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The influence of Survivor stories and a virtual reality representation of a residential school on reconciliation in Canada

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Indigenous Peoples in Canada have endured many genocidal efforts, such as residential schools. Across the country, initiatives to promote critical historical education about residential schools are underway, ranging in duration, content, and immersion. In this study, we tested whether a promising high-immersion approach, a virtual reality residential school, could improve non-Indigenous participants' attitudes and feelings toward Indigenous people. We compared the effects of the virtual residential school to a transcript condition, in which participants read the transcripts of the narration that accompanied the virtual residential school, and an empty control condition. The study had three time points: Baseline (N = 241), intervention (N = 241), and follow-up (N = 132). Immediately following the intervention, what participants learned about the residential school, both through virtual reality and reading the transcripts, increased non-Indigenous participants' empathy, political solidarity, and outgroup warmth for Indigenous people, relative to the control. The virtual reality school, but not transcripts, also increased privity relative to the control. These effects decreased over time. In summary, though both written and virtual reality forms of critical historical education were effective in the short term, to maintain the long-term effects of critical historical education, ongoing or recurring education is likely necessary. These results extend the virtual reality literature to unstudied concepts (political solidarity, privity) and critical historical education literature to a new form of media (virtual reality). We discuss the findings in relation to literature on critical historical education and virtual reality as well as outline future directions.

KEYWORDS

residential schools, Canada, virtual reality, critical historical education, attitudes, empathy

1 Introduction

Indigenous Peoples have lived since time immemorial in what is now known as Canada. Before becoming a united country, the bodies governing what was to become Canada perpetrated a series of policies and tactics designed to destroy Indigenous cultures. One prominent effort was residential schools, which operated in different forms from 1828 onward but were organized more systematically to "get rid of the Indian problem" from the early 1880s until 1997 (Nunavut Tunngavik, 2019; Facing History Ourselves: Canada, 2020; National Centre for Truth Reconciliation, 2023). At these typically church-run schools, students were physically, emotionally, and sexually abused by the adults in charge (Truth and Reconciliation Commission of Canada, 2015). The abuse was intense, ranging from an electric chair at the St. Anne's Residential School (Barrera, 2017) to nutrition experiments carried out at residential schools in northern Manitoba, where researchers documented the impacts of starvation (Mosby, 2013). Thousands of Indigenous children died at these schools, some buried in unmarked graves, never to return home (Gilmore, 2021). Residential schools and ongoing settler colonial efforts in Canada have been recognized in scholarship (Woolford, 2015; Starblanket, 2018; MacDonald, 2019), public commissions and inquiries (National Inquiry into Missing and Murdered Women and Girls, 2019), and in the Canadian House of Commons (Raycroft, 2022) as genocide.

Though Indigenous people across the country have been resilient in the face of persistent and violent attempts to destroy their diverse cultures, residential schools nonetheless have ongoing impacts. For example, both Survivors of residential schools (henceforth referred to as Survivors) and their descendants experience long-term and intergenerational trauma, including elevated mental health issues like depression and suicide (Bombay et al., 2011, 2014; Elias et al., 2012). This past harm has a clear impact on the present experience; that is, there is privity (Starzyk and Ross, 2008).

In response to decades of Survivor advocacy, including class action lawsuits, in 2008, the federal government of Canada issued an official apology after a 2007 legal settlement for the schools (Government of Canada, 2008). As part of this settlement, the Canadian government, churches involved in the schools, Survivors, and representatives from Indigenous nations in Canada created the Truth and Reconciliation Commission of Canada (TRC; National Centre for Truth and Reconciliation, n.d.). A key goal of the Commission was to inform people in and outside Canada about residential schools (National Centre for Truth and Reconciliation, n.d.). A large part of this process involved collecting statements from Survivors across the country to document the harms of residential schools (National Centre for Truth and Reconciliation, n.d.). Ultimately, in 2015, after years of collecting statements, the Truth and Reconciliation Commission of Canada released its multi-volume report along with 94 Calls to Action (National Centre for Truth and Reconciliation, n.d.). Residential schools have been part of public discourse ever since.

Despite increasing awareness of the past and ongoing harms of residential schools since the release of the TRC's reports and Calls to Action, awareness of residential schools has been lower than one might expect. According to national polls, the proportion of non-Indigenous people in Canada who "heard or read anything about residential schools" was 65% in 2022. Thankfully, that number increased to 90% in Canadian Reconciliation Barometer (2022, 2023). Such "awareness," of course, likely does not represent deeper knowing. For this reason, it is vital to educate about these institutions.

To help address this gap, as part of a larger team, which Survivors led, we created a virtual representation of Fort Alexander Residential School (Woolford et al., 2022). With this platform to deliver critical historical education, we wondered how effective it would be in comparison to other, less technological alternatives. Here, we describe a study that answered this question, by assessing the effects of the virtual residential school on empathy, privity, political solidarity, and outgroup warmth, relative to a written transcript or no intervention.

1.1 Critical historical education

Rather than highlight individual instances of racism, critical historical education focuses on racism from an intergroup perspective in historical context, often explaining how it is enduring and systemic (Nelson et al., 2012; Bonam et al., 2019; Neufeld et al., 2021). We focused on residential schools in Canada (see also Neufeld et al., 2021; Efimoff and Starzyk, 2023).

Critical historical education is effective. People who know more about history in this way are more likely to acknowledge racism and support anti-racist policies (Nelson et al., 2012; Salter and Adams, 2016; Bonam et al., 2019; Zell and Lesick, 2022).

Previously, some critical historical education interventions have also improved non-Indigenous peoples' knowledge about, as well as both attitudes and feelings toward, Indigenous people. Hill and Augoustinos (2001), who studied the effects of a multi-day workshop with a critical historical education piece about Indigenous peoples in Australia, found non-Indigenous participants gained knowledge of Indigenous cultures and histories and scored lower on measures of racism. As well, Neufeld et al. (2021), who either measured or manipulated critical historical knowledge (via the length or processing of a written passage) in five studies, found non-Indigenous participants who knew more reported empathy toward Indigenous people and were more likely to believe that residential schools continue to cause harm. Finally, in two experimental longitudinal studies, Efimoff and Starzyk (2023) found brief critical historical knowledge videos positively improved non-Indigenous participants' knowledge, attitudes, feelings, and behaviors toward Indigenous people.

A gap in this literature is that we know little about the benefits of the specific *media* of critical historical education. In most existing studies, critical historical education was delivered as text; less often, audio or video. More immersive media, such as virtual reality, might yield even greater results. To our knowledge, this study is the

first to directly compare more and less immersive forms of critical historical education.

1.2 Virtual reality

Virtual reality is an immersive technology that enables people to enter a virtual world and act within it, typically from a first-person perspective (Gehlbach et al., 2015; Abbas et al., 2023), rather than a third-person view as is common in television and movies. Virtual reality technology is immersive because it mimics real-life sensorimotor experiences (e.g., it is possible to see things in 360 degrees). People may therefore feel as if they are *actually* in the environment portrayed in virtual reality (Barreda-Ángeles et al., 2020).

Within psychological research, there is much interest in virtual reality because the platform is flexible and affords new opportunities. One may better understand basic processes, such as perception, memory, problem-solving, mental imagery, attention (Gaggioli, 2001), habituation (Li and Lee, 2023), and affect, including empathy (Hapuarachchi et al., 2023), by studying how people interact in virtual reality. One may also design experimental studies in virtual reality that are not possible in real life, such as ones that rigorously test which characteristics of a mental health coach are most effective (Wei et al., 2023).

Such research is important because virtual reality experiences can impact real life. For example, interacting with people in a virtual space can improve psychological outcomes. Social interactions in virtual reality can make people feel less lonely and socially anxious (Kenyon et al., 2023). Interacting with mental health therapists via virtual reality can also decrease anxiety and other psychiatric symptoms. For example, for exposure-based interventions for anxiety disorders, virtual reality offers a convenient, cost-effective, and safe way to treat phobias (Maples-Keller et al., 2017). Virtual reality can also be used to improve everyday skills. For example, people who first speak to a supportive audience in virtual reality then give better talks in real life (Kroczek and Mühlberger, 2023). In social psychology, the hope is that virtual reality can also improve relationships between people, including across groups.

1.3 Virtual reality and intergroup relations

Virtual reality may improve intergroup relations because the platform provides poignant perspective-taking experiences. In virtual reality, people can stand *in the shoes* of another person and approximate others' experiences (de la Peña et al., 2010; Kalyanaraman et al., 2010; Gehlbach et al., 2015; Herrera et al., 2018; Shin, 2018; Ingram et al., 2019; Barreda-Ángeles et al., 2020; Ventura et al., 2020). Such virtual experiences are thought to affect key predictors of intergroup relations, namely empathic concern (Kalyanaraman et al., 2010; Gehlbach et al., 2015; Kleinsmith et al., 2015; Sundar et al., 2017; Herrera et al., 2018; Jones and Sommer, 2018; Ingram et al., 2019; van Damme et al., 2019; Barreda-Ángeles et al., 2020; Ventura et al., 2020; Martingano et al., 2021, 2022) and outgroup warmth (Hasler et al., 2014; Chen et al., 2021a,b; Chen and Ibasco, 2023; Tassinari et al., 2023; Branham, 2024). We broadened our focus to also include privity and political solidarity. In doing so, we have diversified the understanding of the effects of virtual reality and the nomological network among the outcome variables themselves. Next, we define these variables and review related research.

1.3.1 Empathy

People tend to call a few things empathy. Some describe empathy as "feeling as another feels" (Batson, 2023, p. 2) or "seeing the world through another person's eyes" (Batson, 2023, p. 2). We instead both conceptualized and measured empathy as feeling *for* others (Batson, 2023). In this view, empathy is an "other-oriented emotion elicited by and congruent with the perceived welfare of someone in need" (Batson, 2018, p. 29) or, said otherwise, "an emotional step in the process of caring for another" (Batson, 2023, p. 2). Thus, in referring to "empathy" throughout, we refer to "empathic concern" (Batson, 2023). People who feel empathic concern for another are, for example, likely to feel softhearted and warm toward them, and quite literally: these are two of the six adjectives in Batson's Empathy Index (Batson, 2023). For a review of how empathy differs from related constructs and personal distress, see Batson (2023).

Empathy matters. According to the empathy-altruism hypothesis, people are motivated to help others when they feel empathic concern, for altruistic reasons. Much debate has centered on whether helping behavior is ever truly altruistic, but research unequivocally demonstrates empathy has motivational and behavioral consequences, some of which provide intergroup benefits (Batson, 2023). For example, when people feel empathy, they are more likely to have positive attitudes (Shechtman and Basheer, 2005; Rosler et al., 2017) and less implicit bias (Whitford and Emerson, 2019) toward and be more likely to help outgroup members (Toi and Batson, 1982; Brown and Cehajić, 2008; Starzyk and Ross, 2008; Batson and Ahmad, 2009).

Can virtual reality interactions increase empathy? Creators of virtual reality seem to think so, calling it a "canvas for storytelling" and the "ultimate empathy machine" (Milk, 2015). Researchers (e.g., Barreda-Ángeles et al., 2020) also agree. Some studies support these ideas (Kalyanaraman et al., 2010; Kleinsmith et al., 2015; Sundar et al., 2017; Herrera et al., 2018; Ingram et al., 2019; Ventura et al., 2020; Martingano et al., 2022) and others even go further, demonstrating that virtual reality outperforms less immersive media in causing people to feel empathy toward an outgroup (Herrera et al., 2018). However, others report that virtual reality does not increase empathy (Gehlbach et al., 2015; Jones and Sommer, 2018; van Damme et al., 2019; Barreda-Ángeles et al., 2020) or work better than less immersive approaches (Herrera et al., 2018; Jones and Sommer, 2018; Martingano et al., 2021, 2022). To help resolve this inconsistency, Martingano et al. (2021) synthesized the findings of 43 studies involving 5,644 participants via meta-analysis. They found that virtual reality increased emotional but not cognitive empathy, suggesting that virtual reality may not elicit effortful cognitive processing, which may be necessary for perspective-taking or cognitive empathy. Martingano et al. (2021) also found that virtual reality and reading about others' experiences were equally effective in eliciting empathy. Their answers to the

question we pose would therefore be: Yes, virtual reality can elicit empathic concern for others, but perhaps no better than other approaches, and the effects of virtual reality are likely lower for perspective-taking.

Given the very real benefit of being able to document history in a more immersive way and the potential for virtual reality to increase empathy, we began to develop a virtual residential school. We thought this school would also increase privity, political solidarity, and outgroup warmth, which we describe now.

1.3.2 Privity

Privity, a sense that past harm continues to cause suffering in the present, is an excellent predictor of support for reparations (Starzyk and Ross, 2008; Imhoff et al., 2012; Banfield et al., 2014; Starzyk et al., 2019). Building on the work of Matsuda (1987) in law, Starzyk and Ross (2008) first used the term in psychology while studying support for reparations for the destruction of a long-standing Black community in Canada called Africville, mistreated historically and relocated unjustly (Clairmont and Magill, 1999). Participants read about the destruction, but the passages varied in whether the relocation still caused participants to suffer and whether the land was still available. Students who learned that the land was still available were more likely to support reparations if former residents continued to suffer because of the harm—there was privity. People are more likely to perceive privity if the harm seems or is, in fact, recent (Burns and Granz, 2022) or if they are more politically liberal (Banfield et al., 2014). Particularly relevant to this study, critical historical education links past harm and present suffering (Neufeld et al., 2021; Efimoff and Starzyk, 2023). If people perceive privity, they are also likely to feel sympathy (Starzyk and Ross, 2008), a component of empathy, and political solidarity (Starzyk et al., 2019), both of which predict support for outgroups. Given all this, we also expected a virtual reality representation of critical historical knowledge to cause people to perceive more privity. To our knowledge, this is the first study to assess the impact of virtual reality on privity.

1.3.3 Political solidarity

Neufeld et al. (2019) conceptualized political solidarity as "the degree to which a person 'stands with' a minority outgroup and their cause and is committed to working alongside them to achieve the desired social change" (Neufeld et al., 2019, p. 728). Here, "minority" refers to a social group with low social status, power, or privilege (Tajfel, 1981; Van Zomeren et al., 2008; see also Seyranian et al., 2008). Intraminority solidarity is a special case of solidarity; it occurs when members of one minority group feel solidarity with another minority group (Craig and Richeson, 2012, 2014, 2016).

Neufeld et al. (2019) also developed the Political Solidarity Measure, which includes three subscales that assess allyship, cause connection, and support for social change with the outgroup. In evaluating convergent and discriminant validity, with participants living in Canada and issues typically of more concern to left-leaning people (i.e., gender income equality, Black Lives Matter, Missing and Murdered Indigenous Women and Girls, reconciliation, and Syrian refugees), Neufeld et al. found their Political Solidarity Measure correlated positively with compassion for strangers, social justice orientation, particularly attitudes and intentions; negatively with social dominance orientation, zero-sum competition, and modern racism; and not at all with impression management.

Starzyk et al. (2019) also clarified the causes and consequences of political solidarity. First, they found political solidarity may occur when people feel a sense of inclusive victim consciousness or perceive outgroup suffering. Second, they found that people with a history of collective victimhood, such as members of racial/ethnic minority (vs. majority) groups, are more likely to have these feelings (see also Cortland et al., 2017). Finally, and consistent with Neufeld et al. (2019), they demonstrated that people who report political solidarity are more likely to support reparations for an outgroup; in this case, Indigenous people in Canada.

There are many ways to increase political solidarity. Some propose that changing people's structural and/or historical attributions for racism may be effective, at least to increase intraminority solidarity, because such reframing leads people to perceive their and other groups' experiences as more similar and perceptions of similarity drive solidarity (Burson and Godfrey, 2020). Such reframing may be one mechanism in critical historical education too, at least for those who identify as belonging to a group that has experienced harm. A critical historical education can, however, cause even those who belong to a privileged group, by racial/ethnic membership standards (e.g., White, undergraduate students born in Canada), to feel more political solidarity with Indigenous people (Efimoff and Starzyk, 2023). Now, a field of study is emerging examining the effects of virtual reality on empathy and solidarity, the proponents of which believe the platform can increase both (e.g., Wang et al., 2022). Another outcome like political solidarity, with a simpler conceptualization and operationalization, but a longer history in intergroup relations, is outgroup warmth.

1.3.4 Outgroup warmth

We studied how favorably or unfavorably participants felt toward Indigenous people, using a one-item thermometer scale touted for being a quick and global indicator of attitudes toward a group (Sears, 1988; Stangor et al., 1991; Haddock et al., 1993; but also see Esses et al., 1993). Popular since the 1990s, participants likely construe this scale as an indicator of warmth because of the thermometer analogy (i.e., scores range from 0° to 100°) and endpoint anchors (i.e., NEGATIVE 0° extremely unfavorable; POSITIVE 100° extremely favorable).

Outgroup warmth is distinct from empathic concern or other descriptions of empathy, though, of course, people are more likely to feel warm toward groups which they experience empathic concern for. In general, they are also more likely to have "feelings" toward the group, as Haddock et al. (1993) found, perhaps in part because of the instructions, which ask participants to consider how they "feel" toward the group.

Outgroup warmth is also distinct from political solidarity, though the two tend to correlate positively and highly (Neufeld et al., 2019). Likely, people tend to feel warmly toward outgroups that they feel political solidarity with.

Like measures of empathy, several projects have assessed the effects of virtual reality on outgroup warmth (Hasler et al., 2014;

Chen et al., 2021a,b; Chen and Ibasco, 2023; Tassinari et al., 2023; Branham, 2024). Some indicate that virtual reality experiences increase feeling thermometer scores (Chen et al., 2021b; Chen and Ibasco, 2023). We expected to replicate this.

2 The current study

In this study, we brought together critical historical education, virtual reality, and intergroup relations, using a longitudinal design. We investigated the impact of a virtual reality residential school on participants' intergroup attitudes and feelings, including empathy, privity, political solidarity, and outgroup warmth over three times (Time 1: Baseline; Time 2: Intervention; Time 3: Follow-up). Further, we compared the impacts of this virtual residential school to a transcript condition, in which participants read the narrative that accompanied the virtual residential school, as well as an empty control condition. The virtual school is a form of critical historical education because it highlights the systemic and historic racism in Canadian history. Additionally, we tested whether the virtual residential school caused significant discomfort so that we could understand the emotional impacts it had on participants and whether any changes to content were needed before publicly launching the virtual school.

Previously, Woolford et al. (2022) completed a qualitative study of this virtual residential school with 20 students from the same university that we drew our sample from. After navigating the virtual residential school for 15 min, these students completed a semi-structured interview lasting 1 h. In general, participants engaged thoughtfully with the virtual residential school. Participants felt as if they "were there," though most also understood their experience was not the same as the Survivors.' All but one said they felt more empathy toward Survivors after navigating the virtual residential school, perhaps because the stories were memorable, and students' degree of recall was excellent. Though virtual reality is often associated with gaming, most participants did not think of the virtual world as a game. The team purposefully designed the school to not be like a game to not trivialize Survivors' experiences—and it is one reason why we put the school on "rails," meaning participants went throughout it in a set order. Finally, many participants spoke about their hopes for healing and that the experience increased or highlighted their interest in reconciliation. Please see Woolford et al. (2022) for more history about this project and images of the school.

The current study builds on Woolford et al.'s (2022) qualitative project. Our longitudinal, multidisciplinary, and Survivor-informed quantitative project fills several gaps, because of the diverse expertise of our team. To our knowledge, no prior research in social psychology has investigated the effects of critical historical education, using virtual reality and text, on empathy, privity, political solidarity, and outgroup warmth toward Indigenous people. In the field of human-computer interaction, which intersects with psychology, this study examines the effects of an increasingly popular technology on several psychological variables. In archival studies, this demonstrates how one may translate records, such as testimony, to educate about history while also effecting change in people, as museums often hope to do. Of course, our project also adds to the growing research on virtual reality, most of which has no longitudinal component (Martingano et al., 2021).

2.1 Hypotheses

We formulated and pre-registered our hypotheses based on the reviewed literature (https://aspredicted.org/GAY_BBL). We report only two hypotheses because we had to remove a condition, and the corresponding hypotheses, due to poor internal validity (see Online Supplementary material [OSM], Supplement A, for details):

1. At time 2 (intervention), participants in the virtual reality condition would score highest on empathy, privity, political solidarity, and outgroup warmth.
2. At time 2 (intervention), compared to control participants, those in the transcript condition would score significantly higher on empathy, privity, political solidarity, and outgroup warmth.

We also explored whether the effects of condition persisted over time for empathy, privity, political solidarity, and outgroup warmth. We considered they may (a) endure, (b) decline, or (c) return to baseline levels. Finally, we explored the effects of condition on discomfort scores.

3 Method

In this manuscript, we describe a mixed 3 between-participants (Condition: Empty Control; Transcript; Virtual Reality) x 3 within-participants (Time: Time 1: Baseline; Time 2: Intervention; Time 3: Follow-up) experimental design.

3.1 Recruitment

Participants were students enrolled in Introduction to Psychology at the University of Manitoba and received partial course credit toward the research participation component of the course.

Participants could independently sign up for and complete Time 1 (Baseline) online, which was part of a larger study open to all students.

Time 2 (Intervention) participation was limited to those who had completed the Time 1 (Baseline) study, lived in Canada for at least 5 years, were non-Indigenous, and received a survey invitation. We emailed eligible participants an invitation to one of three randomly determined experimental conditions: empty control, transcript, and virtual reality. All invitations stated the same study purpose, but some of the noted study details differed. The control and transcript conditions were online studies, whereas the virtual reality condition was in-person. The control condition was estimated to take 15 min and was worth 1 credit, whereas the transcript and virtual reality conditions were estimated to take 45 min and were worth 2 credits. The invitations for the transcript and virtual reality conditions noted that the study would involve descriptions of abuse. The virtual reality invitation additionally indicated that the study would involve virtual reality, which could cause nausea.

TABLE 1 Participant ethnicity.

Ethnicity	Times 1 and 2		Time 3	
	n	%	*n*	%
White	143	59	79	60
Filipino	40	17	25	19
South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)	25	10	11	8
Black	11	5	5	4
Chinese	13	5	7	5
Korean	6	2	5	4
Latin American	5	2	4	3
Southeast Asian (e.g., Vietnamese, Cambodian, Laotian, Thai, etc.)	4	2	3	2
Arab	1	0	0	0
Japanese	1	0	0	0
West Asian (e.g., Iranian, Afghan, etc.)	0	0	0	0

The order of categories is descending, based on Time 1 (Baseline).

Only participants who completed Time 2 (Intervention) could participate in Time 3 (Follow-up), which was an online study.

3.2 Participants

Our initial sample included 247 participants at Time 1 (Baseline) and 2 and 134 at Time 3 (Follow-up), because of attrition. From this sample, as planned, we excluded three participants who identified as Indigenous because we wanted to gauge how distressing the experience was for non-Indigenous participants first. Also, as planned, we excluded four participants who had lived in Canada for <5 years. Again, as planned, we also inspected the data for extreme outliers but ultimately decided not to remove outliers (OSM Supplementary material B). We pre-registered running analyses on an additional dependent variable assessing behavioral intentions, but due to poor psychometric properties, we did not (see OSM, Supplementary Tables S1–S10).

Our final sample at Time 1 (Baseline) and 2 included 241 non-Indigenous participants, most of whom were female (55% female, 44% male, < 1% non-binary) and White (59%; see Table 1). On average, participants were 19.81 years old (SD = 3.75). At Time 3 (Follow-up), 132 non-Indigenous participants remained and, as the initial sample was, were mostly female (61% female, 38% male, < 1% non-binary) and White (60%; see Table 1) and of a similar average age (M = 19.48, SD = 3.20).

3.3 Procedure

At each time, participants gave informed consent before they completed the dependent measures.

At Time 1 (Baseline), participants completed the dependent measures online.

At Time 2 (Intervention), we emailed participants to invite them to sign up for one of three randomly determined experimental conditions. Control condition participants completed the dependent measures online, whereas participants in other conditions attended individual laboratory sessions and completed the dependent measures after the experimental manipulation. In the virtual reality condition, a research assistant provided participants with a brief orientation to the virtual reality experience and equipment. Participants learned that the tour of the virtual residential school would be "on rails," meaning it would follow a predetermined sequence; although the school has the capabilities for users to explore in any manner they wish, we disabled that feature to maximize experimental control and to avoid the possibility that the virtual residential school would feel game-like. Participants also learned that they could stop or pause the tour at any time, such as if they felt distressed or nauseous: With the push of a button, they would be transported to a virtual "safe space," a calming beach scene and sounds. Following the orientation, participants toured through the virtual rendering of the Fort Alexander Residential School. We randomly assigned participants to arrive at the virtual school in one of three ways (i.e., by foot, car, or boat), reflecting how the Survivors had arrived. Then they toured the virtual residential school. While arriving at and in the virtual residential school, participants listened to Survivors' audio narration. In the transcript condition, participants did not experience the virtual residential school. Instead, they read transcripts of the Survivors' narration of the virtual residential school (see OSM Supplementary material D for a sample or contact for a complete transcript).

Finally, at Time 3 (Follow-up), participants completed the same dependent measures as in Time 1 (Baseline) and Time 2 (Intervention) online.

4 Materials

4.1 Virtual school and equipment

The development of the virtual school was Survivor-led, multi-disciplinary, and labor-intensive. The virtual school was based on Fort Alexander Residential School and created with Survivors who attended that school. See Woolford et al. (2022) for a detailed description of the creation of the school.

Participants had an Oculus Rift head-mounted display consisting of goggles and earpieces (see Figure 1). We positioned participants one meter from the sensors so that their viewing experience was clear (Vision, n.d.). The Oculus Rift had a resolution of 2,160 x 1,200 and a refresh rate of 90 Hz (Binstock, 2015) with a 110-degree field of view. Participants could move their heads to get a 360-degree view of the school.

Additionally, Oculus Rift features integrated audio, meaning sounds from the virtual world are placed in three-dimensional space, resulting in participants feeling that sounds in the virtual world come from "beside" or from "above." In each room, participants heard Survivors of the Fort Alexander Residential School describe their experiences in that area of the school. The Survivors described their experiences in the institution, including

FIGURE 1
Photo of a researcher using the virtual reality equipment.

positive memories as well as hardships such as physical and emotional abuse and loss of familial support.

Participants also had an Oculus Rift Touch Controller, which they could use to start or pause the tour (i.e., be transported to the safe space).

4.2 Dependent measures

Except where noted, we computed a composite average score for all multi-item measures if participants responded to at least approximately 80% of the items making up that measure. The measures appeared in the order below, on separate pages. Within each measure, items appeared in random order.

4.2.1 Empathy

We used Batson's (1987, 2023) self-report 6-item measure of empathic concern, an "other-oriented emotion elicited by and congruent with the perceived welfare of someone in need" (Batson, 2018, p. 29). Participants rated how much they felt six feelings (e.g., softhearted) toward "Indigenous Peoples," by selecting "not at all" (coded 1), "slightly" (2), "somewhat" (3), "very much" (4), or "extremely" (5). One factor (Toi and Batson, 1982; Batson, 2023) represents these commonly used items (e.g., Batson, 1987; Batson et al., 1988, 1995, 1997; Chen et al., 2021a; Gubler et al., 2022). Consistent with this, we found the items were highly internally consistent, across all three waves, as indexed by "Cronbach's" alpha ($\alpha_{T1} = .94, \alpha_{T2} = .93, \alpha_{T3} = .93$). Note we have put "Cronbach's" in quotes because he did not develop this popular measure of internal consistency, as is commonly thought, but instead popularized it in a seminal publication (i.e., Cronbach, 1951). Cronbach himself asked that his name not be associated with α (see Cho and Kim, 2015). Given our review, one would expect empathy to correlate positively with privity, political solidarity, and outgroup warmth—it did, with correlations ranging from |.55–.69| (Efimoff, 2022). In contrast, the Empathy Index correlated weakly with social desirability (Efimoff, 2022). Thus, the Empathy Index demonstrated convergent and discriminant validity.

4.2.2 Privity

We adapted Starzyk and Ross's (2008) self-report 5-item measure of privity, the extent to which people perceive a causal connection between past harm and present suffering. All items began with the prefix "Because of Residential Schools, Indigenous Peoples in Canada are still experiencing…" and ended with some form of harm (e.g., "social [relationship] harm"). Participants rated

their agreement or disagreement on a 7-point rating scale, with the options strongly disagree (coded 1), disagree (2), slightly disagree (3), neither agree nor disagree (4), slightly agree (5), agree (6), and strongly agree (7). Scores could therefore range from 1 to 7. These items were highly internally consistent ($\alpha_{T1} = .90$, $\alpha_{T2} = .87$, $\alpha_{T3} = .88$) and represented by one factor. Given that no factor analysis of this measure was previously reported, we conducted an exploratory maximum likelihood common factor analysis with a Direct Oblimin rotation (delta = 0) in SPSS (version 28.0.1.1). The factor loadings (.76–.88) and communalities (initial = .55–.68; extraction = .57–.78) were high, the scree plot indicated one factor, and the first eigenvalue was 3.60, accounting for 71.93% of the variance; all other eigenvalues were < 1.

4.2.3 Political solidarity

We used the self-report Political Solidarity Measure (Neufeld et al., 2019) to assess participants' solidarity with Indigenous Peoples in Canada. Participants rated their agreement or disagreement with nine statements, including "I feel a sense of solidarity with Indigenous Peoples," using the same response scale as for privity. Via exploratory and confirmatory analyses using separate samples and across several issues, Neufeld et al. (2019) demonstrated three correlated factors represent these items. They also demonstrated that the items are both reliable (i.e., internally consistent, appropriately stable over time) and valid (i.e., convergent, discriminant, and predictive validity). One may compute either subscale scores or a composite. The composite we computed was the average of participants' responses to all nine items. Scores could therefore range from 1 to 7. Replicating Neufeld et al. (2019), we found the items were highly internally consistent across all three waves ($\alpha_{T1} = .92$, $\alpha_{T2} = .92$, $\alpha_{T3} = .93$).

4.2.4 Outgroup warmth

We used Haddock et al. (1993; but also see Sears, 1988; Stangor et al., 1991; Esses et al., 1993) self-report Feeling Thermometer scale to assess outgroup warmth. Participants indicated how favorably they felt toward Indigenous Peoples in Canada using a rating scale from 0 to 100. Participants could indicate any number in this range, but a visual representation of the scale included the following anchors: NEGATIVE 0° extremely unfavorable, 10° very unfavorable, 20° quite unfavorable, 30° fairly unfavorable, 40° slightly unfavorable, 50° neither favorable nor unfavorable, 60° slightly favorable, 70° fairly favorable, 80° quite favorable, 90° very favorable, POSITIVE 100° extremely favorable. Though Haddock et al. (1993) framed this as a measure of attitudes, it positively correlated with affect (i.e., $r = .50$), especially among people low on right-wing authoritarianism (Altemeyer, 1981; i.e., $r = .65$). Using Cohen's (1992) effect size cut points, the Feeling Thermometer also correlated moderately to highly with stereotypes and symbolic beliefs. Though a single item, an advantage of this measure is that it is content-free and allows people to self-report their attitudes toward one or many groups quickly (Stangor et al., 1991). Now a widely used measure in intergroup studies, this measure has good test-retest reliability as well as both convergent and discriminant validity (Lolliot et al., 2015).

4.2.5 Discomfort

We used Monteith et al.'s (1993) 7-item self-report discomfort scale to measure discomfort ($\alpha_{T1} = .89$, $\alpha_{T2} = .87$, $\alpha_{T3} = .88$). Sample items include "uneasy" and "tense." Response options were the same as those for our measure of empathy. As in previous research (Monteith et al., 1993), we found these items loaded onto one factor (Direct Oblimin rotation, delta = 0; SPSS version 29.0.1.1). The factor loadings (.52–.87, with the lowest being for "threatened" and the highest being for "uneasy") and communalities (initial = .29–.68; extraction = .27–.75) were high, the scree plot indicated one factor, and the first eigenvalue was 4.26, accounting for 60.92% of the variance (all other eigenvalues were < 1). We included this measure because we wanted to establish the level of discomfort participants experienced in the virtual residential school.

5 Results

We pre-registered using latent growth curve modeling to assess the impact of condition on our dependent variables across time. The fit of all models was terrible and it became clear that latent growth curve modeling was not the appropriate model for our data. Instead, we conducted a 3 (Condition: Empty Control; Transcript; Virtual Reality) x 3 (Time: Time 1: Baseline; Time 2: Intervention; Time 3: Follow-up) repeated measures Analysis of Variance (rmANOVA).

Tests of Hypotheses 1 and 2: As per Table 3, at Time 2 (Intervention), condition significantly impacted scores on empathy (large effect size; Richardson, 2011), privity (medium effect size), solidarity (medium to large effect size), and warmth (medium to large effect size). Specifically, participants in the virtual reality condition had significantly higher scores on empathy, political solidarity, outgroup warmth, and privity than those in the control condition. Unexpectedly, though, participants' scores in the virtual reality condition were not significantly higher than those in the transcript and condition; thus, Hypothesis 1 was partially supported. In partial support of Hypothesis 2, at Time 2 (Intervention), participants in the transcript condition had significantly higher scores on empathy, political solidarity, and outgroup warmth than participants in the control condition, but their scores for privity did not significantly differ.

Exploratory test of the virtual school on discomfort: At Time 2 (Intervention), discomfort scores in the virtual reality condition did not significantly differ from those in the transcript and virtual reality conditions, meaning the virtual school did not cause distress. The pattern of results was the same at Time 3 (Follow-up).

Exploratory tests of effects of conditions over time: Scores on the dependent variables did vary across time (Table 2), typically with medium to large effect sizes, and the Condition X Time interactions were typically non-significant. For the transcript and virtual reality conditions, scores increased from Time 1 (Baseline) to Time 2 (Intervention) for empathy, privity, political solidarity, and outgroup warmth (Table 3). For the transcript and virtual reality conditions, scores on empathy, privity, political solidarity, and outgroup warmth decreased from Time 2 (Intervention) to Time 3 (Follow-up), often such that Time 3 (Follow-up) scores were not significantly different than

10.3389/frsps.2024.1346101

TABLE 2 Repeated measures ANOVA for Times 1–3: within and between subjects effects.

Effect by measure	ANOVA			
	F	*df*	*p*	η_p^2
Empathy				
Time (T)	40.28	2, 258	<.001	.238
T X Condition	7.29	4, 258	<.001	.102
Intercept	2,073.76	1, 129	<.001	.941
Condition	4.05	2, 129	.020	.059
Privity				
Time (T)	15.11	2, 258	<.001	.105
T X Condition	.48	4, 258	.750	.007
Intercept	2,704.47	1, 129	<.001	.954
Condition	2.96	2, 129	.055	.044
Solidarity				
Time (T)	24.92	2, 258	<.001	.162
T X Condition	2.25	4, 258	.064	.034
Intercept	2,729.38	1, 129	<.001	.955
Condition	3.36	2, 129	.038	.049
Warmth				
Time (T)	11.57	2, 256	<.001	.083
T X Condition	1.87	4, 256	.116	.028
Intercept	1,685.68	1, 128	<.001	.929
Condition	3.58	2, 128	.031	.053
Discomfort				
Time (T)	7.90	2, 258	<.001	.058
T X Condition	1.73	4, 258	.145	.026
Intercept	957.64	1, 129	<.001	.881
Condition	0.12	2, 129	.884	.002

N = 132. Within-subjects effects: Time and Time X Condition. Between-subjects effects: Intercept and Condition.

Time 1 (Baseline) and/or Time 2 (Intervention) scores (Table 3). In general, in the transcript and virtual reality conditions, participants scores increased from Time 1 (Baseline) to Time 2 (Intervention), and then decreased from Time 2 (Intervention) to Time 3 (Follow-up), indicating no significant longitudinal results.

Importantly, participants' scores at Time 1 (Baseline) did not vary across condition (Table 3; for other analysis details, see Tables 4 and 5), except for privity. Further, participants' assigned condition was not related to dropping out between Time 2 (Intervention) and Time 3 (Follow-up), $\chi^2(2) = .34$, $p = .843$, *Cramer's V* = .04. Lastly, we conducted rmANOVAs including only Time 1 (Baseline) and Time 2 (Intervention) to maximize the power of the analysis, as these two-time points had the largest sample. We report the results in the OSM (Supplementary Tables S11–S14). The results were very similar to those from the three-time point rmANOVA, except that the Condition X Time interactions were typically significant for the two-time point rmANOVA.

6 Discussion

The main goal of this paper was to investigate the impacts of a virtual reality residential school on non-Indigenous participants' feelings and attitudes toward Indigenous people. Immediately following the intervention (i.e., at Time 2: Intervention), relative to the control group, participants who toured the virtual school reported more empathy, solidarity, privity, and warmth. Transcript condition participants also experienced more empathy, solidarity, and warmth, but not privity, relative to the control group. We also found, through exploratory analyses, that scores tended to increase from Time 1 (Baseline) to Time 2 (Intervention), but decreased from Time 2 (Intervention) to Time 3 (Follow-up). These findings suggest that either a transcript or a virtual school may have meaningful, practical effects in the short term.

Why did the virtual school, but not the transcripts, affect perceptions of privity? In retrospect, we realize the transcripts did not include much explicit content on the ongoing suffering residential schools have caused. For people to make the connection between the past and present, the case for privity may need to be more explicit, especially if the mode of delivery is only in writing. We also suspect the emotion in the Survivors' voices in the virtual school may have conveyed privity. An implication of this is that hearing Survivors talk about their experiences is likely to have the most impact on privity.

We are less certain why the virtual school and transcripts had relatively similar effects. One possible reason is that the mode of delivery did not matter as much as the content of critical historical knowledge. Gaining such an understanding certainly has many prosocial consequences for how people think, feel, and behave toward outgroup members (Hill and Augoustinos, 2001; Adams et al., 2008; Nelson et al., 2012; Salter and Adams, 2016; Bonam et al., 2019; Neufeld et al., 2021; Zell and Lesick, 2022; Efimoff and Starzyk, 2023). Another possibility is that the school was not maximally immersive. Immersion can be limited if the technology feels uncomfortable (Lee et al., 2020) or causes symptoms such as nausea or dizziness (Rebenitsch and Owen, 2016; Duzmanska et al., 2018; Kourtesis et al., 2019; Saredakis et al., 2020) or if the environment seems limited or gamelike rather than lifelike. It is also possible that having the school "on rails" limited participants' immersion, though note that Woolford et al. (2022) found that for at least some participants, the school was quite immersive, with one participant saying, "I definitely felt like I was there" (p. 412) and others agreeing with this sentiment. Perhaps participants experienced less immersion because they "braced" themselves for the possibility that they might see or hear something truly awful (Woolford et al., 2022). Unfortunately, we cannot be sure, because we did not measure immersion, perspective-taking, or psychological engagement, as is now the recommendation (Ventura et al., 2020; Martingano et al., 2021). Perhaps, the virtual school would have been more effective if participants "saw" themselves as an Indigenous child in the school, by embodying an avatar, because embodying an avatar increases increase perspective-taking in intergroup contexts (Ventura et al., 2020) and, in turn,

TABLE 3 Repeated measures ANOVA for times 1–3: effects by condition and time.

Time by measure	Condition			ANOVA by condition within time			
	Control ($n = 47–48$)	Transcript ($n = 45$)	Virtual reality ($n = 39$)				
	M (SE)	*M (SE)*	*M (SE)*	*F*	*df*	*p*	η_p^2
Empathy							
Time 1	$2.77\ (.13)_{a.1}$	$2.87\ (.14)_{a.1}$	$3.07\ (.15)_{a.1}$	1.13	2, 129	.325	.017
Time 2	$2.90\ (.12)_{a.1}$	$3.71\ (.13)_{b.2}$	$3.62\ (.13)_{b.2}$	12.91	2, 129	<.001	.167
Time 3	$2.80\ (.13)_{a.1}$	$2.96\ (.13)_{a.1}$	$3.10\ (.14)_{a.1}$	1.30	2, 129	.277	.020
ANOVA by time within condition	$F_{(2,\ 128)} = 0.76, p = .469, \eta_p^2 = .012$	$F_{(2,\ 128)} = 33.94, p < .001, \eta_p^2 = .347$	$F_{(2,\ 128)} = 13.27, p < .001, \eta_p^2 = .172$				
Privity							
Time 1	$4.66\ (.19)_{a.1}$	$5.24\ (.20)_{b.1}$	$5.22\ (.21)_{ab.1}$	2.86	2, 129	.061	.042
Time 2	$5.09\ (.17)_{a.2}$	$5.55\ (.17)_{ab.2}$	$5.69\ (.19)_{b.2}$	3.28	2, 129	.041	.048
Time 3	$4.96\ (.18)_{a.2}$	$5.35\ (.19)_{a.12}$	$5.42\ (.20)_{a.1}$	1.70	2, 129	.186	.026
ANOVA by time within condition	$F_{(2,\ 128)} = 5.36, p = .006, \eta_p^2 = .077$	$F_{(2,\ 128)} = 3.09, p = .049, \eta_p^2 = .046$	$F_{(2,\ 128)} = 5.95, p = .003, \eta_p^2 = .085$				
Solidarity							
Time 1	$4.22(.16)_{a.1}$	$4.48(.17)_{a.1}$	$4.67(.18)_{a.1}$	1.80	2, 129	.169	.027
Time 2	$4.42(.14)_{a.2}$	$5.03(.15)_{b.2}$	$5.13(.16)_{b.2}$	6.70	2, 129	.002	.094
Time 3	$4.30(.17)_{a.12}$	$4.70(.17)_{a.3}$	$4.71(.18)_{a.1}$	1.90	2, 129	.154	.029
ANOVA by Time Within Condition	$F_{(2,\ 128)} = 2.25, p = .109, \eta_p^2 = .034$	$F_{(2,\ 128)} = 16.72, p < .001, \eta_p^2 = .207$	$F_{(2,\ 128)} = 13.47, p < .001, \eta_p^2 = .174$				
Warmth							
Time 1	$60.43\ (2.98)_{a.1}$	$62.51\ (3.04)_{a.1}$	$68.10\ (3.27)_{a.1}$	1.58	2, 128	.211	.024
Time 2	$61.57\ (2.87)_{a.1}$	$69.87\ (2.93)_{b.2}$	$75.64\ (3.15)_{b.2}$	5.60	2, 128	.005	.080
Time 3	$61.04\ (2.83)_{a.1}$	$65.47\ (2.89)_{ab.1}$	$71.31\ (3.10)_{b.1}$	3.00	2, 128	.054	.045
ANOVA by Time Within Condition	$F_{(2,\ 127)} = 0.16, p = .86, \eta_p^2 = .002$	$F_{(2,\ 127)} = 6.77, p = .002, \eta_p^2 = .096$	$F_{(2,\ 127)} = 6.02, p = .003, \eta_p^2 = .087$				
Discomfort							
Time 1	$1.70\ (.11)_{a.1}$	$1.75\ (.12)_{a.1}$	$1.66\ (.13)_{a.12}$	.14	2, 129	.872	.002
Time 2	$1.62\ (.11)_{a.1}$	$1.73\ (.10)_{a.1}$	$1.91\ (.12)_{a.1}$	1.62	2, 129	.203	.024
Time 3	$1.55\ (.10)_{a.1}$	$1.53\ (.10)_{a.2}$	$1.48\ (.11)_{a.2}$	.11	2, 129	.897	.002
ANOVA by time within condition	$F_{(2,\ 128)} = 1.14, p = .322, \eta_p^2 = .018$	$F_{(2,\ 128)} = 3.88, p = .023, \eta_p^2 = .057$	$F_{(2,\ 128)} = 10.22, p < .001, \eta_p^2 = .138$				

$N = 132$. Time 1 = Baseline ($n = 131–132$), Time 2 = Intervention ($n = 131–132$), Time 3 = Follow-up ($n = 131–132$). Within each row, means that share the same subscripts are equivalent. Within each column, means that share the same numerical subscript are equivalent.

10.3389/frsps.2024.1346101

TABLE 4 Repeated measures ANOVA for times 1–3: effect by condition only.

Measure	Condition		
	Control ($n = 47–48$)	Transcript ($n = 45$)	Virtual reality ($n = 39$)
	M (SE)	*M (SE)*	*M (SE)*
Empathy	$2.82\ (.11)_a$	$3.18\ (.12)_b$	$3.26\ (.12)_b$
Privity	$4.90\ (.17)_a$	$5.38\ (.17)_b$	$5.44\ (.19)_b$
Solidarity	$4.31\ (.15)_a$	$4.73\ (.15)_b$	$4.84\ (.16)_b$
Warmth	$61.01\ (2.68)_a$	$65.95\ (2.74)_{ab}$	$71.68\ (2.95)_b$
Discomfort	$1.62\ (.09)_a$	$1.67\ (.09)_a$	$1.68\ (.10)_a$

$N = 132$. Within each row, means that share the same subscripts are equivalent. Within each column, means that share the same numerical subscript are equivalent. The associated *F*, *df*, *p*, and η_p^2 values are in Table 2.

TABLE 5 Repeated measures ANOVA for times 1–3: effect by time only.

Measure	Time			ANOVA			
	Time 1 ($n = 131–132$)	Time 2 ($n = 131–132$)	Time 3 ($n = 131–132$)				
	M(SE)	*M(SE)*	*M(SE)*	*F*	*df*	*p*	η_p^2
Empathy	$2.90\ (.08)_a$	$3.41\ (.07)_b$	$2.95\ (.08)_a$	36.19	2, 128	<.001	.361
Privity	$5.04\ (.12)_a$	$5.44\ (.10)_b$	$5.24\ (.11)_c$	13.61	2, 128	<.001	.175
Solidarity	$4.46\ (.10)_a$	$4.86\ (.09)_b$	$4.57\ (.10)_a$	28.49	2, 128	<.001	.308
Warmth	$63.68\ (1.79)_a$	$69.03\ (1.72)_b$	$65.94\ (1.70)_a$	10.14	2, 127	<.001	.138
Discomfort	$1.71\ (.07)_{ab}$	$1.75\ (.06)_a$	$1.52\ (.06)_b$	11.94	2, 128	<.001	.157

$N = 132$. Time 1 = Baseline, Time 2 = Intervention. Means that share the same subscript are equivalent.

empathy and other positive intergroup outcomes (de la Peña et al., 2010; Kalyanaraman et al., 2010; Gehlbach et al., 2015; Herrera et al., 2018; Shin, 2018; Ingram et al., 2019; Barreda-Ángeles et al., 2020; Ventura et al., 2020).

Though unexpected, the similar effects of the virtual school and transcripts are, in some ways, reassuring. If we can shift attitudes in these two seemingly disparate ways, then we have more flexibility in how and where we deliver interventions. It was an immense undertaking to create the virtual school, both in time and cost. Now that it exists, it still requires relatively expensive equipment to run. At least in our experience, this equipment takes time to transport and set up, because the computing requirements of the school, at least at the time of the study, precluded using a laptop. In comparison, transcripts cost less time and money to create and can be transported easily and through a variety of methods, including electronic; they can appear on a learning platform, in an email, app, or website. Of course, a virtual school may seem more appealing. In part because of the novelty, some groups may be more interested in experiencing the virtual school than reading the transcripts. A museum with electronic installations may also include the virtual school as an exhibit.

Unfortunately, the effects of the virtual school and reading the transcripts declined at follow-up. Consistent with Martingano et al. (2021), there were no longitudinal effects of the conditions for any variable. A recent set of longitudinal studies (Efimoff and Starzyk, 2023) on the impacts of critical historical education suggest *ongoing or recurring* interventions are necessary to shift feelings and attitudes in the long run. A single interaction with a virtual reality intervention may not be enough to counter the negative cultural narratives about Indigenous people embedded in Canadian society.

Finally, though not a focus of the study, the findings for discomfort are instructive. Virtual reality participants did not experience more discomfort than those in the control group, either at Time 2 (Intervention) or Time 3 (Follow-up). We hope this finding assuages the concern that learning about residential schools is necessarily traumatizing.

6.1 Limitations not acknowledged elsewhere

There are three limitations of our work that we have not discussed much yet and so would like to discuss them briefly. One limitation was a potential selection effect: Some people may have avoided the experimental conditions because the study description warned of descriptions of abuse, some may have avoided the virtual reality condition because of warnings of nausea, and some may have signed up for the virtual reality condition because they wanted to experience virtual reality. We do not see any theoretical reason, however, that descriptions of virtual reality would have resulted in differences in the variables we measured in our study. It is possible, however, that the warning of descriptions of abuse may have pushed away those who were particularly empathetic. This did not appear to be the case, however, as Time 1 (Baseline) empathy scores did not differ across conditions. In fact, for all but one variable (privity), Time 1 (Baseline) scores did not significantly differ across conditions. It is possible, however, that selection effects

account for differences in privity scores; as such, we suggest caution in interpreting the impact of virtual reality on privity. Considered another way, however, these selection effects may have increased our study's external validity. In real life, people who do not like virtual reality, easily get motion sick, or do not wish to hear about abuse, are unlikely to participate in a virtual reality residential school. Because of this parallel, we can be more confident that the results would hold outside the laboratory.

The second limitation was that all our measures were self-reported. Though this is a common approach in this area (e.g., Kalyanaraman et al., 2010; Herrera et al., 2018; Ingram et al., 2019; Martingano et al., 2022) and social psychology more broadly (e.g., Paluck et al., 2021), self-report measures are susceptible to socially desirable responding. Social desirability bias occurs when participants respond to items in a way that garners approval from others (Crowne and Marlow, 1960). Future researchers might include measures of social desirability bias (e.g., the Marlow-Crowne Social Desirability Scale; Crowne and Marlow, 1960; Reynolds, 1982) to control for the impact of social desirability bias in analyses. Before doing so, researchers may do well to consider that social desirability is a stable individual difference that sometimes should be studied, rather than controlled for. Given this, the best route is to use measures that are relatively free of social desirability, such as the measures we used (Efimoff, 2022).

The third limitation is the lack of standardization among our conditions. For example, participants in the control and transcript condition completed the study entirely online, whereas those in the virtual reality condition completed Time 2 of the study in person. Differences among the conditions may have decreased internal validity in a variety of unknown ways. The fact that the transcript condition was online, and the virtual reality condition was in person, but there was no difference between the two conditions, on most variables assuages our concerns about decreased internal validity.

6.2 Future directions

We recommend that researchers continue to investigate how virtual reality affects feelings and attitudes toward outgroups as well as knowledge, for which the findings are also mixed (e.g., Barreda-Ángeles et al., 2021; Makransky et al., 2021). No study has investigated the effects of virtual reality on knowledge or taken a critical historical knowledge approach. To the extent that such learning makes the content more personally relevant, participants may be more likely to recall the information. In Canada, residential schools were located across the country, so can feel "close to home," and the people and institutions who were involved as perpetrators represent many existing social groups, including religious institutions and governments.

Researchers should also explicitly assess and study what determines participants' perspective-taking, immersion, and psychological engagement in virtual reality. Current research often assesses technological immersion (e.g., Martingano et al., 2021), but very little research assesses this construct from the participant perspective, though perspective-taking, immersion, and psychological engagement are likely necessary for virtual reality to cause people to feel empathy and affect other similar intergroup variables. Such research may focus on the potential for individual differences in how people experience virtual reality, such as Iachini et al. (2019) did and found that participants who could more easily imagine vivid mental images felt more present in a virtual reality rendering. Future research may also focus on what makes for a "good story"; that is, an effective one. Our findings suggest that the story matters, but it is unclear what ingredients are most likely to evoke empathy, privity, solidarity, and warmth, as well as other relevant feelings and attitudes. Specific to the results of our study, future researchers might study whether vocal cues, available in sound but not writing, increase privity. Understanding this could help researchers to create guidelines for attitude change through stories.

Lastly, though it is admittedly disappointing that the virtual reality condition was no more effective than the transcript condition, and that there were no enduring effects, we think it is worth reiterating that we only included non-Indigenous participants in this sample. It would be valuable to understand the impact of the virtual residential school on Indigenous participants, though we would expect it to have different effects.

Data availability statement

Datasets from this study cannot be shared due to privacy and confidentiality reasons as the participants did not consent to having their data shared outside the research team involved in the study. Enquiries should be directed to KS, katherine.starzyk@umanitoba.ca.

Ethics statement

The studies involving humans were approved by University of Manitoba Research Ethics Board (Fort Garry Campus). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

KS: Writing – review & editing, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal Analysis, Data curation, Conceptualization. IE: Writing – review & editing, Writing – original draft, Visualization, Validation, Formal Analysis, Data curation. KN: Writing – review & editing, Validation, Supervision, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. AW: Supervision, Resources, Project administration, Funding acquisition, Conceptualization, Writing – review & editing, Methodology. AF: Visualization, Validation, Writing – review & editing, Methodology. JY: Writing – review & editing, Software, Resources, Methodology, Funding acquisition, Conceptualization. AB: Writing – review & editing, Resources, Methodology, Funding acquisition, Conceptualization. JT: Writing – review & editing, Investigation, Formal analysis, Data curation.

SS: Software, Resources, Project administration, Funding acquisition, Conceptualization, Writing – review & editing, Supervision. AM: Writing – review & editing, Resources, Funding acquisition, Conceptualization.

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Conflict of interest

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

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/frsps.2024.1346101/full#supplementary-material

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