.

Keywords
Intergroup bias, Paradoxical thinking, Contradictory information

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1 Introduction

In today's complex and interconnected world, characterized by rapid globalization and technological advancement, the landscape of public discourse imposes considerable pressure on individuals from diverse backgrounds to align their actions and beliefs with their perceived societal values by taking definitive stances on a wide array of pressing issues spanning politics, economics, social justice, and environmental sustainability (Luo, 2017). This pervasive trend, influenced by numerous socio-cultural factors and fueled by the omnipresence of social media and digital communication platforms, often results in individuals firmly entrenching themselves in their respective viewpoints, intertwining them closely with their personal identities and, consequently, engendering biases against dissenting perspectives (Marchal, 2021).

As a consequence of this phenomenon, intergroup bias, which refers to the differential treatment or perception of individuals based on their group membership, has become an increasingly prevalent feature within public discussions across various domains, including politics, media, academia, and everyday social interactions, necessitating a comprehensive and rigorous examination coupled with proactive efforts to decrease them (Bar-Tal, & Hameiri, 2020). This growing recognition of the pervasive nature of intergroup bias has underscored the importance of addressing these biases not only at the individual level but also at the institutional and systemic levels, particularly within the realms of academia, where critical inquiry, intellectual discourse, and the pursuit of knowledge are central tenets (Bar-Tal, & Hameiri, 2020). Given the pivotal role that academia plays in cultivating critical inquiry and fostering nuanced understanding, the exploration of strategies aimed at decreasing biases assumes paramount importance, offering the potential to catalyze transformative shifts towards more inclusive and constructive dialogues within contemporary public arenas (Bar-Tal, & Hameiri, 2020).

To comprehensively address the pervasive issue of intergroup bias and advance efforts to reduce its prevalence, a wide array of intervention methods has been explored within academic discourse. Among these methods, paradoxical thinking

stands out as a strategy that involves presenting the ideas held by a social group with varying degrees of extremity, thereby challenging entrenched beliefs and encouraging critical reflection (Hameiri, Idan, Nabet, Bar-Tal, & Halperin, 2020). Similarly, the provision of contradictory information, which entails presenting individuals with a diverse range of information that contradicts their preexisting viewpoints, has been identified as another promising approach to decreasing intergroup bias (Hameiri, et al., 2020).

This study has chosen to investigate paradoxical thinking and the provision of contradictory information intervention methods due to their clarity, straight-forwardness, presence in real-life argumentations, innovation, and potential application in various contexts, including education. These intervention methods offer unique approaches to challenging entrenched beliefs and fostering critical thinking, making them particularly relevant for addressing intergroup bias, especially showing promise within educational settings.

While these approaches have shown promise in immediate or short-term contexts, there remains a notable gap in the academic literature regarding their long-term effects on mediation of intergroup bias (Paluck, Porat, Clark, & Green, 2021; Prike, & Ecker, 2023). Particularly in today's highly polarized world, where misinformation and mistrust abound, investigating the lasting impact of such interventions is crucial for fostering a sustainable way to meaningfully address the concerns in this matter on a wider social scale (Prike, & Ecker, 2023).

Existing research has primarily focused on the immediate outcomes of paradoxical thinking and inconsistent information interventions, with little attention paid to their enduring effects (Paluck et al., 2021). Prike and Ecker (2023) have proposed that the sustained resolution of such complex social issues requires a more comprehensive exploration within academic research, emphasizing the need for further investigation into effective strategies aimed at addressing these challenges over the long term. Thus, this study aims to address this gap by investigating the long-term effects of paradoxical thinking and inconsistent information interventions in mediating intergroup bias.

In the contemporary socio-political climate, where public discourse is shaped by countless complex factors, the topic of vaccines has emerged as a focal point of contention and polarization. The discourse surrounding vaccines transcends mere discussions of public health; it has become a battleground where deeply entrenched ideological differences clash (Cassam, 2021). Within this landscape, the phenomenon of intergroup bias directed at vaccine-hesitant individuals has risen to prominence as a pressing concern demanding urgent attention.

Against the backdrop of the Covid-19 pandemic and its profound societal repercussions, the imperative to comprehend and address intergroup bias has never been more acute (Hautala, Kluge, Hameiri, Zebarjadi, & Levy, 2022). The pandemic has not only exposed fault lines within society but has also amplified pre-existing tensions, laying bare the challenges inherent in fostering unity amidst diversity. As we navigate through the post-pandemic era, the need to cultivate strategies that promote public health resilience and social cohesion has taken on renewed significance (Cassam, 2021).

In this context, the investigation of intervention methods aimed at decreasing intergroup bias assumes paramount importance. By shedding light on the long-term effects of paradoxical thinking and inconsistent information interventions, this study seeks to illuminate pathways toward sustainable reconciliation and understanding. Through rigorous inquiry and analysis, it is aimed to contribute substantively to the discourse, offering nuanced insights that go beyond the limitations of immediate outcomes. This endeavor is not merely an academic exercise but a proactive step toward fostering empathy, dialogue, and collaboration across ideological divides in the evolving socio-political landscape of the post-pandemic era.

The implications stemming from the findings of this study could potentially hold profound significance for the world of education, where the cultivation of inclusive learning environments is of utmost importance and relevance (Farrell, Dyson, Polat, Hutcheson, & Gallannaugh, 2007). Considering the pervasive influence of intergroup bias, especially in contentious domains such as discussions surrounding vaccines, educators shoulder the weighty responsibility of nurturing

environments that foster critical thinking and empathy. Recognizing the pivotal role of education in shaping attitudes and perceptions, it becomes imperative for educators to equip themselves with effective tools to address and decrease biases among students (Farrell et al., 2007).

By investigating the long-term effects of intervention methods such as paradoxical thinking and inconsistent information provision, educators stand to gain invaluable insights into strategies that can contribute to the cultivation of more inclusive and empathetic learning environments. Armed with a deeper understanding of the mechanisms underlying intergroup bias and decreasing it, educators can proactively integrate these insights into their pedagogical approaches, thereby laying the groundwork for transformative educational experiences.

Furthermore, the integration of such intervention strategies into educational frameworks can decrease biases among students and foster a culture of critical inquiry and open-mindedness (Murawski, 2014). By incorporating these strategies within the education, educators can hypothetically empower students to engage with diverse perspectives, challenge preconceived notions, and cultivate a deeper appreciation for the complexities of the world around them (Murawski, 2014). Furthermore, the implications of this study can be extended beyond the confines of academia, permeating into the realm of education and offering a roadmap for fostering inclusive, empathetic, and intellectually vibrant learning environments.

2 Literature Review

In this chapter, the phenomenon of intergroup bias is discussed. Two intervention methods, paradoxical thinking and provision of contradictory information, to decrease and address intergroup bias in the context of vaccine hesitant individuals that are tested later in this thesis are introduced. I addition the relevance of the postulation of this study in the context of education is also reviewed.

2.1 Intergroup bias

Intergroup bias, a central concept in social psychology, refers to the tendency of individuals to favor members of their own group while exhibiting prejudice or discrimination against members of out-groups (Staats, Capatosto, Wright, & Contractor, 2015). In this chapter, the multifaceted nature of intergroup bias is explored through its various dimensions. Through a comprehensive examination of these aspects, it is aimed to provide a nuanced understanding of the phenomenon of intergroup bias and its implications.

2.1.1 Definition

Intergroup bias refers to the systematic tendency for individuals to favor members of their own social group over members of other groups. This bias can manifest in various forms, including attitudes, beliefs, behaviors, and perceptions, and it often leads to differential treatment or evaluation of individuals based on their group membership (Staatset al., 2015; Amodio, 2014). At its core, intergroup bias reflects the tendency to categorize people into distinct social groups and to perceive these groups as inherently different or hierarchically ranked (Staats et al., 2015).

One of the key components of intergroup bias is the categorization process, whereby individuals classify themselves and others into social groups based on salient characteristics such as race, ethnicity, gender, age, religion, or nationality (Amodio, 2014). Once these group distinctions are established, individuals tend

to show favoritism towards members of their own group, a phenomenon known as in-group favoritism, while simultaneously displaying prejudice or discrimination towards members of out-groups (Gönültaş, & Mulvey, 2022). Despite efforts to understand and reduce intergroup bias, challenges persist in its measurement, conceptualization, and reduction (Hewstone, Rubin, & Willis, 2002).

The origins of intergroup bias can be traced to a combination of social, cognitive, and motivational factors. Social identity theory theorizes that individuals derive a sense of self-esteem and belonging from their group memberships, leading them to seek positive distinctions between their in-group and out-groups to enhance their social identity (Hogg, 2016). From a cognitive perspective, the human tendency to simplify and categorize complex social information contributes to the formation of stereotypes, which are generalized beliefs about the characteristics of different social groups (Huddy, 2001). These stereotypes serve as cognitive shortcuts that help individuals make sense of the social world but can also perpetuate intergroup bias when they lead to oversimplified or inaccurate perceptions of others (Gönültaş, & Mulvey, 2022). Motivational factors such as the desire for social dominance or the need to maintain social cohesion within one's group can further reinforce intergroup bias by motivating individuals to uphold existing group hierarchies or norms (Hogg, 2016).

Intergroup bias can manifest across various domains of social life, including interpersonal interactions, economic transactions, political attitudes, and institutional practices (Hewstone, et al., 2002). In interpersonal contexts, individuals may display bias through differential treatment or evaluation of others based on their group membership, such as showing more trust or warmth towards in-group members compared to out-group members (Hewstone et al., 2002; Gönültaş, & Mulvey, 2022). In conclusion, this chapter provides an overview of the multifaceted phenomenon of intergroup bias, highlighting key theoretical frameworks, moderators, and avenues for bias. Furthermore, it emphasized the significance of comprehending intergroup bias and its practical ramifications in social behavior, highlighting the necessity for ongoing research to tackle the intricate dynamics within intergroup relations.

2.1.2 Intergroup Bias in the Context of Vaccine Hesitancy

The Covid-19 pandemic not only shook the pillars of public health and economy, but further had far reaching societal implications manifesting in various aspects, such as triggering both proximal and distal threat responses among individuals and endorsing nationalist ideas or conspiratorial beliefs (Jutzi, Willardt, Schmid, & Jonas, 2020). Yet, one of the most remarkable trickle effects of the pandemic was observed when it also acted as a catalyst for the emergence of new social divides, driven by a tendency to assign blame (Adler, Hebel-Sela, Lesehm, Lévy, & Halperin, 2022). Particularly contentious was the issue of vaccination (Rabb, Bowers, Glick, Wilson, & Yokum, 2022). The social divide was exacerbated when the rapid process of developing a vaccine to combat the virus prompted certain sections of the society to display cynicism and suspicion toward the vaccines (Tram, Saeed, Bradley, Fox, Eshun-Wilson, Mody, & Geng, 2021).

Despite the fact that vaccines have been repeatedly established as effective and safe public health measures by the medical society, vaccine hesitancy has been frequent in multiple contexts even before the pandemic (Dubé, Laberge, Guay, Bramadat, Roy, & Bettinger, 2013). The pandemic aggravated the already existing schism between the vaccinated majority and the unvaccinated minority, intensifying the delineation of group identities (Rabb et al., 2022). This heightened group identification not only cultivated a sense of belonging and positivity within the vaccinated cohort but also fueled antagonistic attitudes and perceptions towards the unvaccinated segment of the population.

This escalation in intergroup animosity, characterized by heightened emotional responses and polarized sentiments widened the gap between these two groups which underscores the profound social ramifications of vaccination status (Jagodics, & Szabó, 2022). Recent large-scale studies spanning multiple countries have clearly documented this polarization between these groups, with vaccinated individuals displaying attitudes toward the unvaccinated reminiscent of discrimination directed at immigrant and minority populations (Bor, Jørgensen, & Petersen, 2022).

Intergroup bias is a phenomenon that manifests in various contexts, including discussions surrounding vaccine hesitancy. Vaccine hesitancy refers to the reluctance or refusal to vaccinate oneself or one's children despite the availability of vaccines. In the context of vaccine hesitancy, intergroup bias can arise between individuals who hold different beliefs or attitudes towards vaccination (Casigliani et al., 2022). This bias can lead to unequal treatment, stigmatization, or stereotyping of vaccine-hesitant individuals, resulting in social divisions and tensions within communities. One relevant aspect of intergroup bias in the context of vaccine hesitancy is the formation of negative stereotypes or attitudes towards vaccine-hesitant individuals. Those who are hesitant towards vaccination may be perceived as irresponsible, ignorant, or a threat to public health by individuals who hold pro-vaccination beliefs (Hautala et al., 2022).

Conversely, vaccine-hesitant individuals may view those who advocate for vaccination as authoritarian, uninformed, or dismissive of their concerns. These stereotypes and negative attitudes can contribute to interpersonal conflicts, social ostracism, or even discrimination against vaccine-hesitant individuals (Hautala et al., 2022). Acknowledging the minority status of vaccine-hesitant individuals is indeed crucial in understanding the dynamics of intergroup bias in this context since their minority status provides the backdrop for them being discriminated against and not the other way around. While the previous discussion provides a balanced view of the conflict, highlighting the minority status of vaccine-hesitant individuals clarifies the power dynamics at play and the potential for discrimination against this group. This acknowledgment underscores the asymmetrical nature of intergroup bias and its implications for social dynamics and equity considerations within the context of this study.

2.2 Paradoxical Thinking

Within social sciences, a common struggle that has been a subject of captivation is how to influence and alter the attitudes held by certain groups and members of society. In this theme, multiple interventions and tools have been tested in a variety of capacities that have had effects to different degrees (Bar-Tal et al., 2020). One of the methods that aim to bring about change in societal attitudes is

paradoxical thinking. This is an attempt to make the view's bearer aware of the actual content of their opinions by grabbing their attention via extreme and exaggerated statements in line with their original ideas. Finally, once a person is presented with their view in such extreme manner, arbitration of those views into a more neutral stance is often reported (Hebel-Sela, Knab, & Hameiri, 2023).

2.2.1 Definition and Background

Paradoxical thinking constitutes a methodological approach aimed at inducing cognitive shifts in individuals' attitudes through the presentation of extreme and exaggerated messages (Hameiri et al., 2020). These messages, while aligned with existing beliefs and attitudes, are deliberately overemphasized, or infused with absurd content, intended to evoke surprise and a sense of absurdity (Bar-Tal et al., 2020). Unlike conventional approaches that employ counter-attitudinal information, paradoxical thinking initiates a process of cognitive deliberation by first startling individuals with extreme or exaggerated assertions (Hebel-Sela et al., 2023).

This cognitive dissonance often prompts a reevaluation of entrenched beliefs, potentially leading to epistemic questioning and openness to reconsideration (Hameiri et al., 2020). Central to the effectiveness of paradoxical thinking is the element of surprise, which disrupts established cognitive schemas and fosters heightened attention and exploration (Bar-Tal, & Halperin, 2009). By challenging individuals' existing mental frameworks in a nonjudgmental manner, paradoxical thinking facilitates a deeper engagement with conflicting perspectives and may ultimately catalyze shifts in attitudes and beliefs (Bar-Tal et al., 2020).

The roots of paradoxical thinking can be traced back to cognitive dissonance theory, which claims that individuals experience psychological discomfort when they hold conflicting beliefs or attitudes (Festinger, 1957). In the context of paradoxical thinking, cognitive dissonance theory plays a pivotal role in understanding how individuals respond to messages that challenge their beliefs. This discomfort arises from the inconsistency and conflict between their existing beliefs and new information or experiences (Hameiri et al., 2020). In response to

cognitive dissonance, individuals are motivated to reduce discomfort by either changing their beliefs or attitudes to align with the new information or by seeking out information that supports their existing views (Festinger, 1957).

This discomfort motivates individuals to initiate a process through which they try to resolve the inconsistency by either modifying their beliefs or seeking out information that aligns with their existing views. Paradoxical thinking leverages this cognitive dissonance by presenting individuals with messages that challenge their beliefs in an exaggerated or absurd manner, thereby increasing the distinction of the inconsistency and prompting a deeper level of cognitive engagement (Bar-Tal, & Halperin, 2009). By first surprising individuals with extreme or contradictory statements that align with their beliefs, paradoxical thinking disrupts their cognitive schemas and prompts them to reevaluate their attitudes and beliefs (Hebel-Sela et al., 2023).

Moreover, paradoxical thinking is deduced from the concept of latitude of rejection which refers to the range of ideas or messages that individuals are unwilling to accept due to their inconsistency with existing beliefs (Sherif, & Hovland, 1961). Paradoxical thinking messages are strategically designed to fall within this latitude of rejection, thereby increasing the likelihood of cognitive dissonance and prompting individuals to critically examine their beliefs (Hameiri et al., 2020). This approach is distinct from traditional persuasion techniques, which often involve presenting individuals with information that directly contradicts their beliefs and may trigger defensive reactions. Additionally, paradoxical thinking is informed by research on surprise as a catalyst for attitude change. As, studies have shown that surprising or unexpected information prompts individuals to pay closer attention, engage in deeper processing, and ultimately be more open to persuasion (Ziegler, Diehl, & Ruther, 2002).

Paradoxical thinking messages capitalize on this phenomenon by presenting individuals with unexpected or absurd statements that challenge their beliefs, leading to heightened cognitive processing and greater receptivity to alternative perspectives (Meyer, Reisenzein, & Schützwohl, 1997). It can be inferred that the concept of paradoxical thinking has employed elements of cognitive dissonance

theory, latitude of rejection, and research on surprise as a catalyst for attitude change. Paradoxical thinking facilitates a premise on which possibility to alter one's viewpoints is likely by strategically presenting the individual with exaggerated or contradictory messages that align with their beliefs that disrupts their cognitive schemas.

2.2.2 Paradoxical Thinking as an Intervention Method

The context in which paradoxical thinking interventions are implemented also plays a significant role in determining their efficacy (Hebel-Sela et al., 2023). Cultural norms, individual differences, and the nature of the issue being addressed can all influence how individuals respond to paradoxical statements. For instance, what may be considered provocative or thought-provoking in one cultural context might be perceived as offensive or irrelevant in another (Bar-Tal, & Hameiri, 2020). Thus, practitioners must carefully consider these factors when designing and implementing paradoxical thinking interventions (Bar-Tal, & Hameiri, 2020). Furthermore, the timing and frequency of paradoxical interventions are critical. Repeated exposure to paradoxical statements over an extended period may lead to desensitization or habituation, diminishing their impact over time (Cook, Lewandowsky, & Ecker, 2017).

In addition to these challenges, ethical considerations must also be taken into account when employing paradoxical thinking in interventions (Kteily & Bruneau, 2017). Given the potential for paradoxical statements to provoke strong emotional reactions, practitioners must ensure that individuals' well-being and dignity are respected throughout the intervention process. This may require providing adequate support and resources to help individuals process their reactions and navigate any distress that may arise (Kteily & Bruneau, 2017). Furthermore, it has been previously shown that reframing the conflict narrative and adopting a broader perspective can be sufficiently addressed through indirect emotion regulation mechanisms (Halperin, 2014). Paradoxical thinking operates similarly by presenting extreme or exaggerated statements that challenge individuals' existing beliefs indirectly (Bar-Tal et al., 2020).

By eliciting surprise and cognitive dissonance, paradoxical thinking prompts individuals to reconsider their attitudes and beliefs without directly confronting them, thereby indirectly regulating their emotional responses to contentious issues (Hebel-Sela et al., 2023). However, designing such an intervention has its own challenges. One of the main points that must be considered is the degree of extremity and exaggeration of the views. Since if the ideology is not exaggerated enough, it might not induce any critical reflection of the original ideas (Kluge, Somila, Lankinen, & Lévy, 2024). The other issue is, if the statements are too absurd and exaggerated, then the rejection of the statements without serving any reflections is imminent. Therefore, there is a balance that has to be found within paradoxical thinking interventions (Hebel-Sela et al., 2023). This balance is to bring about a point of consideration of one's ideas with extreme statements corresponding to those ideas, not so little that they do not provoke thinking and not so extreme that can be easily dismissed (Hameiri et al., 2020).

2.3 Contradictory Information

Contradictory information, a pivotal concept in cognitive psychology and communication theory (Spohr, 2017), pertains to the presentation of information that conflicts with pre-existing beliefs or attitudes (Bar-Tal, & Hameiri, 2020). In this chapter, contradictory information both as a concept and as an intervention method are examined.

2.3.1 Definition and Background

Contradictory information, as a concept, finds its roots in the broader domain of cognitive psychology and information processing theory (Wickens, & Carswell, 2021). It pertains to the presentation of information that directly contradicts previously held beliefs, attitudes, or knowledge structures within an individual's cognitive framework (Spohr, 2017). This contradictory information often challenges existing schemas and requires individuals to reconcile inconsistencies in their understanding of a particular topic or issue (Bar-Tal, & Hameiri, 2020). The emergence of contradictory information as a concept can be traced back to seminal works in cognitive dissonance theory, which denotes that individuals

experience discomfort or psychological tension when confronted with conflicting beliefs or attitudes (Yahya, & Sukmayadi, 2020).

One of the foundational theories underpinning the concept of contradictory information is Leon Festinger's (1957) theory of cognitive dissonance. Festinger (1957) proposed that individuals strive for cognitive consistency and experience discomfort when faced with contradictory information that threatens their existing beliefs or attitudes. This discomfort motivates individuals to engage in cognitive processes aimed at reducing or resolving the dissonance, either by changing their beliefs or by seeking out information that supports their existing views (Yahya, & Sukmayadi, 2020). This theory laid the groundwork for understanding how individuals respond to contradictory information and provided insights into the mechanisms underlying attitude change and persuasion.

The emergence of the internet and social media platforms has further amplified the prevalence and impact of contradictory information in contemporary society (Pan, Zhang, & Zhang, 2020). The rapid dissemination of information online, coupled with the echo chamber effect of social media algorithms, has created fertile ground for the spread of misinformation and polarizing narratives (Pan et al., 2020; Yahya, & Sukmayadi, 2020). In this digital landscape, individuals are constantly exposed to contradictory information from multiple sources, leading to heightened cognitive dissonance and information overload. The proliferation of contradictory information poses challenges for individuals' information processing abilities and decision-making processes, as they navigate conflicting perspectives and competing claims in search of truth and coherence (Yahya, & Sukmayadi, 2020).

Contradictory information represents a fundamental aspect of human cognition and decision-making, with theoretical roots in cognitive dissonance theory and information processing models. Understanding how individuals respond to contradictory information is essential for elucidating the mechanisms underlying attitude change, persuasion, and information processing (Festinger, 1957; Wickens, & Carswell, 2021). Moreover, in an era characterized by information abundance and digital connectivity, the concept of contradictory information has

taken on renewed significance, shaping public discourse, political debates, and societal attitudes towards contentious issues (Pan et al., 2020).

2.3.2 Contradictory Information as an Intervention Method

The concept of providing contradictory information is rooted in a multifaceted intervention strategy aimed at challenging entrenched beliefs or attitudes. It advances the idea that exposure to information contradicting one's existing viewpoints can induce a psychological state of discomfort, prompting individuals to seek consistency in their cognitive frameworks. This notion aligns closely with the principles of inoculation theory wherein individuals are preemptively exposed to weakened forms of misinformation to build resistance against it (Cook, Lewandowsky, & Ecker, 2017). Similarly, the importance of understanding and countering misinformation in the "post-truth" era, highlighting the role of providing contradictory information in correcting false beliefs cannot be overstated (Cook et al., 2017).

This approach provides the premise that exposure to information contradicting one's existing viewpoints can induce a psychological state of discomfort, prompting individuals to seek consistency in their cognitive frameworks. In a wide scope of consideration providing contradictory information as a mode of intervention to alter or mediate bias is not dissimilar to paradoxical thinking method. Nonetheless, this intervention method suggests that individuals are motivated to restore cognitive harmony by either aligning their beliefs with the new information or rejecting it outright. The implementation of contradictory information interventions can take on both direct and indirect forms. Direct interventions involve explicit communication of conflicting data through identified sources such as reports or lectures, whereas indirect interventions prompt individuals to reach conclusions inconsistent with their beliefs through implicit experiences (Bar-Tal, & Hameiri, 2020).

In direct interventions, the aim is to persuade individuals by overtly presenting contradictory information, thereby challenging their existing beliefs. Conversely, indirect interventions rely on individuals' interpretation of experiences that challenge their beliefs, leading them to reach conclusions incongruent with their

preconceived notions. For instance, correcting negatively biased meta-perceptions serves as a direct intervention, while intergroup contact constitutes an indirect approach wherein individuals learn counter-stereotypical information through interactions with members of other groups.

Despite their effectiveness in decreasing biases and fostering understanding, these interventions are not without limitations. Resistance from individuals with strongly held beliefs and the need for specific contextual conditions for successful implementation pose significant challenges. Moreover, in environments characterized by intense competition, mistrust, and hostility, the efficacy of these interventions may be diminished, potentially leading to unintended, or even exacerbating existing tensions. Thus, while providing contradictory information holds promise as a means of challenging biases, careful consideration of contextual factors and potential barriers is crucial for its successful application (Bar-Tal et al., 2020).

2.4 Relevance to Education

In this chapter, the significance of this study within the domain of education is presented. The critical importance of understanding intergroup bias and proactive approaches to its reduction within educational settings are explored.

2.4.1 Navigating Intergroup Bias in Education

Bias refers to the attitudes, stereotypes, and expectations that educators hold towards certain groups based on their demographics, such as race or socioeconomic status (Staats et al., 2015). In another words, intergroup bias, the tendency for individuals to favor their own group over others, is a pervasive phenomenon with significant implications in educational settings, one of the most prevalent implications being biased-based bullying (Staats et al., 2015: O'Malley, Cerna, Romero, Zhang, & Furlong, 2021).

Research has shown that intergroup bias can manifest in various forms, including stereotyping, discrimination, prejudice, and ultimately bullying which can have detrimental effects on teaching, learning, and classroom dynamics (O'Malley et

al., 2021). The manifestation of these biases in the context of education can be differential treatment, lower academic expectations, and disproportionate disciplinary actions, depending on the various stakeholders at any given educational institution (Grays, Moise, Moore, Young, & Wilder, 2023). In educational contexts, where students come from diverse backgrounds and bring different perspectives and experiences to the classroom, understanding and addressing intergroup bias is crucial for fostering inclusive learning environments, promoting social cohesion, and enhancing educational outcomes for all students (Gönültaş, & Mulvey, 2020).

The implications of bias in education are extensive and multifaceted, impacting students' academic, social, and emotional outcomes (Grays et al., 2023). Research has consistently shown that students who experience bias or biased-based bullying, face disproportionately higher rates of disciplinary actions, lower academic expectations, and limited access to advanced educational opportunities (Grays et al., 2023: O'Malley et al., 2021). Intergroup implicit biases in the context of education can arise in multiple social and interactional dynamics, including biases amongst teachers, biases among students, and biases among teachers and students. Each of these dynamics has far-reaching and detrimental implications on multiple levels.

For instance, biases among educators toward students can lead to marginalization, and diminished self-esteem among students, lower agency among students, losing the sense of belonging, lower academic achievements, and ultimately hindering their educational attainment and well-being (Reyes et al., 2012; Anderson, 2020; Grays et al., 2023). Moreover, bias can perpetuate systemic inequities, contributing to the cycle of poverty and perpetuating social inequalities across generations. Thus, addressing bias in the context of education cannot be overstated for promoting social justice and breaking down barriers to educational attainment for marginalized communities (Grays et al., 2023).

2.4.2 Implementing Strategies to Address Bias

Given the significant impact of bias on student outcomes, there is an urgent need to address bias in education through comprehensive strategies and interventions (O'Malley et al., 2021). Schools must recognize the existence of implicit biases among educators and take proactive steps to decrease their effects (Grays et al., 2023). This requires ongoing professional development programs focused on raising awareness of bias, fostering cultural competence, and implementing research-based strategies to counteract bias in the classroom. By addressing bias in education, schools can create a more equitable and inclusive learning environment where all students have the opportunity to thrive academically and socially, regardless of their background or identity (Reyes et al., 2012; Anderson, 2020; Grays et al., 2023; O'Malley et al., 2021).

This study might offer some insights on two intervention strategies, provision of contradictory information and paradoxical thinking, that could potentially decrease bias. These strategies could be implemented into lesson plans, everyday activities of the students, and pedagogical considerations. The two intervention methods examined in this study, paradoxical thinking and providing contradictory information, hold promise for addressing intergroup bias in educational settings (Cook et al., 2017; Paluck et al., 2021). Paradoxical thinking, which involves presenting extreme or exaggerated messages aligned with individuals' existing beliefs, can prompt students and teachers alike to critically reflect on their attitudes and beliefs (Hameiri et al., 2020). By challenging students' preconceptions in a nonjudgmental manner, paradoxical thinking can stimulate cognitive engagement and promote openness to alternative perspectives.

Similarly, providing contradictory information can challenge students' existing beliefs and prompt them to reevaluate their attitudes and assumptions (Bar-Tal, & Hameiri, 2020). By presenting conflicting data or perspectives, educators can encourage students to engage in critical thinking and consider alternative viewpoints (Cook et al., 2017; Paluck et al., 2021). Both intervention methods have the potential to promote perspective-taking, empathy, and understanding

among students, ultimately fostering more inclusive and respectful classroom environments. The two intervention methods examined in this study offer promising strategies for addressing intergroup bias in educational settings and warrant further exploration and implementation in practice.

3 Research Design

This study forms a component of a broader research initiative titled 'Supporting Pro-social Change in an Era of Intergroup Tensions: A Multidisciplinary and Global Approach'. As part of this comprehensive project, this study focuses specifically on reduction of intergroup bias, particularly in the context of vaccine hesitancy, via two intervention methods. This section outlines the research aim and design employed in this study, including participant recruitment, experimental procedures, and data collection methods. By adhering to research protocols and employing a multidisciplinary approach, the aim is to contribute nuanced insights into the dynamics of intergroup bias and inform the development of effective intervention strategies for promoting positive social change.

3.1 Research Aim

The present study aims to investigate the efficacy of two intervention methods, namely paradoxical thinking and providing contradictory information, in decreasing intergroup bias over the long term and address the gap in the current literature that has been previously presented. By focusing on these specific intervention strategies, the study seeks to contribute to the existing literature on bias reduction by exploring novel approaches that target cognitive processes underlying intergroup bias in a sustained and long-term manner.

Through a longitudinal study design, the research aims to assess the long-term effects of these intervention methods on intergroup bias reduction. By examining changes in attitudes, behaviors, and perceptions over time, the study seeks to elucidate the mechanisms underlying the effectiveness of paradoxical thinking and providing contradictory information in decreasing intergroup bias. Overall, this study seeks to advance knowledge in bias reduction by investigating the efficacy of these intervention methods and mechanisms through which they operate. The research questions guiding the study are as follows:

1) Does the paradoxical thinking intervention method have long-term effects in decreasing intergroup bias?

2) Does the providing contradictory information intervention method have long-term effects in decreasing intergroup bias?

3.2 Participants and Data Collection

The study involved a sample of 86 participants recruited from higher education institutions in Finland. The sample consisted of 63% female participants, with ages ranging from 18.9 to 55.3 years, a median age of 24.7 years, and a mean age of 26.8 years. Recruitment was conducted through invitations circulated within a Finnish higher education institution channel, ensuring that all participants had affiliations with higher education.

Upon recruitment, participants were randomly assigned to one of three subgroups: a control group, a paradoxical thinking intervention group, and a providing contradictory information intervention group. Each participant was then required to complete two surveys designed to measure their levels of empathy towards vaccine-hesitant individuals. The use of surveys as measurement tools allowed for the collection of quantitative data, facilitating the systematic analysis of participants' responses and the evaluation of any changes in empathy levels over time. By employing a randomized controlled trial design, this study aims to provide robust empirical evidence regarding the efficacy of paradoxical thinking and contradictory information interventions in decreasing intergroup bias among vaccine-hesitant individuals.

The scales that were used in the surveys are as follows: (i) negativity against vaccine hesitancy (7 items, some reverse-scored, on a scale of 1-7, 1 being ‘totally disagree', 7 being 'totally agree’); (ii) perceived threat (4 items, on a scale of 1-7, 1 being ‘totally disagree', 7 being 'totally agree’); (iii) feeling thermometer towards the vaccine hesitant population (on a scale of 1-10, 1 being very cold feelings, 10 being very warm feelings) (“Feeling Thermometer,” 2008); (iv) dehumanization scale towards vaccine hesitant individuals (on a scale of 1-10, 1 being not at all human, 10 being very much human) (Kteily & Bruneau, 2017); (v) Emotions about vaccine hesitancy (8 items separately, on a scale of 1-7, 1 being ‘not at all', 7 being 'very much’) (Halperin, 2015); (vi) Perceived competence and

warmth of vaccine-hesitant individuals (4 items in both categories, on a scale of 1-5, 1 being 'not at all', 5 being 'very much') (Durante, Fiske, Gelfand, et al., 2017); (vii) Support for negative outcomes for vaccine-hesitancy (3 items, on a scale of 1-7, 1 being 'not at all', 7 being 'very much').

The surveys were administered both before the interventions and six to nine months afterward to assess the long-term effectiveness and longevity of the interventions in mediating intergroup bias. The instruments used in this study were carefully selected to ensure the validity and reliability of the measurements. Multiple scales were incorporated to capture various facets of intergroup attitudes, providing a comprehensive assessment of participants' perceptions and biases. These scales have been previously validated and employed in similar studies focusing on intergroup attitudes, ensuring consistency and comparability with existing research findings (Hautala et al., 2022; Kluge et al., 2024). By drawing on established measures with demonstrated reliability and validity, this study aimed to uphold the rigor and credibility of its findings while contributing to the broader understanding of intergroup dynamics.

To address these questions, data analysis was conducted using SPSS software, employing the mixed model ANOVA (general linear model) data analysis method to examine changes in all the explicit scales of the survey and test research hypotheses across the different intervention groups. ANOVA allows for the comparison of means across multiple groups, enabling the identification of significant differences and interactions between the intervention methods and their impact on intergroup bias mediation over time which in effect made it the ideal analysis method to address to the research questions. Both interventions were investigated separately and compared to the control group.

3.3 Experimental Procedures

Before delving into the specifics of the interventions employed in this study, it is essential to contextualize their theoretical underpinnings and rationale. The interventions utilized were crafted based on the concepts of paradoxical thinking and inconsistent information, as elucidated by the extant literature reviewed in

preceding chapters. Paradoxical thinking involves presenting individuals with ideas or perspectives that challenge their existing beliefs or assumptions, often employing rhetorical techniques such as exaggeration or reversal to provoke cognitive dissonance and stimulate critical reflection (Kluge et al., 2024).

Similarly, provision of contradictory information interventions entail exposing individuals to a variety of information sources or viewpoints that contradict their held beliefs or attitudes, thereby disrupting cognitive schemas and prompting re-evaluation (Pan et al., 2020). Drawing upon these theoretical frameworks, the interventions were designed to target intergroup bias among participants, with the aim of examining the long term effects the intervention methods. The intervention statements that were read to the participants were in Finnish, participants' first language. Here a direct English translation of the statements are listed.

3.3.1 Paradoxical Thinking Intervention

The statements read to the paradoxical thinking group of the participants were as follows: 1) Government needs to take concrete actions so that anti-vax individuals are constraint to take the vaccine. For example, the tax rate for anti-vax individuals could be largely raised to cover their hospital costs caused by coronavirus. 2) People who refuse to take the corona vaccine should be tested for coronavirus every week and they should pay these tests themselves. Society should not support the unvaccinated people and their coronavirus tests – they brought it on themselves. 3) The amount of wrong and false information on social media about corona vaccines is endless. Too often, even though they understand the lack of logic, people choose to support and share these false claims to cause harm to societal structures. 4) Taking a corona vaccine is not a matter of opinion. It is a national duty, and it reflects that we care about national health security. People should not have the right to choose whether they want it or not. 5) It is contradictory that people who refuse to take the corona vaccine and therefore do not believe in medicine do believe in it and believe they have a right to it when they need hospital treatment for the same virus from which the vaccine would have protected them. 6) Every vaccinated person plays a part in preventing intensive care overload. Therefore, if there is a vaccinated person and a non-

vaccinated person requiring intensive care, the vaccinated person should be the priority. 7) People who don't take the coronavirus vaccine don't value their lives at all. They are willing to take the risk of getting a severe coronavirus infection and die because of it. 8) When taking a coronavirus vaccine, one should not think only of oneself, but also of those in society who cannot be vaccinated due to medication or illness. Unvaccinated people are selfish and do not deserve to be treated as equal members of society. 9) If covid restrictions are re-imposed in the future, they should only apply to unvaccinated individuals. Vaccinated people should be able to freely live their lives and should not suffer restrictions that are largely due to the refusal of other individuals who do not take the vaccine. 10) Employers should be allowed to fire people who refuse to take the coronavirus vaccine without a health reason. This would ensure a safe working environment for all people who have taken the vaccine. 11) Due to the limited number of intensive care units and ventilators in Finland, the capacity of these should be maintained by not providing intensive care to the anti-vax individuals at all. The place in the intensive care unit should be earned by taking vaccination. 12) The corona pandemic has not disappeared. Even vaccinated people have to go through inconvenient isolations, tests, and border controls, because there are still too many unvaccinated people spreading the virus uncontrollably. 13) People who have not taken the corona vaccine should have their own separated region to live in; they should not mix with the corona vaccinated people, because they are dangerous and just try to scare vaccinated people with their lies about vaccine. 14) Unvaccinated people with corona infection are hospitalized up to 17 times more than vaccinated people. They should be placed into isolated buildings and cared for by unvaccinated nurses only, so as not to put any vaccinated people into danger. 15) Unvaccinated people are responsible for the continuation of the corona pandemic and know it but are far too selfish to be part of the solution. They think only of themselves, so they do not deserve to be treated equally to others. 16) Unvaccinated people intentionally increase the costs and burden of health care by refusing safe and readily available precaution methods such as vaccines, so they deliberately choose to sabotage our existing health care system. 17) People who do not take the corona vaccine should be completely isolated from society and have movement restriction. This would force them to take vaccination, which is best for our society. 18) Unvaccinated people

should pay substantial fines for each week they do not take the corona vaccine. This would drive them financially tight and eventually force them to take the vaccine. 19) Vaccination passport should be re-introduced so that we are done with this pandemic. Unvaccinated people can either settle for their fate and be cut out from the society or do us all a favor and go take the vaccine. 20) In Finland, unvaccinated people have caused harm for the whole society. If they are not taking the vaccine, they should be made to do some unpaid labor for the benefit of the society – for example fix roads, clean hospitals, or build vaccination centers. 21) Most of unvaccinated people are uneducated and illiterate people, who are not employed, are loud mouths and like to oppose orders from the authorities. They just want to bully society. 22) Vaccine passports should be re-introduced everywhere. This would open the possibility for vaccinated people to enjoy, for example, cultural experiences; and send a clear message to the rest – you are not welcome in our society.

3.3.2 Contradictory Information Intervention

The statements read to the contradictory information group of the participants were as follows: 1) People who take corona vaccines do not think with their own brains. They do whatever the government tells them to do without thinking about the consequences. Only the unvaccinated have shown the ability to think with their own brains. 2) According to the government, non-vaccinated people will have to pay for their coronavirus tests in the future. This should not be allowed, because the government should support the freedom of choice and not deprive it. 3) People who have taken the corona vaccine release a peak protein into the air that is harmful to unvaccinated people and causes health problems, like infertility. Thus, vaccinated people are a danger to the unvaccinated and should be isolated from society and not the other way around. 4) Pressure from the government and other authorities to take the corona vaccine has never been about the virus or health. It has been about bringing vaccinated people under control and complete control. People who do not see this, have been completely brainwashed. 5) The dangers of the coronavirus have been exaggerated. Government corona policies, such as forcing people to take the corona vaccine and closing of businesses are just “corona hysteria” that restricts fundamental

human rights and increases the power of the pharmaceutical industry, that should be stopped. 6) The government has succeeded to intimidate and manipulate the weakest people in society to take the corona vaccine and only strong individuals have survived unvaccinated. It is scary to see how much weakness there is in our society. 7) People who have confidence in corona vaccines are irresponsible bullies. They don't have anything better to do than spread harmful propaganda and intimidate people to take the vaccine by disseminating false statistics on deaths caused by coronavirus. 8) The corona vaccine has been intentionally poisoned, which causes vaccinated people to become ill. Thus, in addition to vaccines, the pharmaceutical industry earns money from vaccinated people and their future illnesses. 9) The biggest profits for the pharmaceutical industry right now come from people who take corona vaccines. As a result, false information is given about the benefits of the vaccine so that as many people as possible would take it and profits would increase. 10) The corona vaccine is only in the testing phase, thus people that are now vaccinated will be used as guinea pigs. This should not be acceptable anywhere and vaccinations should not have been started based on this information. 11) People who take the corona vaccine have voluntarily decided to take part in a medical human experiment. Thus, in case of adverse effects they should not be offered free (hospital) treatment. 12) Health care professionals has deliberately made corona tests so that they always show positive results. This drives their agenda of getting people manipulated to take the vaccine, be scared and stay at home. 13) Health or life insurance should not cover serious adverse effects or deaths caused by corona vaccines for vaccinated people, Because the situation is self-inflicted. All the information is out there, the vaccinated people have chosen to ignore it. 14) The Finnish Institute for Health and Welfare (THL) and government are conspiring with each other. The goal of this conspiracy is to push the anti-vaccine people to their limits by blaming them, which would force them to take the vaccine. This is how THL and the government control/suppress people. 15) The true meaning of corona vaccinations is to bring people under state control and to increase the power of the pharmaceutical industry. This true agenda/purpose is hidden behind the false vaccine benefits. 16) People who take the corona vaccine are weak and not able to doubt (/question) the decisions of the authorities. They obediently obey every command and are thus easily manipulated to take multiple doses of vaccine. 17)

People who take the corona vaccine do not trust on natural means to increase their body's resistance, such as diet, because pharmaceutical companies have manipulated them to think differently. 18) The corona vaccine was developed because the natural selection did not prevent the overpopulation of the earth effectively enough. Vaccinated people will die of vaccination and unvaccinated will survive, which will solve the problem. 19) The corona vaccine predisposes humans to serious adverse reactions like impotence and lower IQ / weakness of the mind, not all of which are registered so that the hesitancy towards vaccinations do not increase. People are only shown statistics that support vaccine use. 20) Hospital- and intensive care should be denied from the people who have took the corona vaccine and save for those who has not taken it, because vaccinated people have caused their need for hospitalization by taking the vaccine. 21) The government hides information about the corona epidemic and bases its actions on false calculations. In Finland, those who criticize the government's corona policy are silenced so that the hesitancy towards vaccinations does not increase and the power of the government would not reduce. 22) If there is a vaccinated person and non-vaccinated person requiring intensive care, the non-vaccinated person should be the priority, because the vaccinated person have caused the situation itself by taking the vaccine.

3.3.3 Control Group

And the following statements were red to the control group of the participants: 1) Watermelon is a healthy and ideal fruit to eat especially in the hot summer months as it is sweet and contains a lot of water, therefore keeping you hydrated. It is also full of antioxidants and vitamins that greatly nourish the body. 2) Wind turbines generate electricity from wind energy and by doing so they help reduce air pollution and greenhouse gases; Therefore, their use to generate electricity has been encouraged in some countries of the world. 3) AIDS is a combination of symptoms that appear due to failure of the immune system following infection with the HIV virus. It is a deadly disease that has killed millions of people around the world in the last 30 years. 4) More and more young people are suffering from mental health disturbances. One reason for this is that more and more mental work is demanded from everyone. We should keep in mind that we are only

human and adjust our goals accordingly. 5) There is no simple way to convey a heavy and complex message across the stage of the theater, but the marvelous abilities of creation, directing and acting manage to do so, as we sometimes experience. 6) Scientific theories should not preach certain truths to students, but rather equip them with the intellectual tools necessary to make independent evaluations of controversial facts and theories. That is the true purpose of higher education. 7) Many species of insects, mammals and birds are now endangered. Scientists estimate that this may be related to the transition to intensive agriculture where pesticides are widely used and the loss of natural areas in favor of development and construction. 8) The burning of the fuel used to propel the ships releases sulfur oxides and nitrogen and pollutant particles of tiny diameter that penetrate the breath and can lead to illness and death. Therefore, such air pollution should be limited, especially in bays close to localities. 9) The Internet is a global computer network that connects billions of computers worldwide. In the last twenty years, internet development has gained momentum and today the internet has become a major player in most areas of our lives. 10) Following the growth of the population and industry in large cities, air pollution in some of the world's major cities, such as Beijing and New Delhi, has become an almost unbearable environmental hazard that has long crossed the levels considered safe for health. 11) Cancer is a serious and deadly disease characterized by the rapid and uncontrolled proliferation of cells in the body. It strikes various systems and organs in the body and the main division of cancer types is according to the type of cell being affected. 12) Living in areas closer to geographical poles is hugely polluting since we need so much energy to produce heat during winter months. Humankind should consider moving the whole population to areas more naturally suitable for human inhabitance. 13) During pregnancy, it is advisable to avoid drinking alcohol and smoking as studies have shown that these two habits can have a detrimental effect on the fetus and the development of pregnancy. 14) In the past, smoking was common almost everywhere and restrictions were few, but in recent years smoking has been banned in closed public places such as airports, flights, work offices and more. 15) Coral reefs are essential to the ocean ecosystem because they provide food and shelter for many marine creatures. Therefore, we must take care to preserve the reefs that are still left in the world. 16) Recycled fuel can reduce air pollution, save costs and help preserve the

environment. It may be that in the future we can create such fuel that will be environmentally friendly, as there are already examples of aircrafts taking off with fuel made of vegetable oil. 17) Art is not just a beautiful landscape image, or still life, but a product of human thought and creativity, a communication between the inner and the outer world. Art is a vital part in keeping our societies functioning. 18) The days of printed manuscripts may be a thing of the past. If cheap digital book downloads catch on en masse, the publishing industry will change dramatically, as has happened in the music industry. 19) The genocide in Rwanda, Africa, was a deliberate, brutal and systematic killing in which more than half a million people perished. The world should learn from instances like these and oversee that the history would not repeat itself. 20) Environmental pollution often occurs from the widespread global use of oil and coal. Therefore, switching to cleaner fuels or more widespread use of public transportation should be encouraged. 21) China is a very populous country that has long crossed the billion mark despite a "one child" policy. In addition, today China's economy is one of the largest in the world and it exports a very large portion of the products we consume in the West. 22) Individual car owning and using has been on the decline in major capitals of Europe, such as Amsterdam, Copenhagen, and Helsinki. We should strive for even less cars in all of the capitals in the world to keep the air cleaner and keep our planet from overheating.

3.4 Methods

In this study, a mixed analysis of variance (ANOVA) approach was employed to examine the effects of intervention methods in the context of this study (Maxwell, & Delaney, 2004). The reason for selection of mixed ANOVA was based on multiple factors that addressed the central problems of this research design and the specific objectives of this study (Keppel, & Wickens, 2004). Mixed ANOVA allows for the examination of both between-subjects and within-subjects effects, making it well-suited for analyzing data collected from experimental designs involving multiple independent variables and repeated measures (Tabachnick, & Fidell, 2013). Mixed ANOVA offers greater flexibility and statistical power compared to traditional ANOVA models, thereby enabling a more comprehensive

evaluation of intervention effects over time (Tabachnick, & Fidell, 2013). Additionally, the use of mixed ANOVA facilitates the assessment of different intervention types and time points, which is particularly relevant in longitudinal studies examining the long-term effects of interventions in the context of this study (Maxwell, & Delaney, 2004). This approach enables the study to examine the impact of intervention methods across different stages of the intervention period, providing valuable insights into the temporal dynamics of behavior change and attitude formation (Tabachnick, & Fidell, 2013).

Before conducting mixed ANOVA, several assumptions must be met to ensure the validity and reliability of the analysis (Maxwell, & Delaney, 2004). These include assumptions regarding normality, homogeneity of variance, sphericity, and independence of observations. Normality assumptions pertain to the distribution of the dependent variable within each group, with data ideally conforming to a normal distribution. Homogeneity of variance assumes that the variance of the dependent variable is consistent across all levels of the independent variables. Sphericity refers to the equality of variances of the differences between all possible pairs of within-subject conditions. Finally, independence of observations assumes that observations are not influenced by other observations and are drawn independently from the population (Tabachnick, & Fidell, 2013). To evaluate the significance of intervention effects in mixed ANOVA, various statistics are employed, including Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root (Keppel, & Wickens, 2004). Pillai's Trace is a multivariate statistic that assesses the overall significance of the independent variables, representing the proportion of variance in the dependent variables accounted for by the independent variables.

3.5 Ethical Review and Trustworthiness

In the initial stage of data collection, all participants in the study were informed extensively about the content of the study and the ethical considerations of it. They were assured of the voluntary nature of their participation, the assurance of anonymity, and the confidential management and exclusive research use of their

data. They were also explicitly informed that their participation and data can be revoked and removed at any stage of the study. With clear acknowledgement of the author's responsibility during the data collection phase, the participants were treated with respect, dignity, and meticulous care to keep them out of any potential harm including psychological distress.

The study protocol obtained approval from the Aalto University Ethical Review Board and adhered strictly to the established ethical guidelines outlined by the Finnish Advisory Board on Research Integrity. In addition, a written consent form was obtained from every single participant in the study. Strict measures were implemented throughout the data collection process to safeguard data integrity and participant privacy. These measures included pseudonymizing responses through the removal of any identifying information, ensuring participant identities remained undisclosed in both the dataset and any subsequent publications derived from it. Furthermore, all research data underwent secure storage procedures in accordance with the data protection guidelines of the Aalto University.

Unlike fields with observable subjects, behavioral research often deals with human thoughts and feelings, making it challenging to capture accurate data. Thus, the importance of using assessment instruments with established validity and reliability cannot be overstated (Panter, & Sterba, 2011). As for the trustworthiness of the study, a procedural framework was deduced based on the ideas proposed by Panter and Sterba (2011). Two main avenues of investigation and reflection were identified to ensure the trustworthiness and credibility of the research design, mechanisms, execution, analysis, and interpretation of the data; reliability and validity. In order to address the reliability of the entire study, one of the most pivotal denominators is whether the measurements are established or not (Panter, & Sterba, 2011). Moreover, Panter and Sterba (2011) discuss the significance of relevant measurements and inference of those measurements in safeguarding the validity of a quantitative study. In the context of this study all the measurements were chosen in consultation with academic behavioral studies. Further it is noteworthy that the measurements should be consistent throughout different data collection phases in studies that examine a phenomenon during a

period of time, such as this study (Panter, & Sterba, 2011). As mentioned previously, the participants of this study were given identical surveys in both stages of the data collection to adhere to this recommendation as well.

Validity refers to the extent to which empirical evidence and theoretical rationales support the adequacy and appropriateness of inferences and actions based on test scores or other modes of assessment (Panter, & Sterba, 2011). It involves making integrated evaluative judgments about the soundness of inferences drawn from the use of a measurement instrument and considering the potential consequences of those inferences. Validity is not about validating the test or observation device itself but about validating the inferences derived from test scores or other indicators, including the implications for action that these interpretations entail (Panter, & Sterba, 2011). To ensure validity, the author considered various facets, including the balance of evidence supporting score interpretation, the relevance and utility of scores to the intended purpose, the value implications of score interpretation, and the functional worth of testing in terms of its intended and unintended consequences (Panter, & Sterba, 2011).

4 Results

In this section, the outcomes of the interventions aimed at reduction of intergroup bias against vaccine-hesitant individuals are presented and analyzed.

4.1 Analysis and Outcome

In order to answer the first research question to investigate if the paradoxical thinking group displayed long-term effects in comparison to the control group, via a mixed ANOVA was employed to examine the effects of intervention type (control vs. paradoxical thinking) as a between-subjects factor on multiple dependent variables. The sample consisted of 30 participants in the control group and 26 participants in the paradoxical intervention group. Multivariate tests revealed a significant main effect of the intercept, indicating overall differences in the dependent variables between the intervention groups, $F(15, 40) = 583.353$, $p < .001$. However, the main effect of intervention type was not statistically significant, Wilks' $\Lambda = .747$, $F(15, 40)$, $p = .568$, indicating no significant differences in the dependent variables between the control and paradoxical intervention groups. Regarding the within-subjects' effects, there was a close to significant main effect of time, $F(15, 40)$, $p = .076$, suggesting that the dependent variables varied across time points. However, the interaction effect between intervention type and time was not statistically significant, $F(15, 40)$, $p = .713$, indicating that the effect of intervention type on the survey answers did not vary over time. The univariate tests revealed that the time effects were driven by Dehumanization ($F = 5.275$, $p = 0.026$), Sympathy ($F = 12.786$, $p < 0.001$), Compassion ($F = 11.747$, $p = 0.001$), and Guilt ($F = 4.745$, $p = 0.034$).

Source	Measure	F	Sig.
Time effect	Negativity	0.135	0.715
	Threat	0.387	0.536
	Feeling_Thermo	0.013	0.910
	Dehumanization	**5.275**	**0.026**

	Warmth	0.020	0.889
	Competence	0.458	0.501
	Actions	0.132	0.717
	Anger	3.821	0.056
	Hate	1.643	0.205
	Fear	1.163	0.286
	Empathy	1.846	0.180
	Sympathy	**12.786**	**0.001**
	Shame	0.012	0.914
	Compassion	**11.747**	**0.001**
	Guilt	0.024	0.877
Time*group effect	Negativity	0.407	0.526
	Threat	0.223	0.638
	Feeling_Thermo	0.013	0.910
	Dehumanization	0.004	0.952
	Warmth	3.007	0.089
	Competence	1.309	0.258
	Actions	0.010	0.923
	Anger	0.019	0.889
	Hate	0.801	0.375
	Fear	0.423	0.518
	Empathy	1.846	0.180
	Sympathy	0.065	0.799
	Shame	0.166	0.686
	Compassion	0.126	0.724
	Guilt	**4.745**	**0.034**

Table 1 Mixed ANOVA univariate test results for paradoxical thinking group. Sphericity assumed.

In order to answer the second research question to investigate if the group that has been provided with contradictory information displayed long-term effects in comparison to the control group, a mixed ANOVA was conducted to examine the effects of intervention (control vs. provision of contradictory information) as a between-subjects factor and time as a within-subjects factor on the explicit scales

of intergroup bias against vaccine hesitancy. The sample consisted of 30 participants in the control group and 25 participants in the provision of contradictory information intervention group. The between-subjects factor intervention had no significant effect on the dependent variable, Pillai's Trace = 0.255, $F(15, 39) = 0.889$, $p = 0.581$, $\eta^2 = 0.255$. Similarly, the interaction between time and intervention was not significant, Pillai's Trace = 0.229, $F(15, 39) = 0.773$, $p = 0.698$, $\eta^2 = 0.229$. However, there was a significant main effect of time on the dependent variable, Pillai's Trace = 0.482, $F(15, 39) = 2.417$, $p = 0.014$, $\eta^2 = 0.482$, indicating that the survey responses varied significantly across different time points. The univariate tests revealed that the time effects were driven by Dehumanization ($F = 10.707$, $p = 0.002$), Empathy ($F = 4.369$, $p = 0.041$), Sympathy ($F = 8.311$, $p = 0.006$), and Compassion ($F = 15.695$, $p \leq 0.001$).

Source	Measure	F	Sig.
Time effect	Negativity	0.743	0.392
	Threat	0.000	0.989
	Feeling_Thermo	0.329	0.569
	Dehumanization	**10.707**	**0.002**
	Action	0.012	0.913
	Warmth	0.440	0.510
	Competence	0.580	0.450
	Anger	3.227	0.078
	Hate	1.754	0.191
	Fear	1.023	0.316
	Empathy	**4.369**	**0.041**
	Sympathy	**8.311**	**0.006**
	Shame	0.156	0.695
	Compassion	**15.695**	**0.000**
	Guilt	0.169	0.682
Time*group effect	Negativity	1.105	0.298
	Threat	0.023	0.881
	Feeling_Thermo	0.329	0.569

	Dehumanization	0.245	0.623
	Action	0.432	0.514
	Warmth	1.235	0.271
	Competence	0.992	0.324
	Anger	0.004	0.951
	Hate	1.211	0.276
	Fear	0.387	0.536
	Empathy	0.273	0.603
	Sympathy	0.019	0.891
	Shame	0.001	0.971
	Compassion	0.510	0.478
	Guilt	1.828	0.182

Table 2 Mixed ANOVA univariate test results for contradictory information group. Sphericity assumed.

5 Discussion

In this chapter implications and interpretations of the results of this study are reviewed contextualizing them within the broader landscape previous studies and academic literature.

5.1 The Effects

The findings of this study have suggestions for better understanding the effectiveness of intervention methods aimed at decreasing intergroup bias against vaccine-hesitant individuals. Despite the initial hopes and theoretical underpinnings supporting the use of paradoxical thinking and provision of contradictory information interventions (Bar-Tal, & Hameiri, 2020), the results indicate that these methods did not produce meaningful, long-lasting effects on participants' attitudes towards vaccine-hesitant individuals. One of the central findings of the study is the lack of significant differences in intergroup bias scores between the intervention groups (paradoxical thinking and providing contradictory information) and the control group. Contrary to expectations, participants who received either intervention did not exhibit significantly lower levels of intergroup bias compared to those in the control group in long term. This suggests that neither the paradoxical thinking nor providing contradictory information interventions had a lasting impact on participants' attitudes toward vaccine-hesitant individuals.

These results challenge the efficacy of paradoxical thinking and providing contradictory information as standalone intervention methods for decreasing intergroup bias in the context of vaccine hesitancy when long lasting effects are desired. Despite the theoretical rationale supporting these interventions (Bar-Tal, & Hameiri, 2020), the empirical evidence from this study suggests that they may not be effective in producing enduring changes in attitudes and perceptions related to vaccination. This highlights the complexity of addressing biases deeply entrenched within individuals' beliefs and underscores the need for further research into more effective intervention strategies.

5.2 Interpreting Long-Term Effects of Intervention Methods on Specific Measures

The effects of the interventions on intergroup bias were not substantial overall, as previously discussed. However, there were notable changes in certain measures over the long term. Specifically, in the paradoxical thinking group, significant time effects were observed in measures of Dehumanization ($F = 5.275$, $p = 0.026$), Sympathy ($F = 12.786$, $p < 0.001$), Compassion ($F = 11.747$, $p = 0.001$), and Guilt ($F = 4.745$, $p = 0.034$). Similarly, in the contradictory information group, significant time effects were observed in measures of Dehumanization ($F = 10.707$, $p = 0.002$), Empathy ($F = 4.369$, $p = 0.041$), Sympathy ($F = 8.311$, $p = 0.006$), and Compassion ($F = 15.695$, $p \leq 0.001$).

Upon immediate review, it became evident that the measures affected by the long-term frame of this study were similar in both intervention groups and highly intertwined with one another. Notably, three measures—Dehumanization, Sympathy, and Compassion—were identical in both groups. This observation is significant as it suggests that despite the contradictory nature of the intervention methods (paradoxical thinking exaggerating viewpoints to absurdity and contradictory information shedding light on the shortcomings of held viewpoints), they yielded almost identical results in this study. For the contradictory information intervention and the control groups, the long-term interval between the intervention and the secondary survey revealed that participants' emotions of Sympathy, Empathy, and Compassion towards vaccine-hesitant individuals contracted.

This interpretation is complex, but the contextual shift between the time of the intervention and the secondary survey regarding the coronavirus pandemic offers insights. Similarly, for the paradoxical thinking group and the control group, the long-term interval showed that participants' emotions of Sympathy and Compassion lessened towards vaccine-hesitant individuals. Again, the interpretation is complex, but the contextual shift due to the pandemic's subsiding may explain these effects.

It can also be proposed that as the situation regarding the influence of the pandemic became stable, individuals' identification and attitudes towards vaccine-hesitant individuals became more stable. For the dehumanization effects, participants in both intervention groups dehumanized vaccine-hesitant individuals, despite the timely conflict diminishing. This increase in dehumanization may be attributed to the decreased engagement with the subject of vaccines over time. It has previously been showed that dehumanization decreases when conflicting social groups engage and interact with each other over a sustained period of time (Bruneau, Hameiri, Moore-Berg, & Kteily, 2021); so it might be possible to deduce that since the engagement of the participants in its totality with the subject of vaccine and perceived threat posed to the society by individuals who are vaccine-hesitant diminished dramatically in the timeframe of this study, dehumanization in both intervention groups increased, perhaps regardless of the interventions.

Interestingly, the measurement for Guilt increased for participants in the paradoxical thinking intervention group compared to a reduction of guilt in the control group. While this change may seem arbitrary, it could be attributed to the extreme statements read during the intervention, invoking guilt over time. However, drawing more definitive conclusions would be challenging, especially considering that guilt was the only variable that displayed such a change over the study.

There could be several other potential explanations for the observed effects in the long term. Over time, individuals may become accustomed to the information presented during the intervention and normalize their views towards vaccine-hesitant individuals. This normalization could lead to a reduction in emotional responses such as empathy and sympathy (Deatrick, Knafl, & Murphy-Moore, 1999). Continuous exposure to information about vaccine hesitancy and its implications may lead to desensitization among individuals, resulting in reduced emotional responses over time. This desensitization could be a coping mechanism to deal with the constant influx of information and discussions surrounding vaccines (Kinnick, Krugman, & Cameron, 1996). The evolving nature

of the coronavirus pandemic and its associated discourse may have influenced participants' attitudes and emotions towards vaccine hesitancy.

As the pandemic progressed and its immediate impacts lessened, individuals' perceptions of vaccine hesitancy may have shifted accordingly. These additional explanations highlight the multifaceted nature of human behavior and the complex interplay of various factors that may contribute to changes in attitudes and emotions over time. Further research would be necessary to explore these potential explanations in greater depth and elucidate the underlying mechanisms driving the observed effects. Overall, these findings suggest the need for further exploration into the nuanced effects of intervention methods on intergroup bias, particularly in the context of vaccine hesitancy. Further research could delve into the underlying mechanisms driving these changes and explore additional intervention strategies to address intergroup bias effectively.

5.3 The Complexity of Decreasing Bias

These results suggest that while paradoxical thinking and providing contradictory information interventions may have shown promise in immediate or short-term contexts (Kluge et al., 2024), they do not effectively decrease intergroup bias over the long term. This highlights the complexity of addressing biases deeply entrenched within individuals' beliefs and underscores the need for further research into more effective intervention strategies. As a key implication of these results is the recognition of the complexity inherent in addressing biases that are deeply ingrained within individuals' beliefs and attitudes. Intergroup bias, particularly in contentious and polarized contexts such as vaccine hesitancy, is often rooted in complex social, psychological, and ideological factors (Scheepers, Spears, Doosje, & Manstead, 2006). While interventions like paradoxical thinking and providing contradictory information may challenge individuals' preconceived notions in the short term (Bar-Tal, & Hameiri, 2020), they may not be sufficient to produce lasting changes in attitudes and perceptions over time.

This underscores the need for more nuanced and multifaceted intervention strategies that take into account the complexity of intergroup dynamics and address the underlying factors contributing to bias (Crisp, & Beck, 2005). The findings of this study emphasize the importance of critically evaluating the efficacy of intervention methods in addressing intergroup bias, especially in contentious and polarized contexts like vaccine hesitancy. While interventions like paradoxical thinking and providing contradictory information may offer initial promise, their limitations underscore the need for continued exploration and refinement of intervention approaches. This includes exploring alternative intervention methods, integrating interventions into broader frameworks, and considering the dynamic interplay between contextual factors and intervention effectiveness.

5.4 Educational Implications

While the findings of this study did not reveal significant long-lasting effects of paradoxical thinking and providing contradictory information interventions in decreasing intergroup bias against vaccine-hesitant individuals, it is imperative to recognize the potential value of these intervention methods within the field of education. Although these interventions may not be standalone solutions for effecting meaningful change in attitudes over the long term, they can offer valuable insights and opportunities for integration into educational practices, fostering a more inclusive and empathetic learning environment.

One of the key implications of this study for education is the importance of integrating intervention methods for addressing intergroup bias into broader educational frameworks. Given the complex and multifaceted nature of intergroup bias, a sustained approach that combines multiple intervention methods over an extended period is essential for promoting lasting change (Zeyer, & Dillon, 2018). Paradoxical thinking and providing contradictory information interventions, while not independently effective in reducing bias over the long term, can be integrated into lesson planning, material design, and pedagogical approaches to enhance their impact.

Incorporating these interventions into educational practices can provide students with opportunities to critically examine their own biases and assumptions, fostering a deeper understanding of the complexities of intergroup dynamics. By embedding these interventions into the curriculum, educators can create a structured and supportive environment for addressing bias and promoting empathy and understanding among students (Zeyer, & Dillon, 2018). Paradoxical thinking and providing contradictory information interventions can serve as catalysts for facilitating ongoing discussions and critical reflection among students (Chabrak, & Craig, 2013).

By presenting students with diverse perspectives and challenging their preconceived notions, these interventions can encourage students to engage in open and respectful dialogue about contentious issues such as vaccine hesitancy (Chabrak, & Craig, 2013). Moreover, engaging in critical reflection can help students develop the skills and dispositions necessary for navigating complex social dynamics and promoting constructive intergroup relations (Chabrak, & Craig, 2013). By creating opportunities for students to critically examine their own beliefs and engage with diverse viewpoints, educators can empower students to become active participants in building a more inclusive.

Another important implication of this study for education is the value of exposing students to diverse perspectives to foster empathy and understanding (Deliman, 2019). Paradoxical thinking and providing contradictory information interventions can serve as tools for exposing students to a range of viewpoints on controversial issues, encouraging them to consider alternative perspectives and empathize with individuals whose beliefs differ from their own (Deliman, 2019). By broadening students' exposure to diverse perspectives via these intervention methods as pedagogical tools, educators can help cultivate a more inclusive and tolerant learning environment that promotes mutual respect and understanding among students. Additionally, exposure to diverse perspectives can help students develop the critical thinking skills necessary for evaluating information critically and making informed decisions in an increasingly complex world (Deliman, 2019).

At its core, education is about more than just imparting knowledge; it is also about fostering empathy and understanding among students. Paradoxical thinking and providing contradictory information interventions offer valuable opportunities for educators to engage students in activities that promote empathy and understanding across ideological divides. By encouraging students to consider the perspectives of others and reflect on their own biases, these interventions can help cultivate a more empathetic and compassionate generation of learners who are better equipped to navigate the complexities of a diverse and interconnected world (Deliman, 2019). By fostering empathy and understanding among students, educators can help create a more inclusive and harmonious society where individuals from diverse backgrounds can come together to address shared challenges and build a better future for all.

5.5 Contextual Considerations

A notable observation that must be priced into interpretation of the result of this study is that in the second phase of data collection was conducted during a period when the pandemic had begun to subside and the associated disruptions to daily life were diminishing, a pivotal shift in context occurred, influencing the relevance and impact of vaccination-related discussions. Unlike the initial phase, which unfolded amidst the heightened urgency and uncertainty of the pandemic's peak, the subsequent phase witnessed a recalibration of public discourse as the immediate crisis decreased.

Consequently, the immediacy of vaccination-related concerns waned, with individuals potentially experiencing a reduced sense of urgency or personal relevance regarding vaccine-related discussions. This shift in context likely influenced the perceived importance of vaccination and therefore in part might have affected the interventions effectivity. As such, the efficacy of these interventions in mediating intergroup bias against vaccine-hesitant individuals may have been compromised by the evolving landscape of public discourse and the decreasing prominence of vaccination-related concerns. Thus, it becomes imperative to consider the dynamic interplay between contextual factors and

intervention effectiveness, particularly in rapidly changing socio-political environments, to ensure the relevance and impact of intervention strategies aimed at addressing intergroup bias in contentious issues such as vaccine hesitancy.

5.6 Future Research Directions

The present study has provided insights into the long-term effectiveness of paradoxical thinking and providing contradictory information interventions in decreasing intergroup bias against vaccine-hesitant individuals. However, several avenues for future research remain unexplored. Potential directions for future studies to build upon the findings of this research and contribute further to the understanding of intergroup bias and strategies to decrease it, are as follows.

Qualitative data could potentially provide another valuable angle in understanding the dynamics of such interventions and their efficiency in terms of reducing intergroup bias or attitude change. Such longitudinal studies of these interventions that employ mixed-method research design could potentially present a set of pragmatic tools for educators to resolve conflicts in education settings, challenge intergroup bias, and promote meaningful grounds for empathy and social inclusion. Qualitative methods, such as in-depth interviews, focus groups, and participant observations, can offer another dimension into understanding participants' lived experiences and the contextual factors that shape their responses to intervention strategies (Tracy, 2019).

By capturing participants' narratives, researchers can explore the nuances of their attitudes, beliefs, and behaviors related to intergroup bias and intervention effectiveness. Qualitative data can provide depth and context to quantitative findings, illuminating the underlying processes through which interventions impact intergroup dynamics (Tracy, 2019). In addition to quantitative research methods, future studies should consider employing mixed methods approaches to gain a more comprehensive and holistic understanding of the effectiveness of intervention methods in decreasing intergroup bias. By integrating qualitative

data collection and analysis alongside quantitative measures, researchers can access richer insights into participants' experiences, perceptions, and underlying mechanisms driving behavioral change.

Furthermore, the lack of significant long-term effects observed in this study underscores the need for further research into the combination of intervention methods over extended durations. Future studies could explore the integration of paradoxical thinking and providing contradictory information interventions with other approaches, such as intergroup contact, perspective-taking exercises, and narrative-based interventions. By examining the effects of these strategies and their sustained impact on attitudes and behaviors, educators and researchers can gain deeper insights into effective methods for decreasing intergroup bias in educational settings.

Future studies may consider employing sequential explanatory or exploratory mixed methods designs to sequentially collect, analyze, and integrate quantitative and qualitative data. In such research designs, initial collection and analysis of quantitative data to identify patterns or trends, is followed by qualitative data collection to explore underlying mechanisms or contextual factors in greater depth (Tracy, 2019). The integration of mixed methods approaches holds promise for advancing our understanding of intervention strategies for decreasing intergroup bias. By combining quantitative and qualitative methods, researchers can access richer insights into participants' experiences, perceptions, and underlying mechanisms driving behavioral change especially in the context matter of this study.

Another avenue for further investigation is inclusion of neural measurements that has previously been employed to explore the effectiveness of such intervention methods in reduction of intergroup bias (Hautala et al., 2022; Kluge et al., 2024), yet neural data and neuroimaging can provide another scope for understanding the potentials of these intervention methods in long term. Such studies address the current research gap that this study aspires to fill to some extent but with a wider and different scope. Overall, the study's findings underscore the importance of critically evaluating the efficacy of intervention methods in addressing

intergroup bias, especially in contexts as contentious as vaccine hesitancy. Despite the lack of significant effects observed in this study, continued exploration and refinement of intervention approaches remain imperative for fostering inclusive environments and promoting positive intergroup relations in the face of complex societal challenges.

5.7 Limitations

The present study contributes some insights into the effectiveness of intervention methods, such as paradoxical thinking and providing contradictory information, in decreasing intergroup bias against vaccine-hesitant individuals. However, several limitations should be considered when interpreting the findings and drawing conclusions of this study. One of the primary limitations of this study is the relatively small sample size, which may restrict the generalizability of the findings to broader populations (Panter, & Sterba, 2011).

The sample comprised a specific demographic group recruited from higher education institutions in Finland, with limited representation of diverse sociocultural backgrounds and perspectives (Sares, 1998). As a result, the findings may not fully capture the variability of attitudes and behaviors related to vaccine hesitancy across different populations. Future research should aim to include larger and more diverse samples to enhance the external validity of the findings and facilitate cross-cultural comparisons (Panter, & Sterba, 2011).

Another limitation of the study is the relatively short duration of the intervention period due to practical scarcity of resources in the scope of this study. The interventions were implemented over a limited timeframe, which may not have allowed sufficient time to observe long-term effects accurately. Intergroup biases and attitudes toward vaccination are complex constructs that can be influenced by various factors and may require extended intervention periods to produce meaningful and enduring changes. Future studies should consider implementing interventions over more extended durations to capture the sustained effects and dynamics of intervention strategies.

The study may not have fully accounted for all contextual factors that could influence the effectiveness of the interventions. Sociopolitical contexts, media narratives, and public health messaging surrounding vaccination can significantly impact individuals' attitudes and behaviors (Sares, 1998). However, these contextual factors were not systematically explored or accounted for in the study design. Future research should consider incorporating measures to assess contextual influences and adjusting intervention strategies accordingly to enhance their effectiveness in real-world settings (Sares, 1998). Addressing these limitations in future research endeavors will be crucial for advancing our understanding of effective intervention strategies for decreasing intergroup bias. By expanding sample sizes, extending intervention durations and considering contextual factors contributions to the development of more robust and sustainable interventions aimed at fostering positive intergroup relations and public health outcomes are more likely.

5.8 Conclusion

The findings of this study carry significant implications for both future research projects and practical applications. Firstly, they shed light on the intricate and multifaceted nature of addressing intergroup bias, particularly within the context of contentious societal issues such as vaccine hesitancy. The observed lack of substantial, enduring effects underscores the inherent complexity in decreasing biases deeply ingrained within individuals' beliefs and attitudes. This complexity necessitates a nuanced and comprehensive approach that acknowledges the diverse array of factors influencing intergroup dynamics and bias formation.

Moreover, the study's outcomes underscore the critical importance of rigorously evaluating the effectiveness of intervention methods aimed at addressing intergroup bias. While interventions such as paradoxical thinking and providing contradictory information may provide positive results in immediate or short-term contexts, their limited long-term impact underscores the need for more robust and sustained approaches. This suggests the imperative for researchers and

practitioners to engage in continuous refinement and innovation of intervention strategies, informed by empirical evidence and a deep understanding of underlying psychological mechanisms.

Furthermore, the study's findings call attention to the need for interdisciplinary collaboration and integration of diverse perspectives in the development and implementation of intervention approaches. Addressing intergroup bias requires a holistic understanding of sociocultural, psychological, and environmental factors influencing bias formation and perpetuation. As such, future research endeavors should aim to incorporate insights from fields such as sociology, anthropology, communication studies, and public health to develop more comprehensive and contextually sensitive intervention strategies.

In addition, the study underscores the importance of considering the dynamic nature of societal discourse and the evolving landscape of public opinion. Rapid changes in socio-political environments can significantly impact the effectiveness of intervention methods, necessitating ongoing monitoring and adaptation of strategies to remain relevant and impactful. Researchers and practitioners should remain attuned to shifting societal norms, attitudes, and beliefs, and be prepared to adjust intervention approaches accordingly.

Overall, the findings of this study underscore the complexity and importance of addressing intergroup bias, particularly in the context of contentious societal issues. By embracing a nuanced understanding of bias formation and perpetuation and employing comprehensive, evidence-based intervention strategies, practitioners can contribute to fostering more inclusive and equitable societies.

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