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IMPACTS OF INTERSECTIONAL DUAL-PERSPECTIVE VR EXPERIENCES ON EMPATHY AND UNDERSTANDING OF MICROAGGRESSIONS

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Abstract: *This study advances our understanding of virtual reality (VR) as a tool for increasing both empathy and comprehension of microaggressions, using a unique intersectional dual-perspective approach. Through immersive VR video experiences, participants simultaneously experience and witness microaggressions focusing on racial assumptions about academic abilities. The VR video, developed and scripted by two undergraduate students of color, was recorded from two distinct perspectives: a Black student and an Asian American student, providing viewers an opportunity to witness differential treatment based on racial bias. We conducted a mixed-methods survey of 83 students who viewed the VR experience, focusing on self-reported affective and cognitive reactions. Findings indicate that the VR experience heightened participants' understanding and empathy toward microaggressions. Notably, one perspective (the Asian American student), led to greater impact, suggesting the necessity for further exploration of VR experiences' differential impacts and its implications for the intersection of VR and social justice.*

Keywords: *virtual reality, 360-degree video, microaggressions, racism, intersectionality.*

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INTRODUCTION

As virtual reality (VR) technology has increased in popularity with the widespread use of the Oculus/Meta Quest, PlayStation VR, and others, emerging research examines whether such technology can be leveraged to increase empathy for a variety of social issues. Because VR offers the opportunity to have first-person experiences from another person's perspective, it seems well suited to the development of such empathy. These research questions grew in part out of early VR-style documentaries that sought to create empathy for others, such as Chris Milk's *Clouds Over Sidra*, which portrayed the experiences of a Syrian refugee. Projects such as this one have shown significant potential to evoke strong emotional responses and a deeper understanding of others' experiences.

However, moving from anecdotal experiences to academic research has raised numerous ethical challenges. A growing body of academic research aims to evaluate the effectiveness of these approaches, with a particular emphasis on its ability to foster empathy. Such research is vital, because organizations are already adopting VR for training related to diversity, equity, and inclusivity training sessions, with firms like Praxis Labs creating these experiences as a form of employee training for major companies (Brown, 2021). Yet, the results of such programs aren't always documented or reported in an academic manner, complicating their analysis.

Emerging research has largely focused on assessing the impact of VR experiences on empathy and understanding using both first-person and third-person perspectives and by comparing the impact to that of traditional training videos. However, a significant gap in this research exists, as it fails to assess whether the same scene, witnessed from a different perspective (such as that of a Black student versus an Asian American student) can have different impacts. Our project aims to utilize an intersectional research approach by considering whether assuming different identities can impact one's experience in VR. From this, two major research questions evolved:

- RQ1: How does viewing a VR experience from different perspectives (e.g., the perspective of a Black student vs. an Asian American student) impact the viewers' empathy and understanding?

- RQ2: Do participants' demographics and prior knowledge or experiences (e.g., race, age, prior experience with VR) influence their engagement with and the effectiveness of VR in promoting empathy and understanding?

Overall, prior research on the impacts of VR on empathy have yielded mixed results, though many results suggest that role-taking through media like VR can increase empathy by reducing self-other boundaries. This connects to a longer history of research that explores the power of older media to invoke empathy, going so far as to link the rise of universal human rights to the literary explosion in the 18th and 19th centuries (Farmer & Maister, 2017). While VR holds potential for amplifying this effect due to its immersive nature, evaluating its impact is challenging. Racial bias served as a major lens of analysis for many early studies. Banakou et al. (2016) analyzed whether implicit racial bias against Black people can be decreased using VR experiences. They found that implicit bias is decreased, though it

decreases more when the participants are represented by a Black body rather than a White body within the experience. On the other hand, Groom et al. (2009, p. 224) found that "automatic racial bias is not reduced by embodying a person of a disfavored racial group." Roswell et al. (2020) collected survey data based on a 60-minute large group activity about racial microaggressions, followed by a 20-minute VR module. They found that "most respondents (90.8%) reported feeling engaged in the VR experience. Additionally, the majority agreed that VR was an effective tool for enhancing empathy (94.7%), that the session enhanced their own empathy for racial minorities (85.5%), and that their approach to communication would change (67.1%)" (2020, p. 3). Though mixed, VR's potential to increase empathy and reduce bias appears promising.

Raposo et al. (2023) conducted a pilot study simulating the experiences of marginalized individuals, including pregnant women, elderly individuals, wheelchair users, and those with visual impairments to determine if VR would increase empathy among university students. Their results indicated that students had both increased awareness and empathy, suggesting the possibility for using such a tool for pedagogical purposes. Bacca-Acoasta et al. (2023) found that compassion and attitudes toward migrants positively influence emotional empathy in virtual reality experiences, while engagement, attitudes toward migrants, compassion, and immersion enhance cognitive empathy. Pinto-Coelho et al. (2023) found that VR experiences of those with disabilities generates empathy that promotes both inclusion and understanding. van Loon et al. (2018) measured empathy through a behavior game after a VR experience and found that the experience increases empathy for specific others, but only if the partner in the game is the same person whose perspective they assumed in the virtual reality simulation, suggesting that the impact of such experiences may be limited. Sora-Domenjó (2022) conducted an interdisciplinary literature review which found little evidence of any correlation between VR exposure and empathy that was able to evoke changes in prosocial behavior. Overall, evidence of the impact of VR on empathy for marginalized individuals is quite mixed.

Additional research explored whether VR experiences were more effective for bystander training than those presented in a two-dimensional (2D) video format. Rawksi et al. (2022) were surprised to find that VR participants were more likely to use indirect and non-confrontational approaches in VR than in 2D experiences. They hypothesize that "the high presence of VR … may have represented a more true-to-life psychophysiological and emotional experience for trainees and motivated them to prefer less socially risky or more generally applicable Interventions" (2022, p. 29). Notably, this suggests that although participants were less willing to take risks, this may be because the VR platform feels much more real, and thus more risky, than interacting with a 2D experience. Wang et al. (2022) found that while all media interventions increased positive attitudes toward a target population, the effect was largest with the use of VR. Similarly, Hargrove et al. (2020) found that VR and an embodied in-person experience were equally effective in eliciting empathy and behavior change. Schutte and Stilinović (2017) found greater empathy was generated by virtual reality than a 2D video format. Huang and Pan (2023) found that first-person perspectives elicited more emotions and empathy than third-person perspectives. Herrera et al. (2018) found that participants who took on the perspective of a character involved in the narrative, as opposed to being a bystander, reported increased feelings of empathy and connectedness to others in the scene. Finally, in a review of 111 papers, Lee et al. (2024)

found that although VR was not better at generating emotional empathy, it did enhance cognitive empathy, comparatively. Collectively, this body of research suggests that there are some additional benefits to the use of VR technology over 2D video formats.

Literature raises ethical questions about the impact of empathy-focused VR research and whether or not such experiences should be created. Andrejevic and Volcic (2020) argue that empathy relies on a sense of otherness, hence VR's attempt to promote empathy through perspective-taking may be ineffective or even counterproductive. Ramirez (2020) highlights how our intersectional identities shape our experiences, so a White man experiencing a VR simulation in the role of a Black woman may not be truly representative, as a White man and Black woman would experience the exact same situation differently due to their unique identities. Barreda-Ángeles et al. (2020) found that enjoyment in VR can conflict with empathy. Short scenes often miss out on contextual information about a particular crisis or the larger history of systemic oppression (Daily, 2021). This suggests that empathy may not be the most important measure or outcome to consider when using VR, especially as there is no general agreement on how to even define the concept (Bollmer, 2017; Foxman et al., 2021). Instead, we might consider sympathy, radical compassion, or the VR's impact on one's understanding or behavior instead (Aitamurto et al., 2021; Bollmer, 2017; Ramirez, 2020).

VR creators and academic researchers, therefore, need to be careful in making claims about what the technology can do, while also mitigating two extreme reactions viewers may experience: downplaying their own suffering in comparison or over-empathizing in a way that makes them feel as if they completely understand the problems or suffering of someone else (Thatcher, 2019). Ramirez (2020) believes that it could be more impactful to use VR to build sympathy, rather than empathy, allowing the viewer to *witness* rather than *experience* suffering, though other results suggest that it may be difficult to disentangle affective and cognitive outcomes (Chen et al., 2021). Nakamura (2020) critiques projects that equate immersive VR viewing with the genuine experiences of others, suggesting they serve to assuage societal guilt rather than address real issues. While powerful imagery can influence public opinion, as seen in the Civil Rights Movement (Baird, 2010), an ethical tension arises between exploiting others' suffering and fostering empathy that can lead to social change. VR further complicates this by enabling the viewer to assume the role of another person in the scene. Lara and Rueda (2021) argue that framing VR as "being in someone else's shoes" instead of "being someone else" overcomes the need to switch to a sympathy framework rather than one of empathy.

Overall, emerging work on how VR can be leveraged to help combat social struggles suggests that the technology can potentially be helpful, at least in limited contexts, but it is extremely important to consider how to do so ethically. Doing so involves being conscientious about how the media is created, how it is promoted, who uses it, and the types of claims that are made about what it is able to do. Additionally, within the broad umbrella of virtual reality, experiences can vary significantly in terms of how interactive and immersive they are, based on whether the experience consists of 360-degree video or fully virtual environments that allow for movement and interaction with the scene.

METHODS

This project develops a VR experience about microaggressions filmed from two different perspectives and analyzes how identity impacts self-reported affective and cognitive reactions. It uses a mixed-methods survey approach to collect data from participants after they view the VR experience.

Research Ethics Approval

This study was approved by Fitchburg State University's Institutional Review Board, IRB #202223-03. This approval included but was not limited to COVID-19 precautions, the survey instrument, the use of VR headsets, advertising materials, and informed consent for all participants.

Creation of VR Media

Grant funding allowed for the purchase of equipment for filming a 360-degree video project that was then viewed on Oculus Quest 2 VR headsets. Two undergraduate students of color were hired and paid to develop and then write a script for the VR video project during the summer of 2022. Notably, the students opted to create a dual-perspective scene, which would be filmed twice, once from the perspective of each character, one of whom was Black and the other of whom was Asian American (See Figures 1 and 2). One character experiences a professor overestimating their class performance based on race, while the other character has their class performance underestimated based on race. The major difference between the two videos is that the viewer hears internal dialogue from the character whose point of view they are seeing. In light of ethical concerns related to intersectionality noted above, this is important because it makes clear that the participant – with their own racial identity – is not actually taking the place of someone else in the video, and it offers additional observational insight into the impact of the events as they occur.

Figure 1. Scene from the perspective of Karim, a Black student.

Figure 2. Scene from the perspective of Duy, an Asian American student.

While previous research has noted some differences between the impact of 2D video and 360-degree video for impact on empathy, comparatively little research is available on differences in impact between 360-degree video and interactive virtual reality scenes, though theoretical reflections have suggested an interactive experience may have greater impact.

Rather than adding another comparison of 2D versus 360-degree video, we opted instead to create a 360-degree only project, introducing the technological complexity of dual perspectives. Our research focused on 360-degree video specifically because it is now feasible to create projects using the medium at a consumer level. The cameras, editing software, and VR headsets needed to record, edit, and view such a video are priced such that they are reasonably accessible to the general public. The creation of interactive VR content, on the other hand, would be substantially more expensive and require a much higher level of specialized knowledge and skill. We were interested in exploring the potential of more accessible tools. Relatedly, there is little existing experimental research that suggests interactive VR is significantly more or less impactful than 360-degree video. The element of realism was also particularly important for our approach – we wanted our participants to experience this happening with real humans and not simulated characters.

There are several ethical considerations related to this approach. First, because 360-degree video was used, the participants are not visually embodied; there is no avatar with a skin color represented in the video. They meet the character they are taking the place of at the beginning of the video, and then view the scene from that character's perspective, without a body being visible. Research suggests that the presence or absence of an avatar makes little difference in outcomes (Herrera & Bailenson, 2021). Additionally, the dual-perspective approach means the participant not only experiences microaggressions against their character but also witnesses them happening to someone else. This opens up the possibility to experience both empathy and sympathy (Ramirez, 2020).

Additionally, we hope that fictional examples of microaggressions are less susceptible to making people "feel good about feeling bad" in ethically problematic ways (Nakamura, 2020). Much of the VR content that has been critiqued is either documentary footage or shows extreme circumstances that are usually almost immediately recognized as problematic (e.g., refugee camps, extreme poverty, or even war zones) without the need for VR to evoke embodied sympathy. Microaggressions, in contrast, are everyday occurrences that may not be obvious to those who don't regularly experience them.

After the script was complete, a casting call was issued at the beginning of the fall 2022 semester. Several auditions were held throughout September and October in order to complete casting. Rehearsals occurred in November and final filming occurred in December. All student actors were paid for both their time rehearsing and performing. A GoPro Fusion was used to capture video and audio during filming. The camera was placed approximately in the location where the student would be sitting in the classroom in order to mimic their perspective. Some audio, including the internal dialogue noted above, was recorded afterward using a Shure SM7B microphone connected to a laptop and using Audacity. Of note, we sought faculty or student support for those with prior work in 360-degree video and audio production; however, despite a vibrant and regionally well-known film/video concentration at the university, we were not able to find anyone with such experience. A graduate student at our university was hired to produce an original score for the opening and closing segments of the video.

Editing was completed in January 2023 by the researchers using Adobe Premiere Pro. The footage was stitched together using GoPro software before being imported into Adobe. Although the researchers had extensive past experience with video editing, this was their first time editing 360-degree footage. Subtitles were added to the video during this process also

using Adobe Premiere Pro. Each line was added 4 times, equally spaced around the video, so the script could be seen no matter where the viewer might be looking. All students involved in the project were invited to participate in writing this manuscript, but all declined.

Each video was then exported as a movie file that was uploaded as a YouTube 360-degree unlisted video. These videos were then able to be viewed on the Oculus headset using the YouTube application. Participants only ever viewed the videos using an Oculus headset. Unlike interactive, rendered VR environments, 360-degree video did not allow participants to physically interact with the scene or embody an avatar. This decision, as noted, was grounded in accessibility concerns, as interactive VR requires more advanced hardware and software. Future research might compare similar scenes recorded as 360-degree video and interactive rendered content to determine if there is an impact on levels of immersion or emotional and cognitive empathy. The two videos were made publicly available via YouTube in the summer of 2023 after all data collection was complete. They can currently be accessed here and are viewable in 2D via a screen or in 3D via the YouTube VR app:

- https://youtu.be/38kzWaa0cJk
- https://youtu.be/RKJXLIT1cQY

Experiment Design

In the spring 2023 semester, we began the process of recruiting participants for the research. We sought undergraduate participants who were as diverse as possible in terms of traditional demographically important variables such as age, gender, sexual orientation, race, ethnicity, educational attainment, political orientation and income. The purpose of prioritizing diversity at this stage was to try as much as possible to avoid bias, and – given the lack of a dominant hypothesis in the literature as to what groups are most likely to have any particular reaction to the video – we aimed to keep an open mind and seek respondents with as many different attributes as possible, in case some specific subgroup produced meaningful results.

To achieve this level of diversity we sought permission from the IRB to utilize a wide range of recruitment techniques. These included more traditional methods – postering, and sending emails – as well as methods that are less common on our campus – social media posts, and via creating and promoting an on-campus event for the exclusive purpose of providing attendees with the chance to volunteer to become respondents.

The method via which we did the majority of successful recruiting was by contacting faculty and arranging for the research team to visit their classroom in person to recruit for the project, and have the interested students participate right then. Professors typically arranged for us to do our recruitment on days when they had scheduled individual work on research projects, self–guided work on an assignment, or some kind of work that did not require the entire class period to finish. In this way, the students who participated did not miss classroom instruction time, and those students who chose not to participate were not negatively affected.

When we arrived in the classroom, the professor would typically describe the events planned for class that day, and then introduce us. The two PIs took turns in different classes reading a project overview from a prepared script (to help maintain uniformity across sessions) and interested participants were then given access to an informed consent page hosted on Google Docs via a QR code (with paper copies available). Students who completed the informed consent were then invited to view the VR experience in a separate room, two at

a time. Each researcher had a headset preloaded with the VR experience filmed from a different perspective, as a way to roughly evenly divide up the number of participants who would experience each perspective. Participants then completed a paper-based safety screening survey about potential physical discomfort while using VR. Participants who were likely to experience discomfort were not permitted to proceed. The headset was cleaned between each use and participants wore VR eye masks in order to prevent bacterial spread (Creel et al., 2020). Immediately after the participant completed the video, researchers asked two separate questions ("Are you feeling okay after the VR experience?" [wait for response] "Are you experiencing a headache, dizziness, nausea, vision problems, or sudden fatigue?" [wait for response]) designed to assess whether the participant was experiencing motion sickness. The IRB required the researchers not only to ask these questions, but also to have emesis bags on hand, as well as crackers and ginger ale for those who might feel ill, and also to review an approved first-aid video regarding treatment of motion sickness. While it is entirely reasonable to pre-screen for a history of motion sickness, and inquire generally about the participants' well-being following the VR experience, the extent of the focus on respondents' medical health felt quite strong, and at times – such as asking about a long list of specific medical symptoms to a participant who has just verbally stated that they feel fine – put the researchers in a position of seeming to insist that participating in their research is dangerous.

Participants completed a survey after viewing the VR video. We collected a total of 87 responses. Four responses were removed from the results because they indicated that the respondents were not current students, leaving 83 responses that were analyzed.

Measures

For our measures, we adapted and expanded a survey instrument by Roswell et al. (2020). We collected information about participants' demographics, their previous use of VR technology, and whether or not they experienced any physical discomfort. Additionally, we used a 5-point Likert scale to collect information about the following measures:

- *Engagement:* Because the success of VR is closely related to a sense of presence, we wanted to understand how present users were in the video, opting to measure their sense of engagement to achieve this (Souza et al., 2021).
- *Empathy:* Because so much research on VR is linked to the concept of empathy, we believe it is important to include this measure. We also wanted to better understand its potential connection to demographics and other, potentially alternative, cognitive measures.
- *Understanding:* Here we are interested in assessing people's understanding and cognition of both the experiences of others and microaggressions in particular (Aitamurto et al., 2021). To measure this, we asked three related questions about understanding the experience of others, understanding what microaggressions are, and understanding the negative impact of microaggressions.

Limitations

The majority of this research was collected by visiting classes and soliciting volunteers. This process might produce a halo effect for students and lead to their rating the project higher than they otherwise would.

Also, in the area of recruitment, one potential limitation emerged as a result of the researchers incorrectly assuming that a larger percentage of students would be interested in participating in the research because it would be their first opportunity to try out a VR headset. In fact, just 8 of 83 participants reported that this was their first VR experience, indicating that the technology is fairly commonplace. As a result, participation rates may have been adversely affected because we did not anticipate the need to "sell" respondents on participation.

Another assumption that could have affected the quality of the data was the assumption that our participants were familiar with the term "microaggressions." While the term itself was coined in 1969 (Johnson & Johnson, 2019), its popularity really began to rise only in 2014-2015, and its use was still increasing in 2022 when the script was being written for this project. So, it is entirely possible that at least some participants did not enter the research with a clear definition of that key term, which may have limited their understanding of the scenarios in the video as part of a larger trend experienced by members of racial minority groups.

Additionally, because of IRB requirements to closely monitor subjects for safety, the researcher was seated near participants when they filled out the survey. There is a potential that this could affect the participant's ability to report honestly. On the other hand, this proximity allowed participants to report issues or ask questions while completing the survey, which gave the researchers further insight into potential limitations.

A small number of students apparently initially misinterpreted the demographic questions about age, race, etc. as being about the character whose role they assumed. We amended the wording partway through data gathering for clarity. This might indicate they feared the survey was a "test," or an extension of the research rather than a way of gathering data about their experience.

Two participants mentioned they almost submitted negatively-skewed survey responses because the 5-item Likert scale on phones needed scrolling to view all options. Although these respondents corrected their responses, others might not have. For instance, a participant who reported strong disagreement with all questions on VR effectiveness and understanding microaggressions praised the VR in an open-ended question, potentially skewing the overall Likert scale results.

One final limitation can be seen in the case of one participant who spoke with a researcher after the experience. They gave feedback that having other students whom they know as actors in the video made it feel not real – "like a cartoon" – and so they found it wasn't helpful to learn from. Therefore, it is possible that knowing the actors outside of their role in the video decreased overall engagement.

RESULTS

Quantitative Results

Demographics

When looking at the race/ethnicity of our sample versus official university statistics (Office of Institutional Research and Planning, 2023) (see Table 1), our sample is generally representative of the makeup of the student body with two exceptions – an underrepresentation of Hispanic / Latinx respondents (7.2% vs. 15.6%) and an overrepresentation of respondents of two or more races (8.4% vs. 2.3%).

Table 1. Comparative Demographics

Demographic	Sample Population	University Population
Hispanic/Latinx	7.2%	15.6%
Two or more races	8.4%	2.3%
18-24 years old	90.4%	78.4%
25-34 years old	7.2%	10.5%
35+	2.4%	11.1%
Men	60.2%	45.6%
Women	31.3%	54.4%
Non-binary	3.6%	N/A
Transgender or gender non-conforming	2.4%	N/A
Other gender	2.4%	N/A

While the modal age category (18-24) is the same in our sample and university data, 90.4% of our sample was found in this group, whereas just 78.4% of the student population is in that age range. Our sample also showed an underrepresentation of those who are 35 years of age and older (2.4% vs. 11.1%).

The gender demographics results also indicate that our sample differs from the student population as a whole. In all, 60.2% reported as men, 31.3% reported as women, 3.6% reported as non-binary, and 2.4% reported as other. This is different from the university population (54.4% male vs. 45.6% female), although some of this difference can potentially be attributed to the lack of "non-binary" and "other" options in the university's instrument.

Experience with VR

Most respondents were not new to VR, with just 24% reporting that this was their first experience. Still, most people reported just a small number of previous VR experiences, with 29% saying they had 1-2 experiences, and 29% saying they had 3-10 experiences. Still, 5% reported moderately heavy use (10-20 previous) and 13% reported high levels of use (21+ experiences).

The vast majority of respondents (92%) reported experiencing no physical discomfort during the VR experience (See Table 2). A total of 5% reported experiencing problems, and 4% reported that they were unsure. More than a majority (55%) reported feeling "very engaged" with the VR experience, with another 36% reporting feeling "somewhat engaged," and just 8% reported feeling neutral.

Table 2. VR Experiences

First VR experience	24.1%
1-2 previous experiences	28.9%
3-10 experiences	28.9%
10-20 experiences	4.8%
21+ experiences	13.3%
No physical discomfort	91.6%
Experienced some problems	4.8%
Unsure if experienced problems	3.6%
Neutral engagement	8.4%
Somewhat engaged	36.1%
Very engaged	55.4%

Microaggressions

Overall, 78% of participants reported being familiar with what microaggressions are, 14% were unfamiliar, and 7% were unsure. Most respondents (63%) also reported that they had experienced microaggressions during their lifetime. Of those who reported experiencing microaggressions, 7% reported that it happened "very often," 18% responded "often," 40% responded "sometimes," and 36% responded "seldom."

VR Experience Perceptions

More than three-quarters of respondents had positive things to say about the nature and potential of VR technology for understanding others' perspectives, aligning with existing

literature on the benefits of 360 video and taking the perspective of a character for increasing empathy. In particular, 85% either strongly (49%) or somewhat (36%) agreed that the experience was an effective tool for understanding the experiences of other people. In all, 79% either strongly agreed (43%) or somewhat agreed (36%) that participating in the VR session allowed them to better empathize with people who experience microaggressions. And 77% also reported that they either strongly (49%) or somewhat (28%) agreed that they could better understand the negative impacts of microaggressions after viewing the VR experience.

Multivariate Analysis

We used SPSS to analyze the data and seek trends by race, by which VR experience participants saw, and also by their responses to various attitudinal questions. Most of these comparisons produced no statistically significant results, but there were a few key interactions that emerged from the data.

The first such result appeared when addressing our first research question, comparing those who watched the video from the Asian American student's perspective with those who watched the video from the Black student's perspective. Based on responses to the question, "I better understand what microaggressions are after this experience," those who watched the Asian American student's perspective were significantly more likely to report being better able to understand the effects of microaggressions (Pearson's chi-square = 9.973, df = 4, Cramér's V = .346, $p = 0.041$).

Across perspectives, we also saw consistent evidence of an empathy effect in our data. Those who responded most positively to the question "After participating in this VR session, I feel that I can better empathize with people who experience microaggressions" were more likely to respond positively to the statements, "This VR session is an effective tool for understanding the experiences of other people" (Pearson's chi-square = 136.095, df = 16, $p < 0.001$, Cramér's V = .640, $p < 0.001$), "I better understand what microaggressions are after this experience" (Pearson's chi-square = 104.536, df = 16, $p < 0.001$, Cramér's V = .561, $p < 0.001$), and "I better understand the negative impacts of microaggressions after this experience" (Pearson's chi-square = 127.720, df = 16, $p < 0.001$, Cramér's V = .620, $p < 0.001$).

However, not all respondents reported identical gains in empathy. Specifically, people who were unfamiliar with the term "microaggressions" were more likely to respond "not effective" to the questions: "This VR session is an effective tool for understanding the experiences of other people" (Pearson's chi-square = 25.023, df = 8, standardized residual = 3.2, Cramér's V = 0.388, $p = 0.002$) and "I better understand the negative impacts of microaggressions after this experience" **(**Pearson's chi-square = 15.736, df = 8, standardized residual of 2.7, Cramér's V = 0.308, $p = 0.046$).

Table 3. Significant Results

Variable 1	Variable 2	N	χ2	df	p	Cramer's V
What character were you in the video?	How much do you agree that you better understand what microaggressions are after this experience?	83	9.973	4	0.041	0.347
How engaged were you with the VR scene you watched?	What is your ethnicity?	83	33.847	18	0.013	0.452
Before participating in this experience, were you familiar with the term "microaggression"?	How much do you agree that VR is an effective tool for understanding the experiences of other people?	83	25.023	8	0.002	0.388
	How much do you agree that you better understand what microaggressions are after this experience?	83	15.736	8	0.046	0.308
	How much do you agree that you better understand the negative impacts of microaggressions after this experience?	83	15.736	8	0.053	0.308
Which character were you in this video?	How much do you agree that you better understand the negative impacts of microaggressions after this experience?	83	9.973	4	0.041	0.347
How much do you agree that after participating in this VR session, you feel you can better empathize with people who experience microaggressions?	How much do you agree that VR is an effective tool for understanding the experiences of other people?	83	136.095	16	0	0.640
	How much do you agree that you better understand what microaggressions are after this experience?	83	104.536	16	0	0.561
	How much do you agree that you better understand the negative impacts of microaggressions after this experience?	83	127.720	16	0	0.620

There was one final significant result that warrants mentioning, but with a caveat. This result emerged when we looked at the interaction between ethnicity and the question "How engaged were you with the VR scene that you watched?" In this case, the chi-square results (33.847, df = 18, p = 0.013) indicated a significant effect, while Cramér's V (.452) indicates a large effect size. After looking further into the data we found that those who identified as both Black / African American and Hispanic / Latinx had a standardized residual of 3.2 for the neutral answer (which was the lowest response given by any respondent). However, there was only one respondent who reported this particular combination of ethnicities, so we are reluctant to identify it as a true finding. For this same question, though, when looking at Hispanic / Latinx respondents independently, the standardized residual for the neutral response was 2.1, thus indicating that Hispanic / Latinx respondents were more likely than expected to report that the VR scene was only neutrally engaging. Given the larger number of

respondents who reported this ethnicity (N=6), this finding is more likely to represent a meaningful connection between ethnicity and engagement with the VR scene.

Qualitative Results

The final question in the survey was a qualitative clearinghouse question meant to solicit any feedback that respondents wished to share about the project. In all, 48 out of 83 (57.8%) respondents gave a response to this question, and their responses fell into several key themes. Some responses contained multiple themes, and not all responses coalesced around major themes, so the numbers in this section may not sum to 48.

Primary among observed themes (N=17) were positive comments on virtual reality's strengths as a modality for teaching about social issues, again emphasizing the value of the tool for building empathy and understanding of others. Responses particularly mentioned the aspect of taking the perspective of someone in the scenario, in line with the results of Herrera et al. (2018). Responses of this type highlighted VR as "a good tool" that allowed participants to "pla[y] the role of another individual, and se[e] things from their perspective." A few respondents highlighted the ability of VR "to demonstrate microaggressions," with one respondent noting, "[h]aving someone look me in the eye and say micro-aggressions gave me a more effective understanding than if I had just heard about it." Finally, one respondent said, "[a]s a white peer I never experience this so the VR put me in that place."

The second most common theme among the responses was comments about actors and acting. Four respondents made positive comments about particular actors or noted that the acting had elicited an emotional response ("I felt bad for Karim and Duy"). On the other side, six respondents provided negative feedback about the acting: two suggested generally that the "[a]ctors could have sold it a little better." Two respondents suggested that the use of an older actor in the role of the professor "would have been more realistic and might have affected me differently." And one respondent also believed that "Karim … seemed miscast, as I wasn't sure if the guy playing him was actually a black person."

Tied for the third most common theme addressed by respondents was the discussion of, and reflection on, the concept of microaggressions. Some reported unfamiliarity, saying, "[t]he most important lesson was the clarification of what microaggressions actually are" while another noted that "as a white student it is hard to see and understand the expectations of students of different ethnicities." Other respondents, however, reported being all too familiar: "It felt real and reaffirming the harm of micro aggressions where some people don't think they exist. My partner is an Asian American and the conversations in this project were nearly word for word what they experience weekly;" "I feel like I have witnessed a lot of what was taking place in this video with friends so it was a good thing brin[g]ing awareness to it."

DISCUSSION

Empathy and Understanding

One goal of this research was to assess what factors, if any, are associated with participants' reported levels of empathy and understanding following the VR experience. The first relevant finding has to do with factors external to the experiment, namely their personal background and experiences.

External Factors

One salient point was how commonly members of our sample experience microaggressions. Well over half of respondents (63%) reported having experienced microaggressions in their lifetime, which is higher than some previous research has shown. However, this aligns with recent research showing microaggressions are common, especially among younger people and marginalized groups. For instance, Douds and Hout (2020) found that "[o]ne in five Americans was disrespected at least weekly" (539), and that younger people were more likely to report experiencing microaggressions than older people, which meshes well with the overrepresentation of 18-24 year-olds in our sample. Other research also indicates that in some workplaces experiencing microaggressions by women is nearly universal, with 94% reporting it, and separately 81% of racial/ethnic minorities reporting experiencing them as well (Sudol et al., 2021). Still other research also indicates that experiencing microaggressions is a commonplace experience for students of color who attend historically White universities (Lewis et al., 2021). And although rates of commonly reported microaggressions are typically lower – sometimes in the single digits – among White males than among members of other race/sex pairings (Lloyd, 2020), such data is often gathered using a recollection period of one year, whereas our survey instrument inquired about lifetime incidence. Our survey also did not specify microaggressions, instead asking simply if respondents had experienced any, thus potentially broadening the range of incidents identified as microaggressions.

Although knowledge of, and personal experience with, microaggressions was commonplace, it was not universal; this gap in knowledge and experience revealed one of our key findings. The univariate results support the effectiveness of VR as an intervention, with strong support for statements asking about the effectiveness of VR in understanding others' experiences (85%), and for the potential for VR to affect people's attitudes about microaggressions specifically (79%). However, the multivariate results revealed that those respondents who were least familiar with microaggressions were more likely both to view VR as an ineffective means of affecting others' views, and less likely to report that they had gained a better understanding of the negative impacts of microaggressions. From this data it is possible to conclude that, when it comes to social justice, VR technology may be perceived as more effective by those who are already aware of, and support greater efforts around, the issues under discussion. This could be viewed as a problem of "preaching to the converted." Further research is needed to explore whether this effect holds only for microaggressions, and/or only for racial issues, or whether it is broader in scope. Future projects in this area might profitably explore new ways of presenting VR media, using different perspectives

(e.g., first-person vs. third-person), as well as utilizing avatars with different attributes, to identify the most effective methods of influencing viewers' perceptions and attitudes.

Regardless, our study shows a strong correlation between empathy for microaggression victims and related cognitive statements, such as better understanding of microaggressions and their impacts. While we couldn't discern if empathy was pre-existing or induced by the VR session, our findings represent a valuable addition to the literature in demonstrating the co-occurrence of these related cognitive states, and their persistence across participants of different races viewing a scene from the perspective of characters of two different races. This not only supports the idea that empathy can potentially be generated in shorter VR sessions than previously tested (Roswell et al., 2020), but it also suggests that otherness may not be required for the development of empathy. However, further research will certainly be required to provide firm empirical grounding for wider conclusions on these points.

The same type of work could be done around empathy, specifically in terms of what elements of a VR scene may elicit empathy most readily, and how respondent demographics, attitudes, and/or experiences may alter these outcomes. And even if this level of sophistication is not achieved, researchers could attempt something similar by, for instance, assigning participants a VR experience based off of their familiarity with the topic at hand. Rather than having everyone view the same experience – or randomizing which one is seen – perhaps those who are more familiar with the concept being discussed would view a more nuanced experience that gets into additional detail, whereas those unfamiliar with it would view a more introductory experience designed to acquaint them with it.

Dual-Perspective Methodology

One additional key finding from our study arose from the methodological/technological innovation of allowing respondents to view the scene from one of two perspectives – that of an Asian American student, or of a Black student. Results indicate that respondents perceived the presentation shown from the Asian American student's perspective to be a better tool for understanding microaggressions than the one shown from the Black student's perspective. There are a number of potential interpretations of this finding given the content of the VR scene.

One set of interpretations is that respondents might feel differently based on which character they perceived as experiencing worse treatment. However, there are two key issues with this interpretation. First, not only is there no objective way to rate what type(s) of discrimination are the worst but, anecdotally, respondents could not seem to agree among themselves which character had it the worst. Although this was not a question on the survey instrument, the researchers nevertheless had multiple respondents report that they felt that the character whose perspective they had taken on was the one who experienced the worse treatment. Tellingly, though, these reports came at approximately equal rates from those who had viewed the scene from the Asian American student's perspective and those who had done so from the Black student's perspective. Secondly, it is not clear whether – in a VR scene – viewing another character experience racial microaggressions would be more or less impactful than having those same microaggressions directed towards one's own character. Many might assume that personal involvement would produce greater effects, but it is

possible that seeing someone else go through the experience could provide some distance and opportunity for reflection that allows for attitude change.

Another interpretation has less to do with race and more to do with context. In the VR script, the Asian American student was in the position of having his academic ability overestimated by those around him, and was subjected to microaggressions by both students and the professor, including the question, “where are you really from?” which is well known as a microaggression generally, but is directed especially often at Asian people (Friedersdorf, 2015). In contrast, the Black student has his academic ability underestimated, and is targeted with a form of another well known – though more general – microaggression, “People like you…” Given that our respondents are undergraduate students who encounter increasingly difficult academic subject matter each semester, it could simply be that they empathize more with a student who is being asked to tackle difficult work than someone who is already very skilled in a subject area, regardless of the racial microaggressions that are directed at them.

Another possibility is that respondents felt less comfortable taking the role of a Black person than an Asian American person, and this manifested in lower reported perceptions of the effectiveness of the VR methodology. However, very little literature exists on how racist beliefs manifest in situations of inter-racial embodiment in VR. So, without further data, we must set this possibility aside for the moment.

In the end, it is intriguing that we saw the differences that we did across perspectives. Unfortunately, though, given the exploratory nature of this research we were unable to dig into exactly what caused this difference in perception. Future research – potentially involving a series of A/B tests – could be conducted with various audiences to determine how, and with whom, various messaging is most effective.

Demographics

There are a number of potential reasons why we saw an underrepresentation of Hispanic / Latinx respondents and an overrepresentation of respondents of two or more races. One possibility is down to differences in data collection. The university's Common Data Set uses race/ethnicity categories that do not denote anthropological origins, and restricts individuals to be counted in only one group. For instance, it specifies that Hispanic individuals are only reported under "Hispanic," while non-Hispanic multi-racial individuals are reported under "Two or more races." On the other hand, our data-gathering tool asked respondents to select all ethnicities that apply without providing "Two or More Races" as a separate option; instead, researchers assigned this category if a respondent chose multiple boxes.

Regarding Hispanic/Latinx students, it is possible they may have found our project less relevant, possibly due to the lack of specific racial conflict pertaining to their ethnicity. This could explain their lower engagement with the VR scene, and could potentially have led them to discourage peers from participating. However, as the lowest response to the question was "neutral," it seems unlikely that merely ambivalent respondents would actively advocate against peer participation.

The relevance hypothesis also doesn't fully explain why only one group is affected negatively. If all non-White groups had low participation, it could suggest concern among respondents about potentially traumatizing experiences. This is not a far-fetched idea, as even projects that are not designed to cause negative emotions may do so unintentionally:

"[w]omen and people of color … have a very different relation and response to these spectacles of immersive suffering. Seeing black and refugee bodies shot, drowned, and abused in VR is often experienced as trauma rather than as empathetic identification" (Nakamura, 2020, p. 62). However, we instead see a small overrepresentation of people of more than one race, and only marginal effects associated with other races. It seems unlikely that the Hispanic / Latinx population alone would avoid participating in this research and these effects would not extend to any other group.

In the end, more information would be needed to draw a definitive conclusion about why the Hispanic / Latinx population is underrepresented in our sample. Future researchers should keep a close eye on the racial demographics of their samples, and potentially consider utilizing quota sampling methods, to ensure balanced samples.

The majority of our participants were male (60.2%), contrasting with the slightly female-majority university population (54.4%). This may be because as many as 71% of university students who actively use VR technology are male (Frost et al., 2020), indicating an interest and familiarity gap. Considering only 27% of participants were first-time VR users, the male-majority result isn't unexpected.

Regardless of other considerations, though, female underrepresentation in VR research is an important issue, especially as the technology becomes more mainstream. If – as we've seen – female participants are less likely to volunteer, or be recruited, for VR studies then the field risks producing systematically biased data. Recent scholarship also indicates that female researchers are less likely to be involved in VR research, thus introducing further bias into the field (Peck et al., 2020). In future research it is crucial that researchers make an effort to address these gaps and try to achieve appropriate representation in their samples for members of all sexes.

One final demographic issue to explore is age. Our sample was overwhelmingly (90%) in the 18-24 age range, whereas just 74% of the student population is in that age range. This issue most likely stems from a pre-existing gap in familiarity and interest. Recent surveys indicate that younger people (18-34) report both the highest level of interest in, and knowledge of, VR technology among all age groups, and so it is reasonable to conclude that this manifests as a lower likelihood of older respondents volunteering for the research (Alsop, 2023a, 2023b).

Technological Aspects

Finally, it is important also to reflect on some methodological points raised in the research related to the technology that was used. To begin with, the restrictions around allowing participation only by those who pass a motion sickness screening – while it was intended to protect participants from harm – may have been unnecessary, at least for this methodology. Only 5% of participants reported any physical discomfort, and all cases were mild, which is well below the rates reported in other studies (see e.g., Rebenitsch & Owen (2020)). Furthermore, researchers could recall just one instance in which a student volunteered but was denied participation after filling out the motion sickness survey.

The nature of our VR project, which involved only stationary viewing, may explain the low incidence of motion sickness. Likely, more active scenes might induce more discomfort. Notably, several participants told researchers that they associated their past VR-induced

sickness with extensive use or high-movement games. As VR becomes more common, researchers can potentially rely on participants self-selecting into low-movement VR scenes, and only screen new VR users for motion sickness. Our findings, therefore, suggest that 360-degree video might be more accessible than interactive VR for a wider audience. However, there was no significant relationship between being a first time VR user and whether or not they experienced any discomfort (chi-square = 2.361, df = 2, Cramér's V = 0.169, p = 0.307), so it is possible that no instrument is required at all.

We recommend that researchers resist the trend of including complex medical terminology in consent forms, extensive health warnings, and stringent requirements like 1:1 participant monitoring. Given the prevalence of motion sickness in VR, its inclusion in the informed consent process is necessary, but the emphasis on its risk—particularly in low-movement VR scenarios—appears exaggerated relative to the potential for actual harm. Overemphasizing medical risks may deter participation overall by inducing fear, especially among VR novices such as women and older individuals, potentially exacerbating existing disparities in VR research participation.

On the issue of new users, there were some occasional technological challenges associated with getting first-timers acclimated to the VR environment. Some amount of this is due to operating an unfamiliar technology, as well as needing to adapt to the sudden perspective shift associated with viewing a VR scene. However, some amount of it is also due purely to the "cool factor" of being able to look around in a virtual environment for the first time. This created an issue, however, because our scene contained some important information within the first few seconds of the video, namely introducing the viewer to the character from whose perspective they'd be viewing the video. There was some thought of allowing participants to have a "warm-up" time during which they could get used to the technology in a neutral VR scene. However, the amount of time per participant was already relatively high due to the need to describe the project, obtain informed consent, administer the motion sickness instrument, demonstrate the VR technology, explain the use of the single-use face shield, assist respondents in putting on the VR headset and accessing the VR scene, allow them to watch the scene, inquire about their motion sickness, administer the post-survey, and then provide them with and explain the debriefing sheet. In the end, it was common for participants to spend 15-20 minutes all told doing these various steps. Adding on even 2-3 additional minutes for new users to get used to the technology risked further lengthening an already extended process. On the other hand, failing to offer this chance to become familiar with the technology puts users at risk of missing key information in the VR scene. We recommend that future researchers in this area develop their VR scenes with this issue in mind, and consider either building in an explicit extra step for new users, or perhaps structuring the VR scene such that it is front loaded with a small amount of time (such as a display of credits) to allow users to orient themselves before they need to pay attention to the material.

On the issue of tailoring material to users' needs, we received a small number of comments from students who were unsure whether the actor playing the character Karim was Black. Although this is later confirmed by a line in the script where Karim self-identifies as Black, participants who were confused might have already developed an inaccurate perception of the scene by that time. In any similar research ventures in the future, we

recommend that researchers take extra care to ensure that all key variables are made explicit, whether in voiceover, on-screen text, etc.

As noted above, we chose to use 360-degree video rather than an interactive VR environment. Future research should explore the impact of such technological decisions, measuring the difference in impact between 360-video and interactive VR, while also comparing this to instances of motion sickness. Would the inclusion of more interactive elements increase engagement and empathy outcomes while still remaining accessible? Would avatar embodiment affect these outcomes? Our dual-perspective approach also raises new questions. How would participants react if they experienced the scene from both perspectives rather than just one, for example? Our research has contributed to ongoing discourse about the potential role of VR technology in social justice education, while highlighting both the importance of and need for further study of the technological approaches implemented in such projects.

CONCLUSIONS

This research offers an intersectional, exploratory approach to using VR, including the use of a unique two-perspective methodology that allowed respondents the ability to both experience and witness the occurrence of microaggressions at the same time. The finding that one of these perspectives (the Asian American student, whose math abilities are overestimated) created a larger impact than the other is a novel finding that should be explored in subsequent research for purposes of replication, but also to explore the effects of changes to things like the racial identity of characters, the setting in which the interactions take place, power/status differentials, etc.

Additionally, our results support previous findings that VR can help users better understand, and empathize with experiencing, microaggressions and that both cognitive and affective impacts can be increased through VR experiences and are most likely connected to one another. However, we found that VR appears to have the greatest impact on those who are already aware of, and engaged with, a particular issue. This is a crucial point to address especially as VR technology advances and is used more widely and in a greater variety of settings. Caution may be warranted for those seeking demonstrable impacts of VR based training, especially around social issues (e.g., companies implementing diversity, equity, and inclusion training). Further exploration of the points raised in this research will be important to the long-term understanding of the impact of VR experiences, especially in their use for social justice related projects.

IMPLICATIONS FOR RESEARCH, APPLICATION, OR POLICY

This study demonstrates the effectiveness of VR as a way to generate empathy and understanding in those who experience it. However, it sounds a cautious note because VR appears to have the greatest impact on those who are already aware of, and engaged with, a particular issue. This is a crucial point to address especially as VR technology advances and is used more widely and in a greater variety of settings. Caution may be warranted for those

seeking demonstrable impacts of VR based training, especially around social issues (e.g., companies implementing diversity, equity, and inclusion training), and additional research is required to explore this. Additional awareness of, and research into, the impact of the race of the perspective being taken in the VR scene also needs to be completed, as our research suggests that this impacts the overall effectiveness of the experience.

This study also identifies several best practices for VR researchers to consider when designing studies, particularly for those in settings where it is compulsory to seek approval from an IRB. Hopefully these recommendations will be adopted widely and can contribute to standardization in the field, thus facilitating further research.

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Appendix A

Non-Significant Results

Variable 1	Variable 2	N	χ2	df	p	Cramer's V
What is your ethnicity?	How much do you agree that VR is an effective tool for understanding the experiences of other people?	83	45.664	36	0.130	0.371
	How much do you agree that after participating in this VR session, you feel you can better empathize with people who experience microaggressions?	83	41.702	36	0.237	0.354
	How much do you agree that you better understand what microaggressions are after this experience?	83	41.109	36	0.257	0.352
	How much do you agree that you better understand the negative impacts of microaggressions after this experience?	83	47.438	36	0.096	.378
	How engaged were you with the VR scene you watched?	83	15.613	12	0.210	0.307
What is your gender?	How much do you agree that VR is an effective tool for understanding the experiences of other people?	83	19.451	24	0.728	0.242
	How much do you agree that after participating in this VR session, you feel you can better empathize with people who experience microaggressions?	83	23.404	24	0.496	0.266
	How much do you agree that you better understand what microaggressions are after this experience?	83	22.599	24	0.544	0.261
	How much do you agree that you better understand the negative impacts of microaggressions after this experience?	83	20.172	24	0.687	0.246
	How engaged were you with the VR scene you watched?	83	1.360	2	0.507	0.128
Which character were you in this video?	How much do you agree that VR is an effective tool for understanding the experiences of other people?	83	2.952	4	0.566	0.189
	How much do you agree that after participating in this VR session, you feel you can better empathize with people who experience microaggressions?	83	1.353	4	0.852	0.128
	How much do you agree that you better understand what microaggressions are after this experience?	83	7.586	4	0.108	0.302
	How engaged were you with the VR scene you watched?	83	2.620	6	0.855	0.126
How old are you?	How much do you agree that VR is an effective tool for understanding the experiences of other people?	83	5.194	12	0.951	0.144
	How much do you agree that after participating in this VR session, you feel you can better empathize with people who experience microaggressions?	83	7.375	12	0.832	0.172
	How much do you agree that you better understand what microaggressions are after this experience?	83	5.340	12	0.946	0.146
	How much do you agree that you better understand the negative impacts of microaggressions after this	83	4.057	12	0.982	0.128

	experience?					
Was this your first experience with VR?	How engaged were you with the VR scene you watched?	83	4.538	2	0.103	0.234
	How much do you agree that VR is an effective tool for understanding the experiences of other people?	83	3.945	4	0.413	0.218
	How much do you agree that after participating in this VR session, you feel you can better empathize with people who experience microaggressions?	83	3.341	4	0.502	0.201
	How much do you agree that you better understand what microaggressions are after this experience?	83	7.433	4	0.115	0.299
	How much do you agree that you better understand the negative impacts of microaggressions after this experience?	83	6.798	4	0.147	0.286
Did you experience any physical discomfort during the VR session?	How engaged were you with the VR scene you watched?	83	2.917	4	0.572	0.133
	How much do you agree that VR is an effective tool for understanding the experiences of other people?	83	6.960	8	0.541	0.290
	How much do you agree that after participating in this VR session, you feel you can better empathize with people who experience microaggressions?	83	7.572	8	0.476	0.214
	How much do you agree that you better understand what microaggressions are after this experience?	83	2.876	8	0.942	0.132
	How much do you agree that you better understand the negative impacts of microaggressions after this experience?	83	4.152	8	0.843	0.158
Before participating in this experience, were you familiar with the term “microaggression”?	How engaged were you with the VR scene you watched?	83	5.258	4	0.262	0.178
	How much do you agree that after participating in this VR session, you feel you can better empathize with people who experience microaggressions?	83	12.115	8	0.146	0.270
	How much do you agree that you better understand what microaggressions are after this experience?	83	10.788	8	0.214	0.255
Have you experienced microaggressions in your lifetime?	How engaged were you with the VR scene you watched?	83	0.196	2	0.907	0.049
	How much do you agree that VR is an effective tool for understanding the experiences of other people?	83	3.201	4	0.525	0.196
	How much do you agree that after participating in this VR session, you feel you can better empathize with people who experience microaggressions?	83	2.480	4	0.648	0.173
	How much do you agree that you better understand what microaggressions are after this experience?	83	2.283	4	0.684	0.166
	How much do you agree that you better understand the negative impacts of microaggressions after this experience?	83	2.337	4	0.674	0.168
	How engaged were you with the VR scene you watched?	83	6.338	10	0.786	0.195

How often have you experienced microaggressions?	How much do you agree that VR is an effective tool for understanding the experiences of other people?	83	25.509	20	0.183	0.277
	How much do you agree that after participating in this VR session, you feel you can better empathize with people who experience microaggressions?	83	27.978	20	0.110	0.290
	How much do you agree that you better understand what microaggressions are after this experience?	83	28.008	20	0.109	0.290
	How much do you agree that you better understand the negative impacts of microaggressions after this experience?	83	29.566	20	0.077	0.298
What was the last grade of school that you completed?	How engaged were you with the VR scene you watched?	83	6.777	10	0.746	0.202
	How much do you agree that VR is an effective tool for understanding the experiences of other people?	83	12.378	20	0.902	0.193
	How much do you agree that after participating in this VR session, you feel you can better empathize with people who experience microaggressions?	83	14.339	20	0.813	0.208
	How much do you agree that you better understand what microaggressions are after this experience?	83	10.618	20	0.956	0.179
	How much do you agree that you better understand the negative impacts of microaggressions after this experience?	83	8.713	20	0.986	0.162

Appendix B

Full Text of Respondent Post-VR Survey

"Changing Minds" post-VR survey

This survey will allow you to share your experiences after viewing the "Changing Minds" VR project at Fitchburg State University. Your responses will be kept confidential and not shared with anyone outside of the research project. Your participation in this research is completely voluntary and you may choose to stop participating at any time without penalty.

* Required

1. Which character were you in this video? *

   Mark only one oval.

   Karim Monroe (Black student)
   Duy Nguyen (Asian student)

2. How old are you? * Mark only one oval.

   18-24 years old
   25-34 years old
   35-44 years old
   45-54 years old
   55-64 years old
   65+ years old

3. What is your ethnicity? (please select all that apply) * Check all that apply.

American Indian or Alaska Native
Asian
Black or African American
Hispanic or Latinx
Native Hawaiian or other Pacific Islander
White
Prefer not to answer

Other:

4. What is your gender? (please select all that apply) * Check all that apply.

Man
Woman
Non-Binary
Transgender or gender non-conforming
Prefer not to answer
Other:

5. Are you currently enrolled as an undergraduate student? * Mark only one oval.

Yes
No

6. What was the last grade of school that you completed? * Mark only one oval.
Grade school (8th grade or less)
Some high school (did not graduate high school)
High school graduate (12th grade or GED)
Some college (1 or more years without graduating)
Associates Degree/Technical Degree
College Graduate (4-year college, Bachelor's degree)
Some postgraduate (no advanced degree)
Master's degree
Professional degree
Doctorate degree
Prefer not to answer

7. Did you experience any physical discomfort during the VR session (e.g. dizziness, vertigo,
etc.)? *Mark only one oval.

Yes
No
Not Sure

8. Was this your first experience with Virtual Reality (VR)? * Mark only one oval.

Yes → Skip to Question 10
No
Not Sure

9. How many previous experiences have you had with VR? * Mark only one oval.

1-2
3-10
10-20
21+

10. How engaged were you with the VR scene that you watched? * Mark only one oval.

Very engaged
Somewhat engaged
Neutral
Somewhat unengaged
Very unengaged

11. How much do you agree with each of the following statements? * Mark only one oval per row.

Strongly disagree
Somewhat disagree
Neither agree nor disagree
Somewhat agree
Strongly agree

- This VR session is an effective tool for understanding the experiences of other people.
- After participating in this VR session, I feel that I can better empathize with people who experience microaggressions.
- I better understand what microaggressions are after this experience.
- I better understand the negative impacts of microaggressions after this experience.

12. Before participating in this experience, were you familiar with the term "Microaggression"? * Mark only one oval.

Yes
No
Not Sure

13. Have you experienced microaggressions in your lifetime? * Mark only one oval.

Yes → Skip to question 14
No → Skip to question 15

14. Microaggression Followup: How often have you experienced microaggressions? * Mark only one oval.

Very often
Often
Sometimes
Seldom
Rarely

15. Additional Comments

Please feel free to add any additional comments. For example: Which aspect(s) of today's experience were most memorable? And why? Was there anything negative about your experience with VR or anything that could be improved about the experience for the future?

Which character were you in this video?
Karim Monroe (Black student)
Duy Nguyen (Asian student)

How old are you?
18-24 years old
25-34 years old
35-44 years old
45-54 years old
55-64 years old
65+ years old

What is your ethnicity? (please select all that apply)
American Indian or Alaska Native
Asian

Black or African American
Hispanic or Latinx
Native Hawaiian or other Pacific Islander
White
Prefer not to answer
Other (fill in)``

What is your gender? (please select all that apply)
Man
Woman
Non-Binary
Transgender or gender non-conforming
Prefer not to answer

Are you currently enrolled as an undergraduate student?
Yes
No

What was the last grade of school that you completed?
Grade school (8th grade or less)
Some high school (did not graduate high school)
High school graduate (12th grade or GED)
Some college (1 or more years without graduating)
Associates Degree/Technical Degree
College Graduate (4-year college, Bachelor's degree)
Some postgraduate (no advanced degree)
Master's degree
Professional degree
Doctorate degree
Prefer not to answer

Did you experience any physical discomfort during the VR session (e.g. dizziness, vertigo, etc.)?
Yes
No
Not Sure

Was this your first experience with Virtual Reality (VR)?
Yes
No
Not Sure

How many previous experiences have you had with VR?
0

1-2
3-10
10-20
21+

How engaged were you with the VR scene that you watched?

Very engaged
Somewhat engaged
Neutral
Somewhat unengaged
Very unengaged

The following question was posed: “How much do you agree with each of the following statements?” followed by these statements:

This VR session is an effective tool for understanding the experiences of other people.
After participating in this VR session, I feel that I can better empathize with people who experience microaggressions.
I better understand what microaggressions are after this experience
I better understand the negative impacts of microaggressions after this experience..

Before participating in this experience, were you familiar with the term "microaggression"?

Have you experienced microaggressions in your lifetime?

[If yes to base question] →

How often have you experienced microaggressions?

Very often
Often
Sometimes
Seldom
Rarely

Please feel free to add any additional comments. For example: Which aspect(s) of today's experience were most memorable? And why? Was there anything negative about your experience with VR or anything that could be improved about the experience for the future? [Open-ended response.]