Virtual Coaching for Mental Health: Effects of Coach Ethnicity Match, Coach Type Framing, Warmth, and Competence in a VR Setting

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ABSTRACT

With the increasing integration of virtual coaching technologies and AI-driven interventions into psychological well-being applications, it has become essential to understand how users perceive and emotionally respond to virtual coaches. Drawing on Social Identity Theory (SIT), the Computers Are Social Actors (CASA) model, the Stereotype Content Model (SCM), and Parasocial Interaction (PSI) theory, this study examined the effect of coach ethnicity match (matched vs. unmatched) and coach type framing (human vs. AI) on participants' mental health state (anxiety and positive emotion) in a VR context.

This study employed a 2 (coach ethnicity match: matched vs. unmatched) × 2 (coach type framing: human vs. AI) between-subjects design, and 151 participants were randomly assigned to one of four conditions. Participants in all conditions received an identical standardized coaching session delivered by a VR coach whose ethnicity and role framing varied according to the experimental condition. The participants then completed questionnaires that measured their perceived competence and warmth of the coach, as well as their mental health state (anxiety and positive emotion).

The results revealed a significant interaction effect between coach ethnicity match and coach type framing on anxiety: participants experienced less anxiety when the coach matched their ethnicity and was framed as human. However, neither experimental manipulation showed a significant main effect when analyzed independently. Additionally, a general reduction in anxiety over time was observed.

Although coach ethnicity match and coach type framing did not significantly affect perceptions of the VR coach (i.e., perceived warmth and competence), these perceptions were found to strongly predict positive emotion, though they did not significantly reduce anxiety on their own. These findings partially support the Stereotype Content Model (SCM) and suggest that people are emotionally responsive to interpersonal traits, particularly in the development of trust and positive affect.

Interestingly, although identity cues such as coach ethnicity and coach type were not strong predictors on their own, the participants were still socially and emotionally reacting to the VR coach, providing support for PSI theory. Users appeared to form parasocial bonds with the coach based on relational cues, with warmth and competence being the most important factors in creating emotional engagement, even without direct human interaction.

This study contributes to the human-agent interaction literature by illuminating when and how social identity cues and relational qualities influence user experience in a VR environment. This study offers practical insights into how emotionally intelligent virtual agents can be designed, based on the conclusion that relational qualities are more effective than surface-level identity signals in eliciting emotional support, particularly in task-oriented and digital therapeutic contexts.

KEYWORDS: *warmth, competence, anxiety, emotion, AI coaching, coach ethnicity match, coach type framing*

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1. Introduction

Artificial intelligence (AI) has been increasingly integrated into various aspects of human life, including healthcare and psychological well-being. Among its emerging applications, AI-based coaching systems represent a rapidly developing area that offers scalable and accessible alternatives to traditional face-to-face support. These systems have shown promise in promoting mental health by reducing anxiety and enhancing positive emotional states—an especially relevant goal amid growing global concerns regarding emotional distress and the limited availability of mental health care.

Recent research has shown that AI coaches grounded in cognitive behavioral therapy (CBT) and positive psychology can effectively alleviate symptoms of depression and anxiety (Fulmer et al., 2018, as cited in Terblanche et al., 2022, p. 2). For instance, young cancer patients who engaged with AI coaches reported reduced anxiety, suggesting that even in the absence of human intelligence or emotional nuance, AI coaches can provide meaningful psychological support (Greer et al., 2019, as cited in Terblanche et al., 2022, p. 2). These findings challenge the assumption that human presence is necessary for emotional connection and open the door to more inclusive and cost-effective digital interventions.

While traditional coaching has typically relied on interpersonal, face-to-face relationships, AI coaches now offer a more cost-effective, accessible, and scalable alternative. Their capacity to simulate social presence is supported by the Computers Are Social Actors (CASA) paradigm, which posits that people tend to respond to AI agents in socially similar ways as they do to humans (Feine et al., 2019, cited in Zhang & Wang, 2024, p. 85). As AI systems continue to adopt more human-like qualities, they are increasingly viewed as social actors capable of forming emotional rapport and delivering therapeutic benefits.

Despite these advancements, it remains unclear how ethnic matching between clients and their coaches influences clients' perceptions and outcomes in virtual coaching sessions. In traditional psychotherapy, research has demonstrated that ethnic similarity between client and therapist contributes to improved outcomes. According to Cabral and Smith (2011, p. 538), prior studies have generally supported the idea that clients prefer therapists who share their ethnic background. Ethnic matching may further improve outcomes by enhancing mutual understanding and reducing clients' concerns about being misunderstood or mistreated (Kohatsu et al., 2000, as cited in Cabral & Smith, 2011, p. 538).

As AI coaches become more human-like and emotionally expressive, it is important to explore whether these interpersonal mechanisms also apply in virtual environments. If ethnic matching fosters trust and emotional connection in face-to-face therapeutic contexts, it is

plausible that similar effects could also emerge in immersive virtual reality (VR) coaching scenarios. However, the psychological effects of interacting with an AI coach remain underexplored.

To address this gap, this thesis explores the effects of two experimental manipulations on mental health state in a VR coaching setting: coach ethnicity match (i.e., whether the coach and participant share the same ethnicity) and coach type framing (i.e., whether the coach is presented as a human or AI). These manipulations may interact to affect participants' mental health state, namely anxiety and positive affect. The study is conceptually based on Social Identity Theory (SIT), the Computers Are Social Actors (CASA) perspective, the Stereotype Content Model (SCM), and Parasocial Interaction (PSI) theory. In addition to identity cues, this study also explores how participants' perception of the VR coach (warmth and competence)—two of the most essential relational traits—affects their mental health state during the VR coaching session.

To empirically examine how two variables—coach ethnicity match and coach type framing—influence participants' mental health state in a VR coaching environment, the study employs a 2 × 2 between-subjects experimental design, manipulating both variables across four virtual coaching conditions. Participants undergo a standardized VR coaching session and rate their post-session anxiety, positive emotion, and perceptions of the coach's perceived warmth and competence. This design allows for an integrated analysis of both identity-based and relational factors in shaping emotional outcomes. The research question guiding this study is as follows:

"To what extent do coach ethnicity match (matched vs. unmatched) and coach type framing (AI vs. human) impact users' mental health state in a VR coaching setting?"

The remainder of this thesis develops an informed argument about how identity cues and participants' perceptions of the VR coach affect their mental health state. The next chapter summarizes existing literature on the favorable outcome of mental health therapy in both face-to-face and VR contexts, the psychological effects of ethnic similarity, and the perceived social presence of VR coaches. It also introduces the theoretical foundations that frame this study, emphasizing how concepts such as warmth, competence, and the CASA theory provide insight into human responses to anthropomorphized systems. Building on this foundation, the methods chapter outlines how a VR experiment was designed to test the psychological effect of coach ethnicity match and coach type framing, with a particular focus on measuring participants' anxiety, positive emotion, and their perceptions of the coach's warmth and competence. The results chapter examines how experimental manipulations—specifically,

coach ethnicity match and coach type—influence participants' mental health states (anxiety and positive emotion). It also analyzes participants' perceptions of the VR coach in terms of warmth and competence. The conclusion chapter reflects on how these findings extend existing theory and explore their implications for the design of emotionally intelligent VR coaches in mental health, coaching, and broader digital well-being applications.

2. Literature Review and Theoretical Framework

This chapter aims to bridge the research gap by developing a theoretical framework to guide the investigation. It begins by introducing key theoretical concepts related to the research question, drawing from relevant perspectives that underpin the study's analytical position. Based on these foundations, hypotheses are derived from the findings of past studies. The chapter concludes by outlining a theoretical framework.

2.1 Parasocial Interaction (PSI)

Parasocial interactions (PSI) were first introduced by Horton and Wohl (1956), who explored how interactions between media viewers and media characters—such as presenters, actors, fictional characters, and celebrities—can create a parasocial relationship. In this relationship, media viewers respond as if they are engaged in a real-life interaction and imagine a sense of intimacy with media characters (Horton and Wohl, 1956, as cited in Giles, 2002, pp. 279; Perse & Rubin, 1989, as cited in Ye et al., 2021, p. 1094). Specifically, Horton and Wohl (1956) describe parasocial interaction as an illusory experience in which audiences perceive themselves as interacting with a television performer, despite the nonreciprocal nature of the exposure (Hartmann & Goldhoorn, 2011, p. 1104).

Although PSI was originally proposed in the context of traditional mass media, recent technological advancements—such as virtual reality (VR) and artificial intelligence (AI)—have expanded its relevance. PSI offers a valuable lens for understanding how users form emotional connections with the VR coach in the context of a virtual reality environment. Even though users are cognitively aware that the VR coach is neither a real-life friend nor an actual human being, the lifelike appearance and interaction of the VR coach can still evoke a sense of social and emotional connection. After repeated interactions and personalized responses, users may begin to perceive the VR coach as a trustworthy mentor. They may then engage with the coach in ways that resemble real-life relational dynamics. This can lead to emotional comfort, reduced anxiety, and greater receptiveness to the coach's guidance—outcomes that are crucial in mental health and emotional support interventions.

2.2 The Computers as Social Actors Theory (CASA)

The Computers Are Social Actors (CASA) theory, introduced by Reeves and Nass (1996, as cited in Passi et al., 2024, p. 69), proposes that when technologies display human-like characteristics, users tend to apply the same social norms and interaction rules to computers as they do to humans. The phenomenon is referred to as the media equation, or more directly, media equal real life, implying that people process technology-mediated experiences in the same way as non-technology-mediated, real-life experiences (Reeves & Nass 1996, as cited in

Lee, 2008, p. 1). As Reeves and Nass (1996, p. 5, as cited in Lee, 2008, p. 1) noted, “an individual’s interactions with computers, television, and new media are fundamentally social and natural, just like interaction in real life.”

Nass and Moon (2000, as cited in Zhang & Wang, 2024, p. 85) extended this theory by demonstrating that users engage with anthropomorphic systems—such as voice assistants, chatbots, or virtual agents—as if they were social partners. Most notably, the researchers found that even when users are consciously aware that a synthetic voice is not human, users still respond to the synthetic voice as if it were real (Lee, 2008, p. 3). These responses are not based on the belief that the systems are truly human but rather stem from automatic social reactions triggered by cues such as language, facial expressions, and personality traits.

Lee et al. (2008, p. 3) found that people feel a high level of social presence and respond socially to a robot when it exhibits a compelling personality and demonstrates long-term artificial cognitive development. As AI technologies continue to advance, their ability to mimic emotional expression, empathy, and responsiveness has grown stronger, prompting them to be increasingly regarded as social actors rather than mere tools (Choi & Drumwright, 2021, as cited in Zhang & Wang, 2024, p. 86). As a result, users experience higher levels of social presence and are more likely to respond to AI as they would to human beings.

Feine et al. (2019, as cited in Zhang & Wang, 2024, p. 85) observed that the CASA theory has been widely used in various fields, such as marketing, education, and mental health, to explain how users interact with intelligent systems. For instance, Xu et al. (2022, as cited in Zhang & Wang, 2024, p. 86) found that CASA principles reliably predict user reactions to AI in customer service interfaces. Munnukka et al. (2022, as cited in Zhang & Wang, 2024, p. 86) showed that personified virtual assistants significantly enable users' sense of social presence and trust. Likewise, Song and Kim (2022, as cited in Zhang & Wang, 2024, p. 86) highlighted that a robot's social capability, usefulness, and human-like appearance strongly influence user expectations and satisfaction—highlighting CASA's central argument that anthropomorphic design promotes social bonding and trust.

These insights are highly relevant to the context of coaching in virtual reality (VR) environments. In such settings, users interact with the VR coach that may be framed as human or artificial and may also possess identity cues such as race or gender. Moreover, users apply nuanced, personality-based social rules, such as the similarity-attraction rule and the consistency-attraction rule, when they interact with computers (or agents) that manifest a particular personality.

This study draws on the CASA theory to examine how two key factors— coach ethnicity

match (matched vs. unmatched) and coach type framing (human vs. AI)—influence participants' perceptions of the coach's warmth and competence and participants' mental health states (anxiety and positive emotion) in a virtual reality (VR) coaching context. In immersive environments, a VR coach's appearance, speech, and social identity features—such as race—can serve as powerful social cues that activate automatic social cognition processes.

In summary, the CASA theory provides a strong foundation for understanding how users attribute warmth, competence, trust, and social presence to the VR coach, even when they are aware that the agent is non-human. Moreover, the similarity-attraction principle increases the likelihood that participants may perceive a VR coach of the same ethnicity, or a coach portrayed as human, as warmer and more competent. This study examines how anthropomorphism and identity-based similarity influence participants' psychological responses and engagement with a VR coach, providing insights into the broader societal implications of human–VR coach interactions in emotionally supportive settings.

2.3 Social Identity Theory (SIT)

Social Identity Theory (SIT), initially proposed by Tajfel and Turner (1986, as cited in Meuret et al., 2016, p. 2), postulates that individuals categorize themselves and others into social groups and identify others as belonging to either an ingroup (members they identify with) or an outgroup (those they differentiate from themselves). This categorization tendency is driven by the need to enhance self-esteem through positive social comparison, where the ingroup would typically be placed above the outgroup (Tajfel & Turner, 1986, as cited in Meuret et al., 2016, p. 2).

SIT has been utilized in the past for broad social categories, such as ethnicity, nationality, and gender. However, recent studies have emphasized that social identification can be applied in smaller, more interpersonal contexts, such as dyads and therapeutic relationships (Cruwys et al., 2023, p. 2). The strength of shared identity tends to be a better predictor than interpersonally derived variables (e.g., attraction or liking) of what happens in more interpersonal contexts. For example, in the case of a group-based CBT for social anxiety disorder, stronger social identification with the group significantly predicted symptom reduction (Cruwys et al., 2023, p. 2). This means that the therapeutic outcome might be less dependent on group size and more on the feeling of common identity experienced by participants and facilitators.

Unlike other identity theories, which frame the self in terms of unique personal traits, SIT emphasizes the place of perceived similarity with others in defining the self (Cruwys et al., 2023, p. 2). This perspective is most relevant to the current study's investigation of coach

ethnic match in a virtual environment. When the VR coach is perceived as part of the same social group—using visible cues like race by participants—they may feel more comfortable and experience ingroup identification, which may strengthen the therapeutic alliance and promote emotional openness.

Additionally, recent developments within social identity leadership theory (Haslam, Reicher, & Platow, 2020; as cited in Cruwys et al., 2023, p.2) argue that coaches and therapists, as facilitators, can construct group identity among clients through "identity leadership." This involves making clients feel known, valued, and part of a shared social group. When the coach demonstrates identity leadership, he is more likely to develop client trust and achieve psychological benefits. Translating this to a VR coaching environment, it can be assumed that a coach framed as human—particularly one who visibly shares the participant's ethnicity—will be more successful in exhibiting identity leadership, ultimately reducing user anxiety more effectively than coaches framed as AI.

Cumulatively, these findings suggest that the extent to which participants perceive the VR coach as an ingroup member—through ethnicity match and human framing—may significantly influence their psychological responses to the session. This aligns with SIT's broader assertion that shared identity is a predictor of interpersonal trust, emotional safety, and therapeutic effectiveness, even in highly immersive virtual environments.

2.4 Coach Ethnicity Match (Matched vs. Unmatched)

Numerous previous studies have demonstrated that mental illness affects people of color at rates comparable to those of White individuals. However, individuals from ethnic minority groups are significantly less likely to seek mental health services. To address this disparity, researchers and practitioners have emphasized the importance of cultural congruence between therapists and clients. One extensively studied approach involves matching clients and therapists based on shared ethnicity—a practice that has received sustained attention over the past several decades (Cabral & Smith, 2011, p. 537).

According to Cabral and Smith (2011, p. 538), prior research generally supports the idea that clients prefer therapists who share their ethnic background and tend to evaluate them more positively. Meta-analytic findings indicate a moderate to strong effect size for client preference, along with a smaller yet significant effect for positive perceptions of racially matched therapists, including higher ratings of trustworthiness, cultural understanding, and competence. These effects align with foundational psychological theories, which suggest that individuals are more likely to trust and connect with those they perceive as similar (Newcomb, 1961, as cited in Cabral & Smith, 2011, p. 537). Additionally, visible

similarities—such as shared ethnic features—can enhance interpersonal attraction and social affinity (Berscheid, Dion, Walster, & Walster, 1971, as cited in Cabral & Smith, 2011, p. 537).

Ethnic matching has also been shown to improve therapeutic outcomes by fostering mutual understanding and reducing clients' fears of being misunderstood or mistreated (Kohatsu et al., 2000, as cited in Cabral & Smith, 2011, p. 538). On a practical level, shared cultural backgrounds may provide therapists with greater insight into the client's social context, including their access to community resources and support systems. In summary, ethnic similarity may strengthen the therapeutic relationship by fostering emotional resonance and contextual understanding (Cabral & Smith, 2011, p. 538).

While these findings primarily originate from traditional, face-to-face therapeutic settings, the exact psychological mechanisms—such as perceived similarity and interpersonal trust—may also function in virtual environments. This study, therefore, examines whether ethnic matching between participants and the VR coach can yield similar benefits in a digital context.

In this experiment, participants will interact with a VR coach whose ethnicity either matches or does not match their own. The VR coach will appear as either White or Black avatars, while participants may self-identify as White, Black, Asian, or Other. If the participant and the VR coach share the same ethnicity, this is classified as a matched ethnicity condition; otherwise, it is considered an unmatched ethnicity condition. Since only White and Black avatars are utilized, participants identifying as Asian or Other will, by default, be assigned to the unmatched ethnicity condition. Based on prior literature, the following hypothesis is proposed:

H1: Participants interacting with a VR coach avatar of the same ethnicity will report lower post-coaching session anxiety compared to those interacting with a coach avatar of a different ethnicity.

2.5 Coach Type Framing (Human vs. AI)

Avatars play a key role in the effectiveness of virtual programs. They play a critical role in enhancing immersion, social presence, and user engagement within virtual environments (Bélisle & Bodur, 2010, as cited in Chae et al., 2024, p. 1132). It is essential to investigate how framing an avatar as either human- or AI-controlled influences user responses.

Human avatars, with human-like appearance and behavior, are most effective in increasing presence, attractiveness, and user satisfaction (Chae et al., 2024, p. 1133). Greater human-likeness also increases perceived interpersonal closeness and trust, which can

positively affect users' attitudes and psychological responses. These effects align with similarity-attraction theory, which suggests that people are more likely to trust and engage with individuals—or avatars—they perceive as similar to themselves (Newcomb, 1956; Liviatan et al., 2008, as cited in Chae et al., 2024, p.1134). Notably, the impact of avatar design becomes even more evident when users are aware that a real human controls the avatar. In such cases, the perceived source of agency may further enhance credibility, professionalism, and interpersonal authenticity (Nowak, 2004; Luo et al., 2006, as cited in Chae et al., 2024, p. 1133). In this study, the VR human coach refers to an avatar operated by a certified life coach trained in cognitive-behavioral therapy, increasing the authenticity of the coaching interaction.

Recent technological advances have led to increasingly sophisticated AI avatars, making it difficult for users to distinguish whether the avatars they interact with are human- or AI-operated (Hanna, 2024; Wodecki, 2024, as cited in Chae et al., 2024, p. 1133). The literature suggests that AI avatars can facilitate trust in computer systems, simulate social interaction, and offer emotionally supportive dialogue through natural language processing (Liu & Siau, 2023; Hill et al., 2015; Przegalinska et al., 2019, as cited in Butt et al., 2021, p. 1015). They are also praised for creating nonjudgmental environments that foster self-disclosure and task clarity (Ellis-Brush, 2021; Mai et al., 2021; Terblanche et al., 2024, as cited in Passmore et al., 2025, p. 10). In this study, the AI coach refers to an avatar powered by an advanced language model trained in cognitive-behavioral therapy competencies.

While AI avatars offer several promising advantages, they may still lack the nuanced empathy and relational warmth that characterize human-led interactions. (Passmore et al., 2025, p. 12). Such a distinction is especially relevant to emotionally exposed domains like mental health, where trust, authenticity, and perceived emotional presence are at the core of therapeutic outcomes. Passmore et al. (2025, p. 10) provide comparative evidence that, while both human and AI coaches helped reduce stress, Participants who utilized human coaches reported significantly greater reductions in stress levels. Given the well-established relationship in literature between stress and anxiety in emotional well-being, these findings also point to the potential of human framing to more effectively reduce anxiety, particularly in emotionally sensitive contexts such as coaching. These findings suggest that presenting the coach as human may enhance emotional effectiveness, particularly within the framework of interventions aimed at reducing anxiety. Therefore, based on both empirical findings and theoretical justification, the following hypothesis is proposed:

H2: Participants interacting with a VR human coach will report lower post-session anxiety

than those interacting with a VR AI coach.

2.6 The Interaction Effect Between Coach Ethnicity Match and Coach Type Framing

Interpersonal similarity is a well-established factor influencing psychological outcomes in coaching and therapy relationships. Based on the similarity-attraction paradigm (Newcomb, 1961, as cited in Cabral & Smith, 2011, p. 537), individuals are likely to trust, engage with, and respond favorably to other individuals they perceive as similar to themselves.

In mental health and counseling contexts, studies have consistently shown that ethnic client-therapist matching is associated with more favorable evaluations, greater trust, and stronger working alliances (Cabral & Smith, 2011, p. 538). These effects are particularly evident in emotionally sensitive contexts such as anxiety-reduction coaching, where perceived cultural sensitivity can enhance emotional safety and openness.

However, the impact of coach ethnicity match may depend on how the coach is framed—as human or AI. The Computers Are Social Actors (CASA) framework (Reeves and Nass, 1996, as cited in Passi et al., 2024, p. 69) suggests that people apply social rules when interacting with media agents, particularly those with human-like attributes. Responses to AI agents are generally less emotionally nuanced than those to human counterparts. When a coach is depicted as human, users may more readily employ social identity assumptions and make ethnicity more salient. Conversely, when a coach is distinctly delineated as an AI, the agent may be perceived as less socially similar or personally accountable, making ethnic (mis)match less noticeable or relevant.

In other words, this study suggests that the type of coach framing may influence how ethnicity matching affects mental health state. Ethnicity matching may enhance emotional connection and reduce anxiety only when the coach is framed as human; this effect could weaken—or even disappear—if the same coach is presented as an AI agent.

This theoretical integration suggests a potential interaction effect: coach type framing (human vs. AI) could shape how users respond to ethnic similarity. Several initial studies suggest that AI coaches can form affective connections with users in therapy or healthcare settings; however, the depth and consistency of these effects remain unclear (Ellis-Brush, 2021, as cited in Barger, 2025, p. 2). In contrast, human coaches are consistently found to develop deeper relational connections with clients, reinforcing the notion that ethnicity cues may carry more weight in human-framed contexts. For these reasons, the following hypothesis is proposed:

H3: The effect of coach ethnicity match (matched vs. unmatched) on post-session anxiety will be moderated by coach type framing (Human vs. AI).

2.7 The Effectiveness of the VR Coaching Session

Virtual reality (VR) has received increasing attention for its potential applications in psychological contexts. Research indicates that VR interventions can enhance mood in hospitalized children with cancer (Erdős & Horváth, 2023, p. 7) and reduce psychological distress in adults undergoing chemotherapy (Gautama et al., 2023, as cited in Olasz et al., 2024, p. 2348). In clinical contexts, VR has also been widely researched as a therapeutic tool for various mental health conditions. According to Wiebe et al. (2022, p. 2), virtual settings have been successfully applied to the treatment of a vast array of disorders, ranging from phobias and panic disorder to social anxiety, PTSD, OCD, depression, ADHD, eating disorders, and addiction.

Beyond clinical applications, VR has also shown benefits in general emotional regulation through its immersive qualities, which can facilitate the attainment of flow—a deeply focused mental state of complete absorption in an activity and reduced self-awareness, originally introduced by Csikszentmihalyi (1990, as cited in Olasz et al., 2024, p. 2348). When the flow state is attained, decreased activity in the prefrontal cortex and amygdala has been observed (Dietrich, 2003, as cited in Olasz et al., 2024, p. 2348), which can contribute to anxiety reduction.

While this study primarily investigates the effects of coach ethnicity match and coach type framing on mental health state, it also considers the possibility that participating in a VR-based coaching session may benefit mental health regardless of condition. In light of this empirical and theoretical foundation, the following hypothesis is proposed:

H4: Participants' anxiety levels will significantly decrease from pre- to post-session, regardless of condition.

2.8 Warmth and Competence

From a functional and pragmatic perspective (Fiske, 1992, 1993b, as cited in Fiske et al., 2002, p. 879), stereotypes are shaped through interpersonal and intergroup interactions. When individuals encounter others—whether as fellow individuals or members of a group—they instinctively assess the other person's intentions toward themselves or their in-group, as well as the likelihood that those intentions will be successfully carried out. These evaluations align with two key psychological dimensions: warmth, which reflects perceived intent, and competence, which reflects perceived ability.

As previously mentioned, when people interact, they quickly assess others' intentions, often based on the perceived nature of the relationship. If the relationship is cooperative—indicating shared goals, individuals tend to infer that the other has good intentions, leading

them to be perceived as warm and trustworthy (Fiske et al., 2002; Kervyn, Fiske, & Yzerbyt, under review, as cited in Fiske, 2012, p. 14). Conversely, if the intentions are perceived as harmful or competitive, the other is seen as cold and untrustworthy (Fiske, 2012, p. 14).

After assessing another person's intentions, people evaluate whether that person has the ability to act on them. This perceived competence is often inferred from observable indicators such as status, economic success, or occupational prestige. In summary, psychological research shows that people judge others along these two universal dimensions—warmth and competence—sorting them as relatively high or low on each trait (Cuddy, Fiske, & Glick, 2008; Fiske, Cuddy, & Glick, 2007, as cited in Cuddy, 2011, p. 74).

People are likely to stereotype others' warmth and competence based on pervasive stereotypes such as race, gender, and economic status (Cuddy, 2011, p. 74). For instance, in the U.S., White individuals are often stereotyped as both warm and competent, Black individuals as less warm and competent, and Asians as less warm but more competent (Fiske et al., 2002, as cited in Baharloo et al., 2022, p. 2). These stereotypes shape intergroup relationships and influence racialized social interactions (Cuddy et al., 2007; Fiske et al., 2002, as cited in Baharloo et al., 2022, p. 2).

These dimensions of social perception may also operate in virtual environments. When participants interact with avatars displaying salient identity cues, such as race, these stereotypes may be activated. Therefore, in this experiment, participants will interact with a VR coach whose ethnicity either matches or does not match their own. Ethnicity matching may enhance perceived social similarity, and hence it could influence participants' perceptions of the coach's warmth and competence. Based on stereotype content theory and similarity-attraction effects, the following hypotheses are proposed:

H5: Coach ethnicity match is positively associated with perceived warmth of the VR coach.

H6: Coach ethnicity match is positively associated with perceived competence of the VR coach.

Competence and warmth are also relevant in psychological treatment settings. Several factors—such as therapeutic alliance, empathy, and expectations—can influence treatment outcomes. Among these, negative expectations are particularly detrimental, as they can hinder treatment success (Constantino et al., 2011, 2020; Dew & Bickman, 2005; Greenberg et al., 2006, as cited in Seewald & Rief, 2022, pp. 150–151). Therefore, increasing positive expectations is crucial, with therapists playing a key role in this process. This concept, known as the therapist effect, emphasizes the importance of the therapist's warmth and competence, which are considered critical dimensions of interpersonal behavior (Howe et al., 2019, p. 4).

Therapists demonstrate warmth through personal engagement and care, as well as competence through efficiency, expertise, and knowledge. Some researchers suggest that a therapist's warmth and competence can increase positive expectations, which are essential for favorable treatment outcomes (Blasini et al., 2018; Howe et al., 2019; Westra et al., 2011; Zion & Crum, 2018, as cited in Seewald & Rief, 2022, pp. 150–151). The effect of warmth and competence on anxiety is discussed in the following sections.

According to the Stereotype Content Model (SCM), people make social judgments based on two key traits: warmth and competence (Fiske et al., 2002, as cited in Yao, 2023, p. 737). These perceptions are often influenced by physical appearance, behaviors, and contextual cues (Zhou et al., 2019, as cited in Yao, 2023, p. 736). Notably, such judgments extend beyond human agents. When non-human agents, such as avatars or artificial intelligence, exhibit human-like qualities—anthropomorphism—humans respond socially, attributing personality, intentions, and emotions to them (Kim & McGill, 2011; Nass & Moon, 2000, as cited in Yao, 2023, p. 736).

As a result, individuals may perceive warmth and competence not only from other humans but also from non-human agents designed to simulate human social behavior. This theoretical foundation supports the notion that participants will form impressions of the VR coach based on these dimensions, regardless of whether the coach is framed as human or AI. Accordingly, the following hypotheses are proposed:

H7: Coach type framing is positively associated with perceived warmth of the VR coach.

H8: Coach type framing is positively associated with perceived competence of the VR coach.

2.9 Anxiety

Anxiety is characterized by the anticipation of a perceived threat, involving both cognitive elements (e.g., irrational fear, catastrophizing) and physiological symptoms (e.g., arousal, sweating, dizziness) (Penninx et al., 2021; Hamm, 2020; Creamer et al., 1995, as cited in Premkumar et al., 2022, p. 1).

While most individuals recover quickly from distress, those with generalized anxiety disorder (GAD) experience persistent, uncontrollable anxiety that can become overwhelming. Their daily functioning is often impaired by uncontrollable stress and fear of uncertainty. This condition can last a long time and affects women twice as often as men. The current prevalence is estimated to be between 2% and 3%, but the lifetime prevalence of GAD in the United States is about 5%. Rates of GAD vary by gender, race, and social class. In the U.S., GAD affects approximately 6.8 million adults (3.1% of the population), yet only 43.2%

receive treatment. Rising anxiety rates in the U.S. have been linked to factors such as excessive social media use, sleep deprivation, genetic predispositions, and environmental stressors (Mishra & Varma, 2023, p.1).

Advancements in immersive technology have made VR therapy a promising treatment for anxiety disorders. VR therapy has demonstrated superior outcomes compared to a waitlist control group (Carl et al., 2019, as cited in Premkumar et al., 2022, p. 1), making it a viable psychological intervention. VR therapy offers several accessibility benefits to encourage help-seeking among individuals reluctant to engage in face-to-face therapy or experiencing subclinical to moderate anxiety symptoms who might not reach the threshold for clinical referral (Premkumar et al., 2022, p. 1).

Warmth has been found to play a role in reducing anxiety. For example, Festen et al. (2013, as cited in Zafar & Jami, 2016, p. 15) discovered that maternal and paternal emotional warmth were negatively associated with anxiety symptoms in children. The anxiety-reducing effects of warmth are not limited to family contexts; instead, they extend to therapeutic, educational, and virtual environments. Warm, supportive interactions are believed to foster a sense of psychological safety and trust, thereby reducing anxiety in various settings.

In VR mental health coaching, perceived warmth from the coach may serve as a protective factor against anxiety. Building on this foundation, the present study investigates whether perceived warmth in a VR coach can reduce post-session anxiety. Accordingly, the following hypothesis is proposed:

H9: Perceived warmth is negatively associated with post-session anxiety.

Therapist competence has been shown to directly influence anxiety symptom reduction. Brown et al. (2012, p. 97) found that higher CBT therapist competence was associated with better clinical outcomes in patients with anxiety disorders—especially when delivered by novice therapists using technological assistance—and that this effect was attributable to competence rather than adherence. Similarly, Branson et al. (2015, p. 2) reported that significantly more patients treated by the most competent therapists demonstrated reliable improvement in anxiety symptoms. In contrast, patients treated by less competent therapists were more likely to experience symptom deterioration, further supporting the crucial role of therapist competence in anxiety treatment outcomes.

In the context of AI-based interventions, similar trends have emerged. The effectiveness of AI-based conversational agents (CAs) in reducing psychological distress is more pronounced when using generative AI, multimodal or voice-based CAs, and delivering interventions via mobile applications and instant messaging platforms. These findings suggest

that more advanced and capable AI agents may be more effective in alleviating anxiety (Li et al., 2023, pp. 1, 9). Accordingly, the following hypothesis is proposed:

H10: Perceived competence is negatively associated with post-session anxiety.

2.10 Emotion

Emotions are central to human experience, shaping thoughts, behaviors, and overall well-being. As such, efficiently assessing emotional states is a critical concern in psychological research and practice. Watson et al. (1988, pp. 1063–1064) introduced the Positive and Negative Affect Schedule (PANAS) in their seminal paper, a brief yet reliable self-report measure designed to systematically index two fundamental dimensions of emotion: positive affect (PA) and negative affect (NA). The scale consists of 20 items—10 representing positive emotions (e.g., "inspired," "determined," and "attentive") and 10 representing negative emotions (e.g., "distressed," "upset," and "nervous"). Respondents rate the extent to which they experienced each of these emotions during a specific period, allowing for the flexible measurement of both state and trait effects.

The Stereotype Content Model (SCM) builds on this foundation by proposing that people categorize others according to two dimensions: warmth and competence. Different combinations of these traits result in four distinct stereotype types, each associated with a specific emotional response. For instance, individuals or groups perceived as warm but incompetent—such as the elderly or people with disabilities—tend to elicit pity. Those perceived as both warm and competent inspire admiration, while those viewed as neither warm nor competent—such as the homeless or individuals with substance use disorders—often provoke contempt. In contrast, groups seen as competent but not warm—such as wealthy elites or high-status minority professionals—typically evoke envy (Fiske et al., 2002, p. 878).

As previously mentioned, people perceived as high in both warmth and competence often evoke admiration, a response closely connected to positive emotions such as inspiration, determination, and attentiveness. These emotions are particularly relevant in coaching contexts, where feelings of inspiration and focus can enhance engagement, motivation, and psychological well-being. According to Smith’s (2000, as cited in Cuddy et al., 2008, p. 105) theory of social comparison, individuals frequently experience admiration and inspiration when they compare themselves to others they see as successful and aligned with their values or goals. Similarly, Cialdini et al. (1976, as cited in Cuddy et al., 2008, p. 105) noted that people may feel pride and admiration when they identify with high-performing groups or figures, even indirectly, such as when supporting a successful sports team. These forms of

assimilative comparison suggest that perceiving someone as both warm and competent can lead to an emotional uplift, particularly when the other party is viewed as a positive, affiliative figure.

Building on this theoretical foundation, this study examines whether participants' perceptions of a virtual coach avatar's warmth and competence influence participants' emotional responses. Based on this framework, the following hypotheses are proposed:

H11: Perceived warmth is positively associated with post-session emotional response.

H12: Perceived competence is positively associated with post-session emotional response.

2.11. Theoretical Framework

The theoretical framework is presented in Figure 2.1 and is constructed based on the concepts and hypotheses discussed earlier. It includes two independent variables—coach ethnicity match and coach type framing—and two dependent variables—post-session anxiety and post-session emotion. In addition, warmth and competence are included as relational variables that are hypothesized to directly influence mental health state.

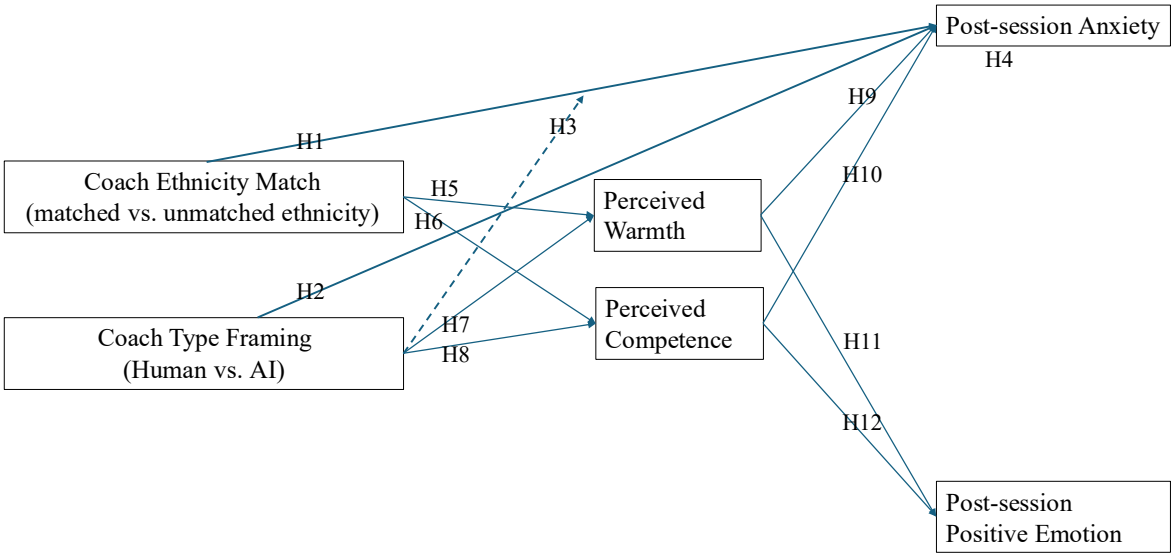


Figure 2.1

The theoretical framework

3. Method

This chapter outlines the research design employed to address the research question. It begins by introducing and justifying the use of a quantitative methodology, followed by a description of the sampling strategy, research procedures, including a pre-test/post-test survey and a VR-based experiment, and the measurement instruments applied to assess the key variables. The chapter concludes by presenting the analytical approach applied.

3.1 Research Design

A quantitative research design was selected to examine the proposed hypotheses. While qualitative research focuses on understanding experiences through non-numerical information, quantitative research collects and examines numerical information to test hypotheses and explore causal relationships. Given that this study aimed to how coach ethnicity match and coach type framing influence participants' mental health state in a VR coaching environment, a quantitative approach was deemed most appropriate.

Data were collected through pre-test, and post-test surveys administered via Qualtrics, along with an onsite VR experiment, where participants interacted with a VR coach in staged environments. VR was chosen because it facilitates immersive, realistic simulations of social interaction and enables the manipulation of VR coach characteristics (coach ethnicity match and coach type framing) within a highly controlled yet ecologically valid setting. This method enables the measurement of subtle psychological responses—such as social and affective impressions—in ways that questionnaires alone cannot replicate.

Participants' mental health state and perceptions of the VR coach were measured before and after the VR experiment. This design enabled standardized psychological data collection and facilitated statistical testing of associations between independent and dependent variables (Babbie, 2016, p. 261). It provided experimental control, procedural consistency, and high-quality data under conditions.

3.2 Sampling

The target sample consisted of individuals aged 18 or older who were able to participate in the VR experiment onsite. No prior experience with virtual reality was required. Participants from diverse ethnic backgrounds were welcomed in order to create conditions in which the VR coach's ethnicity could either match or not match that of the participant. Participants were recruited via convenience sampling from social media and the university participant pool between April 23, 2025, and May 16, 2025.

This study employed a 2 × 2 between-subjects experimental design, manipulating coach ethnicity match (matched vs. unmatched) and coach type framing (human vs. AI). Participants

were randomly allocated to one of four experimental conditions (matched ethnicity + human, matched ethnicity + AI, unmatched ethnicity + human, unmatched ethnicity + AI). The assignment ensured a balanced distribution across conditions.

This sampling strategy enabled tests of interaction effects between coach ethnicity match (matched vs. unmatched) and coach type framing (human vs. AI) on mental health state (anxiety and positive emotion). While convenience sampling has the effect of limiting the generalizability of results, participants' ethnic backgrounds still yielded valuable insights into user attitudes and emotional responses to the VR coach.

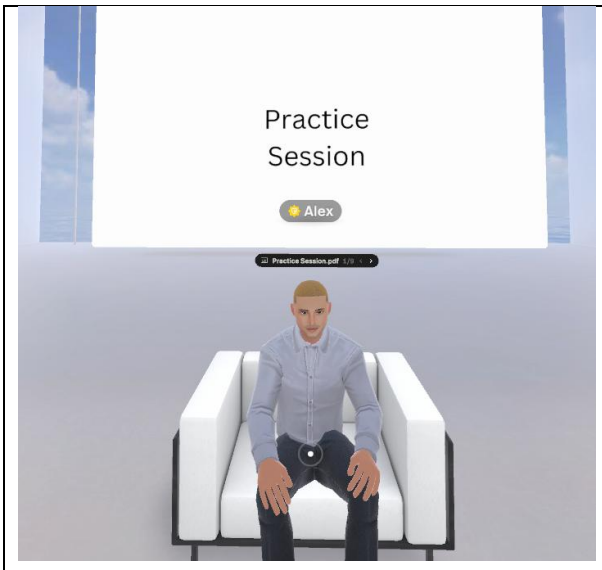
3.3 Research Procedure

The research procedure consisted of three parts: a pre-test survey, a VR experiment, and a post-test survey. All VR experiments were conducted individually, with one participant participating at a time to ensure focused attention and maintain the integrity of the experimental manipulation.

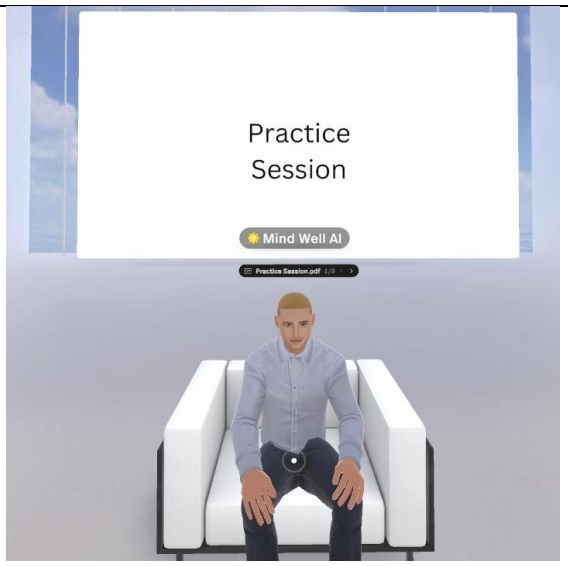
Upon arrival, participants began with a pre-test survey, which included a brief explanation of the study's purpose—namely, to investigate how people experience a short mental health coaching session in virtual reality (VR). Participants were informed that their participation was voluntary and that the study involved no known risks. Contact details for the researcher were also provided in case participants wished to follow up (see Appendix A for the full consent form).

The survey included a screening item that asked participants to confirm they were over the age of 18 and that they agreed to participate in the study. Participants had to select "agree" to proceed. This served both as an eligibility check and a means to prevent minors from participating.

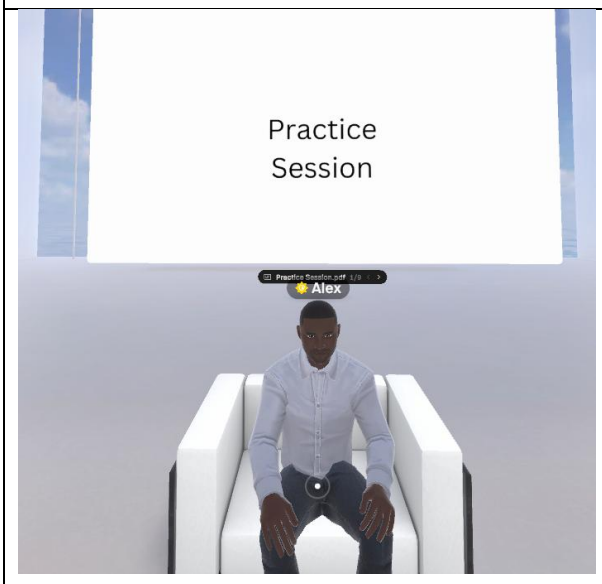
The first section of the survey focused on demographic questions, followed by questions about emotions and anxiety. Participants were then randomly assigned to one of four conditions in a 2 (coach ethnicity match: matched vs. unmatched) × 2 (coach type framing: human vs. AI) between-subjects study (see Figure 3.1). Next, the researcher instructed the participant to put on the VR headset and enter a virtual waiting room with a mirror, a tree, a dog, and several paintings on the wall (see Figure 3.2). The researcher then instructed them to explore the environment briefly to familiarize themselves with the surroundings.



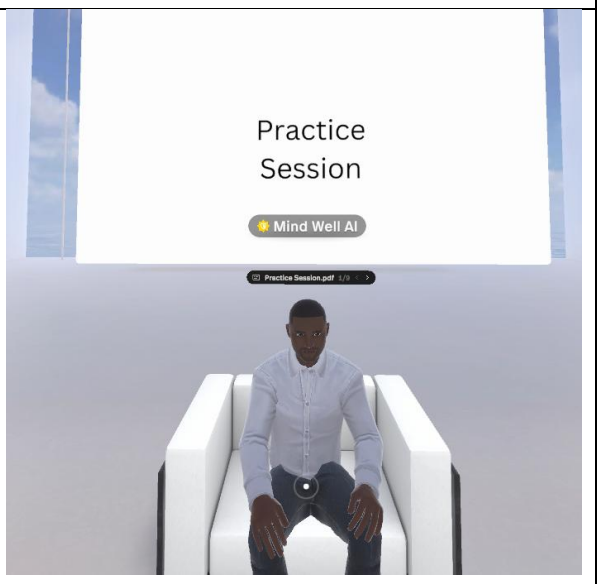
White coach + Human framing



White coach + AI framing



Black coach + Human framing



Black coach + AI framing

Figure 3.1

Visual representation of the four experimental conditions combining coach ethnicity and framing.

Note. Participants interacted with a VR coach that was either White or Black. The ethnicity match was determined based on the participants' self-identified ethnicity. If the VR coach and participant shared the same ethnicity, the condition was classified as matched; otherwise, it was unmatched. Participants identifying as Asian or Other were automatically assigned to the unmatched condition, as only White and Black avatars were used in the study.

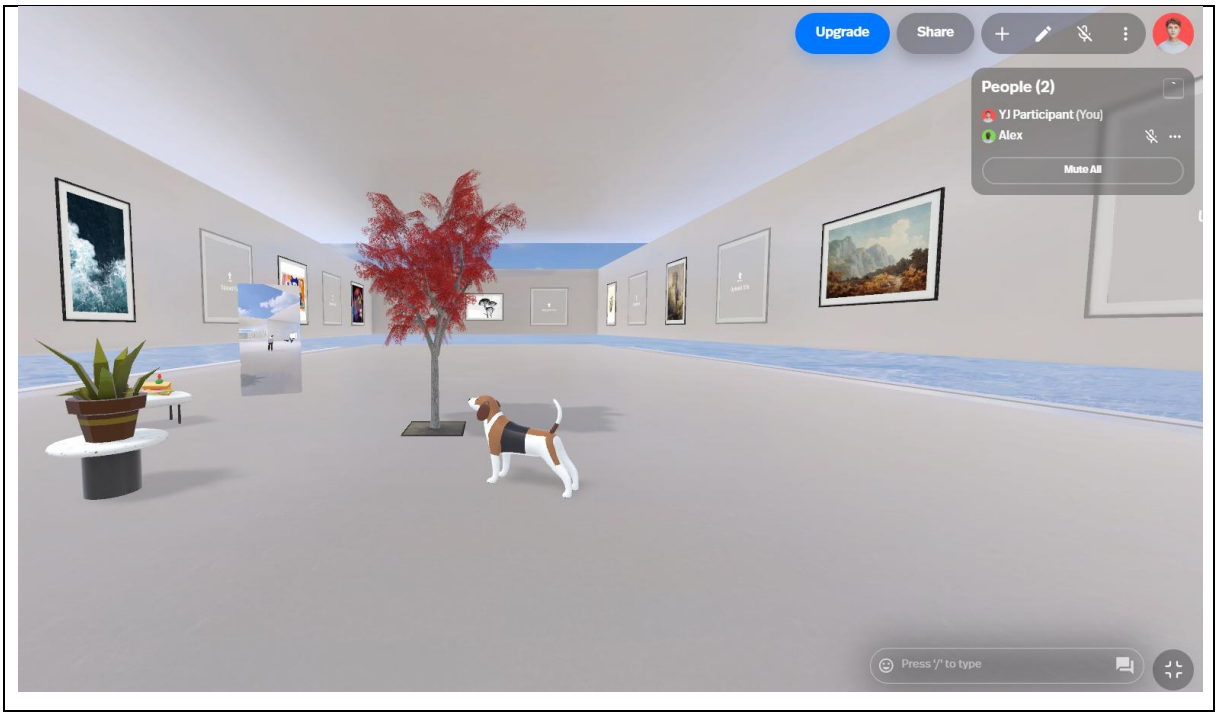


Figure 3.2

The virtual waiting room

Subsequently, the researcher instructed the participant to approach the VR coach and stand where the virtual seat was located. The researcher then placed a physical chair behind the participant and asked the participant to sit down, aligning their position with the virtual setting to enhance the sense of immersion. This setup enhanced the feeling of presence in front of the VR coach and prepared to begin the interaction. Behind the VR coach, a screen was available for the participant to click on and view example answers (see Figure 3.3).

Figure 3.3

The VR coach and a screen displaying example answers for the participant

To acquaint the participant with the process, a practice session was conducted while the researcher remained in the lab. During the session, the researcher played a pre-recorded set of instructions and sample questions such as the following: “How’s the weather today?” and “What are you going to do today?” The participant rehearsed listening to these questions and was instructed by the researcher to click on the screen to read example answers and then verbally respond to the questions.

Following the practice session, the coaching session began. The researcher exited the lab, leaving the participant alone. The researcher remotely played pre-recorded coaching questions and lip-synced as the VR coach to create the illusion of real-time interaction. The coaching questions were:

"How are you feeling today?"

“Acknowledging how you feel is a great first step. Now, let’s think about what might be behind that feeling. What are the things in your life right now that might have made you feel this way?”

"If you could feel something different, something better—what would that be?"

"What kinds of thoughts have been running through your mind recently?"

“What emotion best describes how you’re feeling right now?”

The session concluded with a breathing exercise led by the VR coach to help the participant relax.

After the session, the researcher returned to the lab and guided the participant to complete a post-test survey. This included two manipulation check items: one asked whether the participant perceived the VR coach's ethnicity as matched or unmatched, and another asked whether they believed a human or an AI controlled the coach. The survey then reassessed participants’ emotional state, anxiety, and perceptions of the coach’s warmth and competence. The entire experiment lasted approximately 30 minutes.

3.4 Participants

Participants were asked to fill out demographic questions including their age (numbers only), gender:1 (*Male*), 2 (*Female*), 3 (*Non-binary*), 4 (*A gender not listed here*), 5 (*Prefer not to say*), nationality (*List of countries*), race: 1 (*Black*), 2 (*White*), 3 (*Asian*), 4 (*Other*), religion: 1 (*Buddhism),* 2 (*Christianity*), 3 (*Hinduism*), 4 (*Catholicism*), 5 (*Islam*), 6 (*Free thinker*), 7 (*Agnostic*), 8 (*Atheist*), 9 (*Other*), and level of education: 1 (*Less than high school*), 2 (*High school graduate*), 3 (*Some college*), 4 (*Associate degree (e. g., AA, AS)*), 5 (*Bachelor’s degree (e.g., BA, BS)*), 6 (*Master’s degree [e.g., MA, MS, MBA]*), 7 (*Doctorate [e.g., PhD, EdD]*).

The total number of participants in this study was 151 (70 males, 80 females, and one non-binary individual), aged between 18 and 32 years (M = 21.05, SD = 2.64). All participants were older than 18 years and completed all questions.

Participants came from 38 different nationalities. The majority were from Europe: 40.4% were Dutch, followed by German (8.6%), French (6.0%), Italian (4.0%), Spanish (3.3%), Greek (3.3%), Hungarian (3.3%), Bulgarian (2.6%), Swedish (2.0%), and Polish (2.0%). The remaining 24.5% of participants were from other countries.

Regarding ethnicity, most participants identified as White (82.1%), followed by Asian (9.3%), Other (7.3%), and Black (1.3%).

For religion, the top three groups were atheist (33.1%), Christian (22.5%), and agnostic (13.9%), followed by free thinker (11.3%), Islam (7.3%), Catholicism (6.0%), Other (2.6%), Hinduism (2.0%), and Buddhism (1.3%).

Regarding level of education, all participants obtained at least a high school diploma, which was the largest category of education (54.3%). Followed by bachelor's degree (33.1%), master's degree (11.3%), and some college (1.3%), the demographic details of the participants are presented in Table 3.1 below.

Table 3.1

Participant demographics

Variable	Category	Frequency (n)	Percentage (%)
Age	18 – 25	142	94.0
	26 – 30	8	5.3
	30 above	1	0.7
Gender	Male	70	46.4
	Female	80	53.0
	Non-binary	1	0.7
Race	Black	2	1.3
	White	124	82.1
	Asian	14	9.3
	Other	11	7.3
Religion	Buddhism	2	1.3
	Christianity	34	22.5
	Hinduism	3	2.0
	Catholicism	9	6.0

	Islam	11	7.3
	Free thinker	17	11.3
	Agnostic	21	13.9
	Atheist	50	33.1
	Other	4	2.6
Education	High school graduate	82	54.3
	Some college	2	1.3
	Bachelor's degree	50	33.1
	Master's degree	17	11.3

3.5 Measurements

All measures were adapted from validated scales, as follows.

3.5.1 Perceived Warmth

Perceived warmth was measured using items from the Stereotype Content Model (SCM), originally developed by Fiske et al. (2002, p. 897). The reliability of the scale has been demonstrated, with a reported Cronbach's alpha value of .85 for warmth (Durante et al., 2012, p. 732). The validity of the SCM is supported by theoretical and empirical evidence, which shows that lack of warmth is predicted by perceived competition (Fiske et al., 2002, p. 893).

In the original study, the Stereotype Content Model (SCM) included six items to measure warmth; however, three items were selected for this study. Responses were recorded on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*extremely*). The mean score for perceived warmth was $M = 3.12$, $SD = .85$.

To explore the underlying dimensions of the three items of warmth, a Principal Component Analysis (PCA) was conducted using direct oblimin rotation based on eigenvalues (> 1.00). The Kaiser-Meyer-Olkin value of .70 verified the sampling adequacy for the analysis, as this exceeds the acceptable minimum value of .60. Bartlett's test of Sphericity was significant, $\chi^2(6) = 159.19$, $p < .001$, thereby indicating that the correlations between items were sufficiently large for a PCA. The resultant model consisted of one factor, which explained 73.1% of the variance in warmth. Lastly, the factor loadings and the Cronbach's alpha of the factor are presented in Table 3.2, which exceeds the recommended threshold of .70, revealing adequate reliability and convergent validity of the factors.

Table 3.2

Factor loadings, explained variance, and reliability of the one factor found for the scale 'warmth'

Item	*Warmth*
How "warm" does the coach avatar seem to you?	.89
How "trustworthy" does the coach avatar seem to you?	.85
How "friendly" does the coach avatar seem to you?	.82
R^2	.73
Cronbach's α	.82

3.5.2 Perceived Competence

Perceived competence was measured using items from the Stereotype Content Model (SCM), originally developed by Fiske et al. (2002, p. 897). The reliability of the scales has been demonstrated, with a reported Cronbach's alpha value of .86 for competence (Durante et al., 2012, p. 732). The validity of the SCM is supported by theoretical and empirical evidence, which shows that competence is predicted by perceived status (Fiske et al., 2002, p. 893).

In the original study, the Stereotype Content Model (SCM) included six items to measure competence; however, three items were selected for this study. Responses were recorded on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*extremely*). The mean score for perceived competence was $M = 2.81$, $SD = .86$.

To explore the underlying dimensions of the three items of competence, a Principal Component Analysis (PCA) was also conducted using direct oblimin rotation based on eigenvalues (> 1.00). The Kaiser-Meyer-Olkin value of .65 verified the sampling adequacy for the analysis, as this exceeds the acceptable minimum value of .60. Bartlett's test of Sphericity was significant, $\chi^2(3) = 152.20$, $p < .001$, thereby indicating that the correlations between items were sufficiently large for a PCA. The resultant model consisted of one factor, which explained 70.4% of the variance in competence. Lastly, the factor loadings and Cronbach's alpha of the factor are presented in Table 3.3, which exceeds the recommended threshold of .70, indicating adequate reliability and convergent validity of the factors.

Table 3.3

Factor loadings, explained variance, and reliability of the one factor found for the scale 'competence'

Item	*Competence*
How "capable" does the coach avatar seem to you?	.89
How "competent" does the coach avatar seem to you?	.88
How "confident" does the coach avatar seem to you?	.74
R^2	.70

Cronbach's α	.79

3.5.3 Anxiety

Anxiety was measured using the PROMIS Emotional Distress – Anxiety Short Form developed by Wilford et al. (2018, p. 13). The original scale contains seven items and has demonstrated excellent internal consistency in prior research, with Cronbach's alpha values of .96, .95, and .95 at baseline, 4-month, and 9-month assessments, respectively (Wilford et al., 2018, p. 6). Additionally, convergent validity has been supported through moderate correlations with anxiety T-scores (r = .60–.65), indicating the scale reliably captures anxiety-related experiences.

In this research, five items from the original PROMIS short form were selected to assess participants' anxiety levels before and after the VR coaching session. All items were administered using a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*). Pre-session anxiety was moderate (M = 2.51, SD = .80), and post-session anxiety decreased slightly (M = 2.10, SD = .84).

To verify the reliability and dimensionality of the adapted version in this study, Principal Component Analysis (PCA) was conducted separately for pre- and post-test data. A single-factor structure emerged in both cases, explaining 70.2% of the variance in the pre-test and 69.2% in the post-test. The Kaiser-Meyer-Olkin (KMO) values were .86 (pre-test) and .85 (post-test). Bartlett's tests of Sphericity were significant in both cases, with $\chi^2(10) = 428.96$ for the pre-test and $\chi^2(10) = 422.99$ for the post-test, both at $p < .001$), indicating that the correlations between items were sufficiently large for a PCA.

The Cronbach's alpha for the five-item scale was .89 at both time points, demonstrating strong internal consistency. Factor loadings and reliability statistics of anxiety (pre-test), and anxiety (post-test) are presented in Table 3.4 and Table 3.5, respectively, all of which exceed the recommended threshold of .70, supporting both reliability and convergent validity within the current context.

Table 3.4

Factor loadings, explained variance, and reliability of the one factor found for the scale 'anxiety (pre-test)'

Item	*Anxiety*
In the past 7 days...	
I felt anxious	.89
I found it hard to focus on anything other than my anxiety	.85

I felt tense	.83
I felt worried	.82
I felt uneasy	.81
R^2	.70
Cronbach's α	.89

Table 3.5

Factor loadings, explained variance, and reliability of the one factor found for the scale 'anxiety (post-test)'

Item	*Anxiety*
Right now…	
I felt anxious	.89
I felt tense	.89
I felt worried	.83
I felt uneasy	.79
I found it hard to focus on anything other than my anxiety	.75
R^2	.69
Cronbach's α	.89

3.5.4 Emotion

Emotion was assessed using the Positive and Negative Affect Schedule (PANAS) developed by Watson et al. (1988, p. 1067). The full version of PANAS comprises 20 items, with 10 assessing positive affect (PA) and 10 assessing negative affect (NA). The scale has demonstrated strong psychometric properties in prior studies, with Cronbach's alpha ranging from .86 to .90 for PA and .84 to .87 for NA, indicating high internal consistency reliability. Test-retest correlations over an eight-week period ranged from .47 to .68 for PA and .39 to .71 for NA, indicating that PANAS scales exhibit a significant level of stability in every time frame. PANAS has also shown good external validity with related constructs such as general distress, depression, and state anxiety (Watson et al., 1988, pp. 1065 – 1066).

In this study, three positive affect items (PANAS items 1, 2, and 3) were selected to measure participants' emotional state before and after the VR coaching session. Responses were recorded on a 5-point Likert scale, ranging from 1 (*not at all*) to 5 (*extremely*). Pre-session positive emotion was moderate (M = 3.20, SD = .68), and post-session positive emotion increased slightly (M = 3.35, SD = .74).

A Principal Component Analysis (PCA) with direct oblimin rotation was conducted to

examine the underlying structure of the selected emotion items. The Kaiser-Meyer-Olkin (KMO) values were .62 for the pre-test and .65 for the post-test, exceeding the acceptable minimum of .60 and confirming sampling adequacy. Bartlett's test of Sphericity was significant in both cases, with $\chi^2(3) = 107.86$ for the pre-test and $\chi^2(3) = 116.27$ for the post-test, both at $p < .001$, indicating that the correlations between items were sufficiently large for a PCA.

A single-factor solution was extracted at both time points, accounting for 65.0% of the variance at pre-test and 66.8% at post-test. The Cronbach's alpha values and factor loadings are reported in Table 3.6 (pre-test) and Table 3.7 (post-test), all of which exceeded the .70 threshold, indicating adequate reliability and convergent validity of the emotion scale within this study.

Table 3.6

Factor loadings, explained variance, and reliability of the one factor found for the scale 'positive emotion(pre-test)'

Item	*Emotion*
Please indicate how much you feel this way at this moment	
Determined	.88
Inspired	.82
Attentive	.71
R^2	.65
Cronbach's α	.73

Table 3.7

Factor loadings, explained variance, and reliability of the one factor found for the scale 'positive emotion(post-test)'

Item	*Emotion*
Please indicate how much you feel this way at this moment	
Inspired	.87
Determined	.85
Attentive	.73
R^2	.67
Cronbach's α	.75

3.6 Manipulation check

This study employed a 2 × 2 between-subjects experimental design, manipulating coach

ethnicity match (matched vs. unmatched) and coach type framing (human vs. AI). Participants were randomly assigned to one of the four experimental conditions. The number of participants and the ethnicity breakdown across the four conditions are presented in Table 3.8 below.

Table 3.8

Participant distribution and ethnicity breakdown across experimental conditions

Condition	Number of Participants	Participant Ethnicity	Participant Ethnicity Breakdown	
			Frequency (*N*)	Percentage (%)
Matched ethnicity+ Human	35	Black	1	2.9
		White	34	97.1
Matched ethnicity +AI	39	Black	1	2.6
		White	38	97.4
Unmatched ethnicity + Human	38	White	26	68.4
		Asian	7	18.4
		Other	5	13.2
Unmatched ethnicity + AI	39	White	26	66.7
		Asian	7	17.9
		Other	6	15.4

A manipulation check using a chi-square test revealed that participants' perception of the coach ethnicity match (matched vs. unmatched) was significantly influenced by the assigned condition, $\chi^2(1, N = 151) = 127.95$, $p < .001$. Specifically, 95.9% of participants in the ethnicity-matched condition correctly identified that the coach shared their ethnicity, indicating that the manipulation was successful.

In contrast, a manipulation check using a chi-square test revealed that participants' perception of the coach type (human vs. AI) was not significantly influenced by the assigned condition, $\chi^2(1, N = 151) = 2.04$, $p = .154$. Specifically, only 24.7% of participants in the human condition identified the coach as human, suggesting a failure of the manipulation in that condition.

3.7 Reliability and Validity

To ensure validity, all variables in this study were operationalized using previously validated instruments. A thorough literature review was conducted to confirm that each

measure had been empirically tested and shown to assess the intended construct accurately. The use of such established measures provides greater confidence that the instruments accurately capture the intended constructs, thereby enhancing construct validity.

To ensure reliability, the selected scales have demonstrated Cronbach's alpha values of .70 or higher in the studies where they were originally developed. Furthermore, all procedures used in this research are thoroughly described in the methods section, enabling replication by future researchers and contributing to methodological reliability. No new multidimensional scales were developed for this study; instead, all such measures were adapted from prior research. Minor wording modifications were made to align the items more closely with the context of this study, specifically the use of a VR coach.

3.8 Analytical Approach

Following data collection, data analysis was conducted using SPSS. The dataset was first cleaned and then assessed for internal consistency through reliability analysis on each subscale. To test the proposed hypotheses, a series of quantitative analyses were then conducted.

To test H1, H2, and H3, a two-way ANOVA was conducted with coach ethnicity match (matched vs. unmatched) and coach type framing (human vs. AI) as the independent variables and post-session anxiety as the dependent variable.

To test H1, H2, and H3 in the context of the failed manipulation—where participants' perception of the coach type did not align with the assigned conditions—an additional analysis using ANCOVA was conducted. In this analysis, post-session anxiety was the dependent variable; coach ethnicity match and coach type framing were included as fixed factors, and perceived coach type was included as a covariate.

To test H4, a repeated measures ANOVA was conducted with coach ethnicity match (matched vs. unmatched) and coach type framing (human vs. AI) as between-subjects independent variables, and time (pre-session vs. post-session anxiety) as the within-subjects factor.

To test H5 to H12, multiple regression analyses were conducted to examine the relationships between the independent variables and the dependent variables. In addition, simple linear regression analyses were performed to cross-validate the results of the multiple regressions.

To test H5 and H7 in the context of the failed manipulation, an additional multiple linear regression with a covariate was conducted. In this analysis, warmth was the dependent variable; coach ethnicity match and coach type framing were included as predictors, and

perceived coach type was included as a covariate.

To test H6 and H8 in the context of the failed manipulation, a similar multiple linear regression with a covariate was conducted, with competence as the dependent variable and the same predictors and covariate as described above.

The study's conclusions are based on the outcomes of hypothesis testing, which are presented and interpreted in Chapter 4: Results.

4. Results

This chapter presents the findings from the data analysis. The data were entered into IBM SPSS to perform statistical tests relevant to addressing the hypotheses outlined in Chapter Two. The chapter begins with hypothesis testing.

4.1 Relationship Between Experimental Manipulation and Mental Health State

4.1.1 Two-way ANOVA

To test H1, H2, and H3, a two-way ANOVA was conducted with coach ethnicity match (matched vs. unmatched) and coach type framing (human vs. AI) as the independent variables and post-session anxiety as the dependent variable.

The results showed no significant main effect of coach ethnicity match, $F(1, 147) = .24$, $p = .624$ partial $\eta^2 = .00$, and no significant main effect of coach type framing, $F(1, 147) = .50$, $p = .482$ partial $\eta^2 = .00$. However, there was a significant interaction effect of coach ethnicity match, and coach type framing, $F(1, 147) = 10.45$, $p = .002$ partial $\eta^2 = .07$ (see Table 4.1).

Therefore, H1 and H2 were rejected, while H3 was supported. This indicates significant interaction between coach ethnicity match and coach type framing on post-session anxiety.

Table 4.1

Result of the two-way analysis of variance (N=151)

	Sum of Squares	*df*	Mean Square	*F*	*p*	η^2
Coach ethnicity match	.16	1	.16	.24	.624	.00
Coach type	.33	1	.33	.50	.482	.00
Coach ethnicity match*Coach type	6.95	1	6.95	10.45	.002**	.07
Error	97.72	147	.67			
Total	771.36	151				

Note. *$p < .050$, ** $p < .010$, *** $p < .001$

To further explore this interaction effect, descriptive statistics for each of the four conditions were examined (see Table 4.2). When the VR coach was framed as human, participants reported lower anxiety in the matched ethnicity condition ($M = 1.80$, $SD = .71$) compared to the unmatched condition ($M = 2.29$, $SD = .77$). Conversely, when the coach was framed as AI, participants reported lower anxiety in the unmatched condition ($M = 1.96$, $SD = .82$) than in the matched condition ($M = 2.32$, $SD = .94$). This pattern suggests that ethnicity match has a stronger influence on reducing anxiety when the coach is framed as human, but this effect appears to reverse—or at least diminish—when the coach is framed as AI.

Table 4.2

Mean and standard deviation of post-session anxiety across the four conditions

Coach ethnicity match	Coach type	*M*	*SD*
Matched	Human	1.80	.71
Matched	AI	2.32	.94
Unmatched	Human	2.29	.77
Unmatched	AI	1.96	.82

In summary, the two-way ANOVA revealed a significant interaction effect between coach ethnicity match and coach type on post-session anxiety, although no main effects were found.

4.1.2 Repeated Measures ANOVA

To test H4, a repeated measures ANOVA was conducted with coach ethnicity match (matched vs. unmatched) and coach type framing (human vs. AI) as between-subjects independent variables, and time (pre-session vs. post-session anxiety) as the within-subjects factor. Descriptive statistics indicated that anxiety levels decreased from pre-test to post-test for all groups.

The main effect of time was significant, $F(1, 147) = 52.65$, $p < .001$, partial $\eta^2 = .26$, indicating a significant decrease in anxiety levels from pre-test ($M = 2.51$, $SD = .80$) to post-test ($M = 2.10$, $SD = .84$). However, no significant interaction effect was found between time and coach ethnicity match, $F(1, 147) = .14$, $p = .706$, partial $\eta^2 = .00$, suggesting that anxiety levels did not significantly differ between matched and unmatched groups over time.

Likewise, no significant interaction effect was found between time and coach type framing, $F(1, 147) = .04$, $p = .845$, partial $\eta^2 = .00$, suggesting that anxiety levels did not differ significantly between human and AI coach groups over time. The three-way interaction effect (time× coach ethnicity match× coach type framing) was not significant, $F(1, 147) = 2.71$, $p = .102$, partial $\eta^2 = .02$, suggesting that anxiety levels did not differ significantly between matched ethnicity and unmatched ethnicity groups, human and AI coach groups over time. Therefore, H4 is supported.

In summary, the repeated measures ANOVA revealed a significant main effect of time on reducing participants' anxiety levels, regardless of condition; however, no interaction effects were observed. Although the experimental manipulations did not yield significant main effects, the observed reduction in anxiety over time suggests that the experimental setting had a meaningful psychological impact.

4.1.3 ANCOVA (Additional Analysis to Account for the Manipulation Check Result)

Although the manipulation check revealed that participants' perception of the coach type did not align with the assigned conditions (only 24.7% in the human condition identified the coach as human), the ANCOVA results indicated that their subjective perceptions did not significantly covary with post-session anxiety (p = .852). This suggests that the manipulation failure did not systematically bias the outcome. However, the non-significant main effect of coach type framing may reflect the lack of perceptual differentiation between conditions rather than a true null effect. Notably, the significant interaction between coach ethnicity match and coach type (p = .002) suggests that coach ethnicity match had differential effects on anxiety depending on coach type framing, even in the context of the failed manipulation. Further research with improved manipulations or perceptual checks is needed to clarify these findings.

4.2 Relationship Between Experimental Manipulation and Perception of the VR Coach

4.2.1 Multiple Linear Regression

To test H5 and H7, a multiple linear regression was conducted with warmth as the dependent variable. The predictors were coach ethnicity match and coach type framing. The model was not significant, $F(2, 148) = 1.70$, p = .187, R^2 = .02. The effect of coach ethnicity match on warmth was marginally significant (β =−.15, p = .070), which rejects H5. Furthermore, the effect of coach type framing on warmth was not significant (β = .02, p = .830), which rejects H7. All the values are presented in Table 4.3 as follows.

Table 4.3

Multiple regression analysis to predict warmth

Predictor	Block 1
Coach ethnicity match β	(.15)
Coach type framing β	.02
	R^2 = .02

Note. *p < .050, ** p < .010, *** p < .001

To test H6 and H8, a multiple linear regression was conducted with competence as the dependent variable. Predictors were coach ethnicity match and coach type framing. The model was not significant, $F(2, 148) = 1.39$, p = .251, R^2 = .02. The effect of coach ethnicity match on competence was not significant (β =−.13, p = .104), which rejects H6. Moreover, the effect of coach type framing on competence was not significant (β = −.03, p = .710), which rejects H8. All the values are presented in Table 4.4 as follows.

Table 4.4

Multiple regression analysis to predict competence

Predictor	Block 1
Coach ethnicity match β	(.13)
Coach type framing β	(.03)
	R^2 = .02

Note. *p < .050, ** p < .010, *** p < .001

4.2.2 Multiple Linear Regression with Covariate (Additional Analysis to Account for the Manipulation Check Result)

As previously mentioned, the manipulation of perceived coach type failed. To examine whether this failure affected the relationship between the two experimental manipulations and perceived warmth, a multiple linear regression with a covariate was conducted. Warmth was entered as the dependent variable; coach ethnicity match and coach type framing were entered as predictors; and perceived coach type was included as a covariate.

The overall model was not significant, $F(3, 147) = 1.14$, $p = .334$, $R^2 = .02$, indicating that the model did not explain a significant proportion of variance in warmth. None of the predictors reached statistical significance: coach ethnicity match, $F(1, 147) = 3.32$, $p = .070$; coach type framing, $F(1, 147) = .04$, p = .852; and perceived coach type, $F(1, 147) = .05$, $p = .822$.

These results indicate that neither coach ethnicity match nor coach type framing predicted warmth, thus rejecting H5 and H7. The findings are consistent with the results from the multiple linear regression analysis reported in Section 4.2.1.

Likewise, to examine whether this failed manipulation affected the relationship between the two experimental manipulations and perceived competence, another multiple linear regression with a covariate was conducted. Competence was entered as the dependent variable; coach ethnicity match and coach type framing were entered as predictors; and perceived coach type was included as a covariate.

The overall model was not significant, $F(3, 147) = 1.37$, $p = .254$, $R^2 = .03$, indicating that the model did not explain a significant proportion of variance in warmth. None of the predictors reached statistical significance: coach ethnicity match, $F(1, 147) = 2.72$, $p = .101$; coach type framing, $F(1, 147) = .26$, $p = .615$; and perceived coach type, $F(1, 147) = 1.32$, $p = .252$.

These findings indicate that neither coach ethnicity match nor coach type framing predicted competence, thus rejecting H6 and H8. The findings are consistent with the results from the multiple linear regression analysis reported in Section 4.2.1.

In summary, these analyses suggest that participants' subjective perception of the coach

type did not substantially alter the relationship between the manipulated variables and perceived warmth or competence. Therefore, the failed manipulation did not appear to bias the outcome systematically.

4.2.3 Simple Linear Regression

To test H5, a simple linear regression was conducted with warmth as the dependent variable and coach ethnicity match as the predictor. The model was found to be marginally significant, $F(1, 149) = 3.37$, $p = .068$, $R^2 = .02$. The effect of coach ethnicity match on warmth was also marginally significant ($\beta = -.15$, $p = .068$), which rejects H5. All values are presented in Table 4.5 as follows.

Table 4.5

Simple linear regression analysis to predict warmth

Predictor	Block 1
Coach ethnicity match β	(.15)
	$R^2 = .02$

Note. *$p < .050$, ** $p < .010$, *** $p < .001$

To test H6, a simple linear regression was conducted with competence as the dependent variable and coach ethnicity match as the predictor. The model was not significant, $F(1, 149) = 2.66$, $p = .105$, $R^2 = .02$. The effect of coach ethnicity match on competence was also not significant ($\beta = -.13$, $p = .105$), which rejects H6. All values are presented in Table 4.6 as follows.

Table 4.6

Simple linear regression analysis to predict competence

Predictor	Block 1
Coach ethnicity match β	(.13)
	$R^2 = .02$

Note. *$p < .050$, ** $p < .010$, *** $p < .001$

To test H7, a simple linear regression was conducted with warmth as the dependent variable and coach ethnicity match as the predictor. The model was not significant, $F(1, 149) = .06$, $p = .802$, $R^2 = .00$. The effect of coach type framing on warmth was not significant ($\beta = .02$, $p = .802$), which rejects H7. All the values are presented in Table 4.7 as follows.

Table 4.7

Simple linear regression analysis to predict warmth

Predictor	Block 1

Coach type framing β	.02
	R^2 = .00

Note. *p < .050, ** p < .010, *** p < .001

To test H8, a simple linear regression was conducted with competence as the dependent variable and coach type framing as the predictor. The model was not significant, $F(1, 149) = .11$, $p = .736$, $R^2 = .00$. The effect of coach type framing on competence was not significant ($\beta = -.03$, $p = .736$), which rejects H8. All values are presented in Table 4.8 as follows.

Table 4.8

Simple linear regression analysis to predict competence

Predictor	Block 1
Coach type framing β	(.03)
	R^2 = .00

Note. *p < .050, ** p < .010, *** p < .001

The results of simple linear regression were identical to those of multiple regression.

4.3 Relationship Between Perception of the VR Coach and Mental Health State

To test H9 and H10, a multiple linear regression was conducted with post-session anxiety as the dependent variable. The predictors were warmth and competence. The model was found to be significant, $F(2, 148) = 3.96$, $p = .021$, $R^2 = .05$. However, the effect of warmth on post-session anxiety was not significant ($\beta = -.16$, $p = .193$), which rejects H9. Similarly, the effect of competence on post-session anxiety was not significant ($\beta = -.08$, $p = .482$), which rejects H10. All values are presented in Table 4.9 as follows.

Table 4.9

Multiple regression analysis to post-session anxiety

Predictor	Block 1
Warmth β	(.16)
Competence β	(.08)
	R^2 = .05

Note. *p < .050, ** p < .010, *** p < .001

To test H11 and H12, a multiple linear regression was conducted with post-session positive emotion as the dependent variable. The predictors were warmth and competence. The model was found to be significant, $F(2, 148) = 16.21$, $p < .001$, $R^2 = .18$. Warmth was a significant positive predictor of post-session positive emotion ($\beta = .23$, $p = .040$), thereby supporting H11. Furthermore, competence was also a significant positive predictor of post-

session positive emotion (β = .23, p = .044), which supports H12. All values are presented in Table 4.10 as follows.

Table 4.10

Multiple regression analysis to post-session positive emotion

Predictor	Block 1
Warmth β	.23*
Competence β	.23*
	R^2 = .18

Note. *p < .050, ** p < .010, *** p < .001

The results of the hypothesis tests are presented in Table 4.11.

Table 4.11

Results overview

	Hypothesis	Result
H1	Participants interacting with a VR coach avatar of the same ethnicity will report lower post-coaching session anxiety compared to those interacting with a coach avatar of a different ethnicity.	Rejected
H2	Participants interacting with a VR human coach will report lower post-session anxiety than those interacting with a VR AI coach.	Rejected
H3	The effect of coach ethnicity match (matched vs. unmatched) on post-session anxiety will be moderated by coach type framing (Human vs. AI).	Supported
H4	Participants' anxiety levels will significantly decrease from pre- to post-session, regardless of condition.	Supported
H5	Coach ethnicity match is positively associated with perceived warmth of the VR coach.	Rejected
H6	Coach ethnicity match is positively associated with perceived competence of the VR coach.	Rejected
H7	Coach type framing is positively associated with perceived warmth of the VR coach.	Rejected
H8	Coach type framing is positively associated with perceived competence of the VR coach.	Rejected
H9	Perceived warmth is negatively associated with post-session anxiety.	Rejected
H10	Perceived competence is negatively associated with post-session	Rejected

	anxiety.	
H11	Perceived warmth is positively associated with post-session emotional response.	Supported
H12	Perceived competence is positively associated with post-session emotional response.	Supported

5. Conclusion

This final chapter summarizes the key findings from the previous chapters, answers the research question, and discusses the theoretical and practical implications of the research. The study's limitations and recommendations for future research are also outlined.

5.1 Main Findings

The research question of this thesis is: *"To what extent do coach ethnicity match (matched vs. unmatched) and coach type framing (AI vs. human) impact users' mental health state in a VR coaching setting?"*

The results indicated that there were no main effects of coach ethnicity match (matched vs. unmatched) or coach type framing (AI vs. human) on post-session anxiety. Thus, H1 and H2 were rejected. However, a significant interaction effect between coach ethnicity match and coach type framing was observed, thereby supporting H3. Additionally, a substantial reduction in anxiety over time was found across all conditions, suggesting that the experimental setting had a meaningful psychological impact and provided support for H4.

However, some hypotheses were not supported by the results. Neither coach ethnicity match nor coach type framing had a significant effect on perceived warmth or competence, resulting in the rejection of H5, H6, H7, and H8.

In addition, perceived warmth and competence did not significantly predict post-session anxiety, thus rejecting H9 and H10. However, both were found to be significant positive predictors of post-session positive emotion, supporting H11 and H12.

5.2 Theoretical Implications

5.2.1 Social Identity Theory Supports the Interaction Effect of Coach Ethnicity Match and Coach Type Framing

The interaction effect between coach ethnicity match (matched vs. unmatched) and coach type framing (AI vs. human) on post-session anxiety was found to be significant, supporting the proposition of Social Identity Theory (SIT) that social identity cues are impactful but context-dependent. The results indicate that when the VR coach was framed as human, participants experienced a greater anxiety reduction when the coach's ethnicity matched their own.

According to Social Identity Theory (Tajfel & Turner, 1986, as cited in Meuret et al., 2016, p. 2), individuals tend to categorize others and themselves into ingroups and outgroups, deriving self-esteem from being members of respected ingroups. When individuals perceive others as sharing a social identity, such as ethnicity, they are likely to experience trust, emotional security, and psychological closeness. This ingroup bias enhances the quality of

interpersonal communication and can assist in emotional regulation and support.

In this study, participants in the condition where the VR coach was human-framed and matched in ethnicity reported lower levels of post-session anxiety. This suggests that social identity cues are more psychologically significant when the VR coach is perceived to be socially present, such as a human-framed coach. Human framing likely also enhanced perceptions of authenticity and social closeness, allowing participants to view the coach as a significant social other.

Notably, unlike an AI-framed coach, a human-framed coach was more likely to be considered an ingroup member, especially when combined with common identity cues such as ethnicity. This type of categorization strengthened the social bond between participant and coach, which subsequently supported greater emotional trust and reduced anxiety. Once the coach was specified as an ingroup member of the participant's category, participants were better able to reduce their psychological defenses and respond more openly on an emotional level.

5.2.2 The CASA Theory: Conditional Support for Interaction Effects, Challenge to Main Effects

The significant interaction effect between coach ethnicity match and type framing on post-session anxiety can also be explained through the lens of the Computers Are Social Actors (CASA) theory. This theory posits that when digital agents display human-like social cues—such as voice, facial expressions, or interpersonal behaviors—users respond to them as if they were human social partners.

In this study, participants responded more strongly to social identity cues, specifically, ethnic similarity, only when the coach was presented as human. This suggests that framing the coach as human increases the perceived social presence and credibility of the coach, encouraging participants to follow social scripts and expectations regarding the VR coach. As a result, identity-based cues, such as shared ethnicity, became meaningful, leading to greater trust and reducing anxiety.

Conversely, when the VR coach was presented as an AI, participants likely perceived it as less socially capable and emotionally expressive. This diminished the relevance of shared ethnicity, as participants were less likely to perceive the AI coach as a real social partner. These results are consistent with the CASA theory, which suggests that users' social responses depend on the degree to which they perceive the agent as human-like.

However, the lack of main effects challenges the assumption of CASA that social responses to human-like cues are automatic or universal. While CASA (Reeves & Nass, 1996,

as cited in Lee, 2008, p. 1) argues that humans tend to impose social norms on computers and AI agents when exposed to human-like cues, the current findings suggest that these social reactions may be context-dependent rather than inherent. Specifically, social responses are elicited only when participants perceive the VR coach as human-enough and socially engaging. In the absence of strong social cues or perceived emotional authenticity, participants may have interpreted the AI-framed coach as a tool rather than a relational partner, thereby reducing the salience of social identity cues. In contrast, the human-framed coach appeared to activate higher-level social cognition, including ingroup favoritism based on shared identity.

Taken together, these findings suggest the need to refine the CASA theory by incorporating contextual and identity-based moderators. Surface-level anthropomorphic features alone may not be sufficient to trigger social responses toward the VR coach. Rather, such responses are also shaped by participants' interpretations of the coach's social role, emotional capacity, and interpersonal relevance.

5.2.3 Revisiting the Media Equation and Social Presence: The Limits of Automatic Anthropomorphism

These non-significant direct effects of coach ethnicity match (matched vs. unmatched) and coach type framing (human vs. AI) and on post-session anxiety contradict the predictions of the Media Equation framework (Reeves & Nass, 1996, as cited in Lee, 2008, p. 1), which presumes that individuals have automatic reactions to media and virtual agents akin to their responses to actual social actors. According to this theory, users are likely to anthropomorphize digital agents simply due to their human-like appearance or communicative behavior. However, the present findings suggest that such surface-level cues do not automatically elicit social or emotional responses, particularly in immersive, task-oriented contexts.

This observation aligns with growing evidence in virtual agent research indicating that anthropomorphism is not an inevitable response, but rather one that is conditional and context-dependent. For instance, in contrast to commonly held expectations, Nowak and Biocca (2003, pp. 490 – 491) found that agents with lower levels of anthropomorphism sometimes elicited stronger feelings of social presence and co-presence than more human-like agents—likely because highly anthropomorphic designs create expectations that are not met during interaction. They further demonstrated that users reported no difference in presence regardless of whether they believed they were interacting with a human-controlled avatar or a computer-controlled agent, indicating that how users interact with the agent and the quality of

that interaction are more important than simply whether the agent is labeled as human or AI.

Therefore, the lack of main effects suggests that labeling an agent as "human" or "AI" is insufficient to elicit strong emotional or psychological reactions unless it is accompanied by affective and relational cues that establish trust and presence. These results highlight the need to refine media anthropomorphism theories by incorporating contextual cues and user interpretation, rather than assuming an automatic, uniform social response to all virtual agents.

5.2.4 The Role of Warmth and Competence in Predicting Emotional Outcomes

In this study, the perceived warmth and competence of the VR coach significantly predicted participants' post-session positive emotions, but not their post-session anxiety. This finding aligns with the Stereotype Content Model (SCM), which proposes that people categorize others along two dimensions: warmth and competence. Different combinations of these traits lead to distinct stereotype types that evoke specific emotional responses. Individuals perceived as both warm and competent tend to inspire positive emotions, such as admiration (Cuddy et al., 2008, p. 105). While warmth and competence may also foster trust (Fiske, 2012, p. 14), they may not serve as an immediate mechanism for reducing anxiety.

The findings of the study indicated that the perceived warmth and competence of the VR coach did not significantly reduce participants' anxiety, which contrasts with previous literature, which suggested that users' anxiety may be reduced when they perceive the warmth and competence of the therapists. For example, Festen et al. (2013, as cited in Zafar & Jami, 2016, p. 15) and Zafar and Jami (2016, p. 15) demonstrated that warmth is negatively associated with anxiety. Similarly, Li et al. (Li et al., 2023, pp. 1, 9) stated that capable AI agents may be more effective in reducing anxiety. These discrepancies may indicate that anxiety reduction requires additional or alternative mechanisms beyond warmth and competence.

Moreover, the findings can also be interpreted through the lens of Parasocial Interaction (PSI) theory. According to PSI theory, individuals can form one-sided emotional relationships with media figures—not only TV figures but also virtual figures—based on their perceived interpersonal attributes. In this study, participants may have formed parasocial relationships with the VR coach when it was perceived as warm and competent, resulting in a higher emotional attachment and positive affect. However, while such relational impressions may enhance affective involvement, they are not necessarily sufficient to activate the cognitive or physiological mechanisms required for anxiety reduction. This suggests that parasocial bonding may foster feelings of rapport and trust, but it is not, on its own, an effective

mechanism for relieving anxiety.

5.2.5 Anxiety Reduction Can Occur Through Mechanisms Other Than Warmth and Competence

As mentioned earlier, anxiety reduction can be accomplished through mechanisms other than warmth and competence. A review of recent VR studies highlights several alternative mechanisms that contribute to alleviating anxiety.

First, Tarrant et al. (2018, pp. 1, 11) found that VR meditation significantly decreased anxiety-related brain activity, indicating its therapeutic potential. Such effects may stem from emotional regulation facilitated by mindfulness and immersive environments, rather than the interpersonal traits of a virtual agent. Similarly, Rasouli et al. (2023, p. 2) reported that anxiety reduction, particularly in high-stress situations such as public speaking, can be achieved through interactions with intelligent agents. The benefit may arise from several mechanisms, including the agents' ability to create a safe, nonjudgmental environment for social practice, to personalize support, to provide realistic social cues, and to integrate with traditional therapeutic techniques. These features make intelligent agents particularly well-suited for individuals who experience anxiety driven by fear of negative evaluation in social situations, rather than by perceptions of warmth or competence.

Second, Zeng et al. (2025, p. 2) proposed that Virtual Reality Therapy (VRT) reduces anxiety through several key mechanisms. For instance, it immerses patients in realistic, multisensory virtual environments that help divert attention from anxious thoughts and provide safe, controlled exposure to anxiety-provoking situations. This immersion supports emotional regulation and gradual desensitization, leading to improved anxiety symptoms (Zeng et al., 2025, pp. 2, 9).

Lastly, exposure to nature has been shown to reduce anxiety. Specifically, the design elements were developed based on prior research indicating that both exposure to nature and mindfulness practices can facilitate relaxation and alleviate anxiety. Gorini et al. (2010, as cited in Tarrant et al., 2018, p.2) utilized a nature-based VR experience in their study of Generalized Anxiety Disorder (GAD) and achieved positive outcomes. This aligns with research demonstrating that exposure to nature consistently reduces the stress response, even when nature is depicted through various media, including plants, posters, slides, videos, and more. These changes in the stress response have been measured using various physiological monitoring techniques, including muscle tension, skin conductance, pulse transit time, and cardiac response.

In summary, while the study indicated that warmth and competence can foster positive

emotions, they may not be sufficient for the immediate reduction of anxiety. Instead, alternative mechanisms—such as immersive presence, repeated exposure, mindfulness practices, and nature-based design, as proposed in other literature—play a critical role in alleviating anxiety in virtual contexts.

5.2.6 The Nonsignificant Main Effects of Coach Ethnicity Match and Coach Type Framing: Possible Explanations

Throughout this study, the impact of coach ethnicity matching and coach type framing on anxiety was found to be nonsignificant. This finding may be surprising, especially given earlier research that suggested the effectiveness of racial congruence and perceived humanness on therapeutic outcomes. However, several factors may help explain these results.

First, the immersive nature of virtual reality (VR) environments may reduce the prominence of racial cues compared to face-to-face interactions. In contrast to real-world contexts where physical appearance is more directly noticeable and emotionally significant, VR participants may focus more on task completion and the specific role of the coach than on visual identity cues.

Second, participants may have prioritized the instructional or performance-related aspects of the coaching task over the coach's social identity. This task-oriented mindset could overshadow more nuanced interpersonal dynamics, such as racial similarity or the human-AI distinction.

Third, the characteristics of the sample may have limited the generalizability of these effects. For example, suppose the participants were a homogeneous group (e.g., cultural homogeneity) or had limited experience with interracially mixed or AI agents. In that case, their reactions might not extend to patterns that are more common in more diverse or cross-cultural samples.

These interpretations are consistent with the gaps and inconsistencies noted in previous studies. For instance, Makatchev et al. (2013, pp. 17–18) demonstrated that, despite efforts to embed ethnic cues through robot behaviors and faces, no ethnic homophily effect was observed. This was likely due to the robot's tool-like framing and the functional nature of the task context, which may reduce the salience of social identity features such as race. Likewise, Li et al. (2021, pp. 1529–1530) also implied that the virtual coach's functional roles, such as expert companion, encouragement, and motivation, are the primary drivers of user outcomes. This aligns with my interpretation: In function-centered VR contexts, participants focus on utility and performance rather than social identity cues. Similarly, Barger (2025, p.1) investigated how clients perceive and evaluate the working alliance during a single coaching

session with either an AI coach or a human coach. The results showed no significant differences in participants' ratings of the working alliance between the AI and human coaches, with both receiving moderate to high scores.

Collectively, these factors may explain why, in this VR mental health support coaching experiment, matching coach ethnicity and framing by coach type did not produce significant effects on participants' anxiety levels. The immersive nature of the VR environment, along with the task-oriented aspect of the coaching scenario, may have led participants to focus more on the coach's functional role rather than their social identity attributes.

5.2.7 Theoretical Contributions and Refinements of the Study

This research revealed an interaction between coach ethnicity match and coach type framing affecting participants' anxiety levels. However, neither factor alone significantly reduced anxiety levels. These findings challenge previous assumptions about how human framing and social identity cues influence emotional reactions in virtual environments. Specifically, participants did not experience reduced anxiety simply because a coach was framed as human or matched their ethnicity. This indicates that participants may have been more task-oriented and paid less attention to social identity cues such as race in a VR setting.

Although coach ethnicity match and coach type framing did not significantly affect perceived warmth or competence of the VR coach, warmth and competence themselves were strong predictors of positive emotion. This supports the thesis that relational attributes are more important in predicting emotional outcomes, even when surface-level social identity cues are weaker.

Overall, this study advances existing theory by highlighting the importance of affective and relational traits—such as warmth and competence—in human-agent interaction. It suggests that VR users may rely less on social identity cues and more on perceived interpersonal qualities when evaluating virtual agents.

Furthermore, this study contributes theoretically by integrating social identity and media equation theories with more indirect affective and relational measures. This integration offers deeper insight into how users develop emotional reactions to virtual agents, providing valuable implications for future research and design in human-computer interaction.

5.3 Practical Implications

This study has several practical implications for the design of virtual coaching systems, human-computer interaction, and digital mental health platforms. First, the finding that neither coach ethnicity match nor coach type framing significantly affected user anxiety individually suggests that designers should not rely too heavily on surface-level identity cues to enhance

user experience. Users in task-oriented contexts such as VR coaching seem less concerned about identity-based attributes and more focused on the task itself. Therefore, designers should prioritize seamless task flow and intuitive interactions over identity matching alone.

Second, although social identity factors were not strong predictors of users' emotional responses, the study concluded that perceptions of warmth and competence significantly boosted positive emotions. This highlights the importance of designing virtual agents with interpersonal traits, including professionalism, empathy, and transparency. These relational characteristics may have a greater impact than whether the agent shares the user's ethnicity or is presented as human or AI.

Third, the results indicate a need for adaptive and personalized design strategies. Since various interactive factors can influence emotional responses, designers should explore ways to provide adaptive features—such as adjustable communication styles, tones, or feedback levels—to meet users' preferences, cultural contexts, and usage scenarios.

Finally, these findings have broader implications in mental health, fitness education, and distance learning. Creating virtual agents that integrate warmth and competence can enhance user engagement, yield stronger intervention outcomes, and result in a more positive overall user experience.

5.4 Limitations and Future Research

While this study offers valuable insights into how users respond to virtual coaches that provide different social and relational cues, certain limitations should be acknowledged. First, the study was conducted in a controlled virtual reality (VR) environment with scripted scenarios. This ensured experimental control but may not fully reflect the richness of human-agent communication in real life, where interactions can be more responsive and tailored. Future work might employ more interactive or adaptive training systems to examine the effect of real-time actions on user responses.

Second, the participant sample may limit the generalizability of the findings. Most participants were university students or young adults with limited demographic diversity. Since perceptions of ethnicity, AI, and interpersonal traits can vary across cultures, age groups, and life experiences, future studies should consider more diverse and representative samples, particularly in cross-cultural contexts.

Third, this study focused on short-term emotional outcomes, including anxiety reduction and increased positive emotion. However, user attitudes and behaviors, such as trust, sustained engagement, and long-term emotional impact, may evolve over time. Future research could employ longitudinal designs to investigate how perceptions of virtual agents

evolve over repeated interactions.

Fourth, although coach ethnicity match and coach type framing were used as experimental manipulations, social identity is a multidimensional construct. Future research could examine the impact of other identity factors—such as gender, accent, and age—as well as intersectional identities that may influence human–computer interactions in more nuanced ways.

Lastly, while warmth and competence were the focus of this study's relational model, other affective and communicative traits (e.g., humor, assertiveness, responsiveness) may also shape user experiences. Future research could expand the emotional framework to include a broader range of relational cues, which could provide richer insights for designing emotionally intelligent virtual agents.

In summary, this study lays the groundwork for understanding how identity and relational features influence participants' mental health state in VR contexts. However, future research should aim to enhance real-world applicability, diversify the participant base, and deepen the interactional complexity of virtual agent designs.

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Appendix A: Survey Questionnaire

MA Thesis - Ying-Ju Chou

Survey Flow

Block: Consent (2 Questions)
Standard: Participant ID(Pre) (1 Question)
Standard: Demographic (6 Questions)
Standard: PANAS(pre) (1 Question)
Standard: Affect Grid (pre) (1 Question)
Standard: Anxiety(Pre) (1 Question)
Standard: Self-Concept (pre) (1 Question)
Standard: VR experiment instruction (1 Question)
Standard: Race (1 Question)

BlockRandomizer: 1 - Evenly Present Elements

Standard: Condition 1 Black + Human'' (1 Question)
Standard: Condition 2 Black +AI'' (1 Question)
Standard: Condition 3 White + Human'' (1 Question)
Standard: Condition 4 White + AI'' (1 Question)

Standard: Post test instruction (1 Question)
Standard: Affect Grid (post) (1 Question)
Standard: Manipulation check (2 Questions)
Standard: Self-Concept(Post) (1 Question)
Standard: PANAS(Post) (1 Question)
Standard: Realism (1 Question)
Standard: Similarity (1 Question)
Standard: Anxiety(Post) (1 Question)
Standard: Warmth and competence (1 Question)
Standard: Trust (1 Question)
Standard: Sense of presence (7 Questions)
Standard: BAIT (1 Question)
Standard: feedback (1 Question)
Standard: End (1 Question)

Page Break

Start of Block: Consent

Q1 Dear participant, I am Masters' students Ying-ju Chou working under the supervision of Dr. Vivian Chen and Dr. Jinju Kim at Erasmus University Rotterdam. You are invited to participate in a research study conducted at Erasmus University Rotterdam as part of a Master's thesis in the Media & Business programme. This study investigates how people experience a short mental health coaching session in virtual reality (VR). You will be guided through a simulated environment where you interact with a virtual coach designed to simulate a brief, supportive conversation focused on general well-being. The goal of the research is to better understand how people evaluate and emotionally respond to this type of digital support experience. We are especially interested in how participants perceive and relate to the coach, and how the experience may shape impressions and feelings. Your feedback will help inform how VR might be used for future mental health support tools. Your participation is completely voluntary, and you may withdraw from the study at any time without explanation or consequence. The full study will take approximately 20–25 minutes. **What will you be asked to do?** The study includes these parts: - Part 1: You will begin with a short pre-survey, including demographic questions (e.g., age, gender, cultural background), followed by a brief practice round in VR to get used to the controls and instructions. - Part 2: You will then enter the main VR session, in which you will interact with a virtual mental health coach in a short scenario. - Part 3: After the session, you will complete a post-interaction survey where you'll evaluate your experience and your impressions of the coach. - Short interview with recording (for participants joining the experiment on Monday /Tuesday) -Part 4: You will participate in a short interview, which will be video recorded. **What kind of data is collected?** During this study, the following data will be collected: - General background information (e.g., age, gender, cultural background) - Your interaction choices in VR - Your post-session responses about how you experienced the interaction and evaluated the virtual coach - Measures of your emotional state before and after the session At Erasmus University, we conduct scientific research. We do this to learn, help people, and contribute to society. Since we are an academic institution conducting scientific research, we process your personal data exclusively for research on the basis of public interest. The data retrieved will be treated anonymously and your personal information will be kept strictly confidential. Your privacy will be protected to the maximum extent. No personally identifiable information will be reported in any research product. We are committed to managing and using your responses in accordance with the FAIR principles, ensuring that the data collected is Findable, Accessible, Interoperable, and Reusable. Your data is accessible only by our research team. Your participation is voluntary, and you are free to discontinue your participation at any time. **Contacts and questions** Do you have a complaint or concerns about your privacy? Please email 656209yc@eur.nl , or visit www.autoriteitpersoonsgegevens.nl. (T: 088 - 1805250)Click to write the question text

Q19 Please indicate your decision by selecting one of the options below:

○ Yes, I confirmed that I am 18 years or older, I have read and understood the information above, and I voluntarily agree to participate in this study. (1)

○ No, I do not consent to participate. (2)

Skip To: End of Survey If Please indicate your decision by selecting one of the options below: = No, I do not consent to participate.

End of Block: Consent

Start of Block: Participant ID(Pre)

Q106 What is your participant ID (Number)?

_____

_____

_____

_____

_____

End of Block: Participant ID(Pre)

Start of Block: Demographic

Age How old are you?

_____

_____

_____

_____

_____

Gender What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / third gender (3)
- ○ A gender not listed here (please specify) (4)

_____

- ○ Prefer not to say (5)

Nationality What is your nationality?

▼ Afghanistan (1) ... Zimbabwe (194)

Ethinicity What is your ethnicity?

- ○ White/ Caucasian (1)
- ○ Other (please specify): (5) _____

Religion What is your religion?

- ○ Buddhism (1)
- ○ Christianity (2)
- ○ Hinduism (3)
- ○ Catholicism (4)
- ○ Islam (5)
- ○ Free Thinker (I won't believe something just because a religion says it's true—I need to think it through myself.) (6)
- ○ Agnostic (I'm not sure if gods exist or not.) (7)
- ○ Atheist (I don't believe in any gods.) (8)
- ○ Others (please specify) (9) _____

Education What is the highest level of education you have attained?

- ○ Less than high school (3)
- ○ High school graduate (4)
- ○ Some College (9)
- ○ Associate degree (e. g., AA, AS) (7)
- ○ Bachelor's Degree (e.g., BA, BS) (10)
- ○ Master's Degree (e.g., MA, MS, MBA) (11)
- ○ Doctorate (e.g., PhD, EdD) (12)

End of Block: Demographic

Start of Block: PANAS(pre)

PANAS Please indicate how much you feel this way at this moment.

	Not at all (1)	A little bit (2)	Somewhat (3)	Very much (4)	Extremely (5)
Inspired (1)	○	○	○	○	○
Determined (2)	○	○	○	○	○
Attentive (3)	○	○	○	○	○
Upset (5)	○	○	○	○	○
Ashamed (6)	○	○	○	○	○
Nervous (7)	○	○	○	○	○

End of Block: PANAS(pre)

Start of Block: Affect Grid (pre)

Q1 Given below is a grid with different squares representing different feelings – a sort of 'map' for feelings. **The center of the grid represents a neutral, average, everyday feeling; it is neither positive nor negative**. The further a score is from the center, the more extreme the feeling. Grids to the right (or left) of the "neutral" point represent more pleasant (or less pleasant) feelings. Scores to the top (or bottom) of the "neutral" point represent more arousal (or less arousal). To help, we have labeled the most extreme corners of the scale with descriptors. Using the grid below, please select the **one square** that best describes your **current mood**. To choose a square, hover over the grid and click your mouse button or trackpad. To unselect a square, click it again. Your response can include

only one green checkmark.

	Off (1)	On (2)
1,9 (6)		
2,9 (87)		
3,9 (88)		
4,9 (89)		
5,9 (90)		
6,9 (91)		
7,9 (92)		
8,9 (93)		
9,9 (94)		
1,8 (95)		
2,8 (96)		
3,8 (97)		
4,8 (98)		
5,8 (99)		
6,8 (100)		
1,7 (101)		
1,6 (102)		
1,5 (103)		
7,8 (104)		
8,8 (105)		

9,8 (106)

2,7 (107)

3,7 (108)

4,7 (109)

5,7 (110)

6,7 (111)

7,7 (112)

8,7 (113)

9,7 (114)

2,6 (115)

3,6 (116)

4,6 (117)

5,6 (118)

6,6 (119)

7,6 (120)

8,6 (121)

9,6 (122)

2,5 (123)

3,5 (124)

4,5 (125)

5,5 (126)

6,5 (127)

7,5 (128)

8,5 (129)

9,5 (130)

1,4 (131)

2,4 (132)

3,4 (133)

4,4 (134)

5,4 (135)

6,4 (136)

7,4 (137)

8,4 (138)

9,4 (139)

7,3 (167)

9,3 (168)

8,3 (169)

6,3 (170)

5,3 (171)

4,3 (172)

3,3 (173)

2,3 (174)

1,3 (175)

9,2 (179)

8,2 (180)

7,2 (181)

6,2 (182)

5,2 (183)

4,2 (184)

3,2 (185)

2,2 (186)

1,2 (187)

9,1 (189)

8,1 (190)

7,1 (191)

6,1 (192)

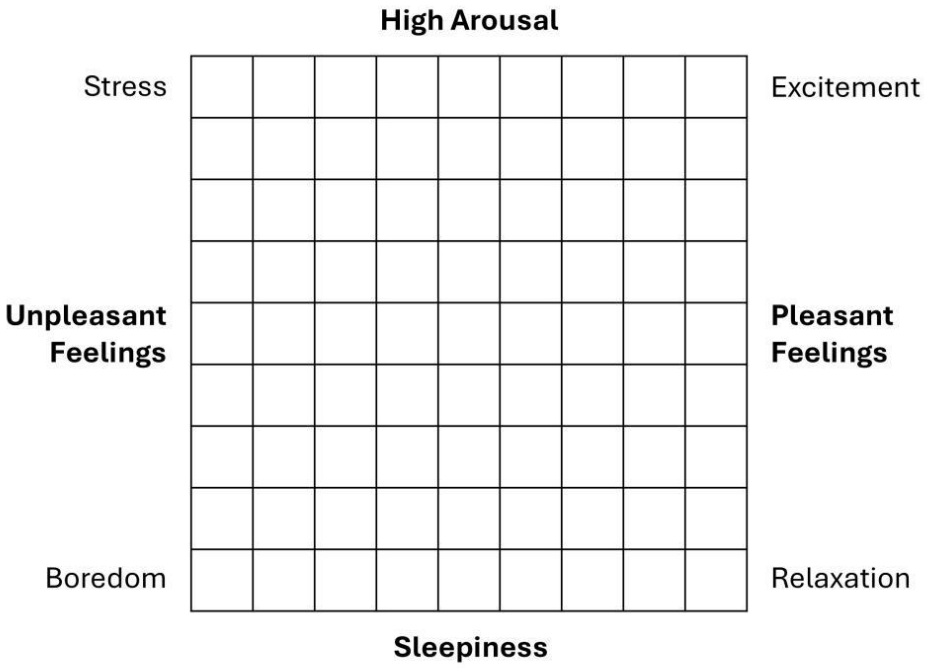
5,1 (193)

4,1 (194)

3,1 (195)

2,1 (196)

1,1 (197)



End of Block: Affect Grid (pre)

Start of Block: Anxiety(Pre)

Q24-Anxiety Please answer the following statements. In the past 7 days...

	1 -Never (1)	2 - Rarely (2)	3 - Sometimes (3)	4 - Often (4)	5 - Always (5)
I felt worried (3)	○	○	○	○	○
I found it hard to focus on anything other than my anxiety (4)	○	○	○	○	○
I felt anxious (5)	○	○	○	○	○
I felt uneasy (6)	○	○	○	○	○
I felt tense (7)	○	○	○	○	○

End of Block: Anxiety(Pre)

Start of Block: Self-Concept (pre)

Q103 Please indicate how much you agree with the following statements.

	1 — Strongly disagree (1)	2 — Disagree (2)	3— Neutral (3)	4 — Agree (4)	5 — Strongly agree (5)
Overall, I have a lot of respect for myself. (1)	○	○	○	○	○
Overall, I lack self-confidence. (2)	○	○	○	○	○
Overall, I am pretty accepting of myself. (3)	○	○	○	○	○
Overall, I don’t have much respect for myself. (4)	○	○	○	○	○
Overall, I have a lot of self-confidence. (5)	○	○	○	○	○
Overall, I have a very good self-concept. (6)	○	○	○	○	○
Overall, I have pretty positive feelings about myself. (7)	○	○	○	○	○
Overall, nothing that I do is very important. (8)	○	○	○	○	○

End of Block: Self-Concept (pre)

Start of Block: VR experiment instruction

Q21 You're now ready to begin Part 2 of the study. In this next part, you will enter a virtual environment and interact with a virtual mental health coach. Before entering the VR world please follow the instructions on the next screen carefully.

End of Block: VR experiment instruction

Start of Block: Race

Q139 What is your race?

- ○ Black (1)
- ○ White/ Caucasian (2)
- ○ Asian(East/ South) (3)
- ○ Others (4)

End of Block: Race

Start of Block: Condition 1 Black + Human''

Q144 This is Alex, an avatar **controlled by a certified and experienced life coach** trained in cognitive-behavioral therapy techniques. You will meet him during the virtual session. Please take a moment to observe the avatar.(Stay on the page and let the researcher know you're ready.) Please inform the research that you are ready to enter the VR environment. Wait for the researcher's instructions before putting on the VR headset. They will guide you through the process.

End of Block: Condition 1 Black + Human''

Start of Block: Condition 2 Black +AI''

Q145 This is MindWell AI, an avatar coach **powered by an advanced language model** trained in cognitive-behavioral therapy techniques. You will meet it during the virtual session. Please take a moment to observe the avatar. (Stay on the page and let the researcher know you're ready.) Please inform the research that you are ready to enter the VR environment. Wait for the researcher's instructions before putting on the VR headset. They will guide you through the process.

End of Block: Condition 2 Black +AI''

Start of Block: Condition 3 White + Human''

Q146 This is Alex, an avatar **controlled by a certified and experienced life coach** trained in cognitive-behavioral therapy techniques. You will meet him during the virtual session. Please take a moment to observe the avatar.(Stay on the page and let the researcher know you're ready.) Please inform the research that you are ready to enter the VR environment. Wait for the researcher's instructions before putting on the VR headset. They will guide you through the process.

End of Block: Condition 3 White + Human''

Start of Block: Condition 4 White + AI''

Q147 This is MindWell AI, an avatar coach **powered by an advanced language model** trained in cognitive-behavioral therapy techniques. You will meet it during the virtual session. Please take a moment to observe the avatar.(Stay on the page and let the researcher know you're ready.) Please inform the research that you are ready to enter the VR environment. Wait for the researcher's instructions before putting on the VR headset. They will guide you through the process.

End of Block: Condition 4 White + AI''

Start of Block: Post test instruction

Q1 Now that you have completed your virtual session, in this final part we'd like to ask you a few questions about your experiences. If you're ready, click Next to begin.

End of Block: Post test instruction

Start of Block: Affect Grid (post)

Q2 Given below is a grid with different squares representing different feelings – a sort of 'map' for feelings. **The center of the grid represents a neutral, average, everyday feeling; it is neither positive nor negative**. The further a score is from the center, the more extreme the feeling. Grids to the right (or left) of the "neutral" point represent more pleasant (or less pleasant) feelings. Scores to the top (or bottom) of the "neutral" point represent more arousal (or less arousal). To help, we have labeled the most extreme corners of the scale with descriptors. Using the grid below, please select the **one square** that best describes your **current mood**. To choose a square, hover over the grid and click your mouse button or trackpad. To unselect a square, click it again. Your response can include

only one green checkmark.

	Off (1)	On (2)
1,9 (6)		
2,9 (87)		
3,9 (88)		
4,9 (89)		
5,9 (90)		
6,9 (91)		
7,9 (92)		
8,9 (93)		
9,9 (94)		
1,8 (95)		
2,8 (96)		
3,8 (97)		
4,8 (98)		
5,8 (99)		
6,8 (100)		
1,7 (101)		
1,6 (102)		
1,5 (103)		
7,8 (104)		
8,8 (105)		

9,8 (106)

2,7 (107)

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4,7 (109)

5,7 (110)

6,7 (111)

7,7 (112)

8,7 (113)

9,7 (114)

2,6 (115)

3,6 (116)

4,6 (117)

5,6 (118)

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7,6 (120)

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4,4 (134)

5,4 (135)

6,4 (136)

7,4 (137)

8,4 (138)

9,4 (139)

7,3 (167)

9,3 (168)

8,3 (169)

6,3 (170)

5,3 (171)

4,3 (172)

3,3 (173)

2,3 (174)

1,3 (175)

9,2 (179)

8,2 (180)

7,2 (181)

6,2 (182)

5,2 (183)

4,2 (184)

3,2 (185)

2,2 (186)

1,2 (187)

9,1 (189)

8,1 (190)

7,1 (191)

6,1 (192)

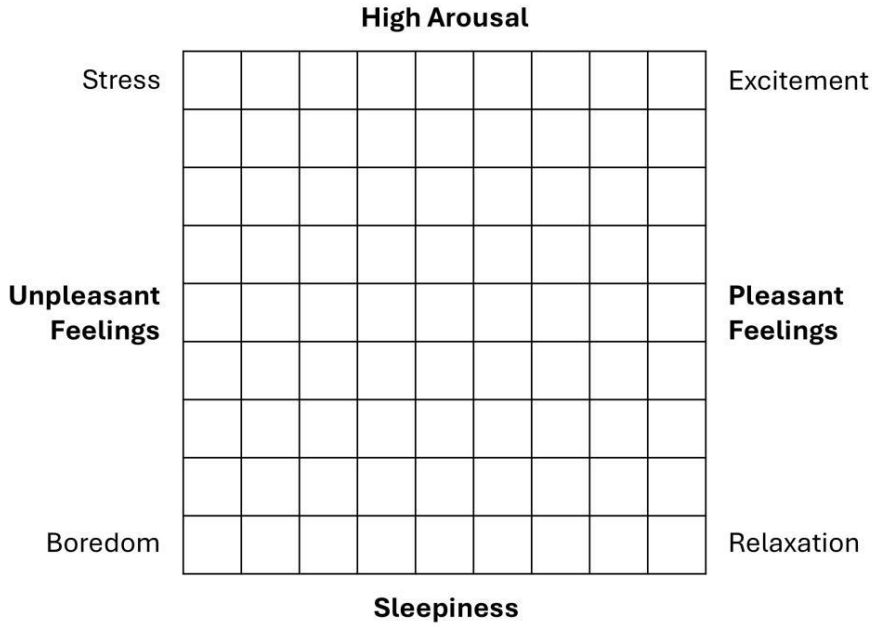
5,1 (193)

4,1 (194)

3,1 (195)

2,1 (196)

1,1 (197)



End of Block: Affect Grid (post)

Start of Block: Manipulation check

Q1 Does the coach avatar appear to be of the same or a different ethnicity as you?

- ○ Same ethnicity (1)
- ○ Different ethnicity (2)

Q2 Do you think the VR coach was operated by a human or an AI language model?

- ○ Human (1)
- ○ AI (2)

End of Block: Manipulation check

Start of Block: Self-Concept(Post)

Q1 Please indicate how much you agree with the following statements after the coaching session.

	1 — Strongly disagree (1)	2 — Disagree (2)	3— Neutral (3)	4 — Agree (4)	5 — Strongly agree (5)
Overall, I have a lot of respect for myself. (1)	○	○	○	○	○
Overall, I lack self-confidence. (2)	○	○	○	○	○
Overall, I am pretty accepting of myself. (3)	○	○	○	○	○
Overall, I don’t have much respect for myself. (4)	○	○	○	○	○
Overall, I have a lot of self-confidence. (5)	○	○	○	○	○
Overall, I have a very good self-concept. (6)	○	○	○	○	○
Overall, I have pretty positive feelings about myself. (7)	○	○	○	○	○
Overall, nothing that I do is very important. (8)	○	○	○	○	○

End of Block: Self-Concept(Post)

Start of Block: PANAS(Post)

Q1 Please rate how much you feel this way **right now**.

	1 -Not at all (1)	2- A little bit (2)	3- Somewhat (3)	4- Very much (4)	5- Extremely (5)
Inspired (1)	○	○	○	○	○
Determined (2)	○	○	○	○	○
Attentive (3)	○	○	○	○	○
Upset (5)	○	○	○	○	○
Ashamed (6)	○	○	○	○	○
Nervous (7)	○	○	○	○	○

End of Block: PANAS(Post)

Start of Block: Realism

Q1 Please indicate how much you agree with the following statements

	1 — Strongly disagree (1)	2 — Disagree (2)	3 — Neutral (3)	4 — Agree (4)	5 — Strongly agree (5)
The "posture" of the coach avatar was natural. (1)	○	○	○	○	○
The "behavior" of the coach avatar in the mental coach scenario was authentic. (2)	○	○	○	○	○
The "facial expressions" of the coach avatar were realistic. (3)	○	○	○	○	○
The "outfit" of the coach avatar appeared "natural". (5)	○	○	○	○	○

End of Block: Realism

Start of Block: Similarity

Q1 Please indicate how much you agree with the following statements.

	1 — Strongly disagree (1)	2 — Disagree (2)	3 — Neutral (3)	4 — Agree (4)	5 — Strongly agree (5)
The coach avatar is similar to me. (1)	○	○	○	○	○
The coach avatar and I are alike (2)	○	○	○	○	○
The coach avatar is someone like me. (3)	○	○	○	○	○
The coach avatar is similar to a friend of mine. (4)	○	○	○	○	○

End of Block: Similarity

Start of Block: Anxiety(Post)

Q1 Please respond to the following statements based on how you feel **right now**.

	1 — Strongly disagree (1)	2 — Disagree (2)	3— Neutral (3)	4 — Agree (4)	5 — Strongly agree (5)
I feel worried (3)	○	○	○	○	○
I find it hard to focus on anything other than my anxiety (4)	○	○	○	○	○
I feel anxious (5)	○	○	○	○	○
I feel uneasy (6)	○	○	○	○	○
I feel tense (7)	○	○	○	○	○

End of Block: Anxiety(Post)

Start of Block: Warmth and competence

Q1 Please answer the following questions.

	1 —Not at all (1)	2—Slightly (2)	3—Moderately (3)	4—Very (4)	5—Extremely (5)
How "friendly" does the coach avatar seem to you? (1)	○	○	○	○	○
How "warm" does the coach avatar seem to you? (2)	○	○	○	○	○
How "trustworthy" does the coach avatar seem to you? (3)	○	○	○	○	○
How "competent" does the coach avatar seem to you? (5)	○	○	○	○	○
How "confident" does the coach avatar seem to you? (6)	○	○	○	○	○
How "capable" does the coach avatar seem to you? (7)	○	○	○	○	○

End of Block: Warmth and competence

Start of Block: Trust

Q1 Please indicate how much you agree with the following statements.

	1 — Strongly disagree (1)	2 — Disagree (2)	3— Neutral (3)	4 — Agree (4)	5 — Strongly agree (5)
The coach avatar displays "integrity". (1)	○	○	○	○	○
The coach avatar is "dependable". (2)	○	○	○	○	○
The coach avatar is "reliable". (3)	○	○	○	○	○
I can "trust" the coach avatar. (4)	○	○	○	○	○

End of Block: Trust

Start of Block: Sense of presence

Q1 In the Virtual Reality environment I had a sense of "being there"

- ○ 1 —Not at all (1)
- ○ 2—Slightly (2)
- ○ 3—Moderately (3)
- ○ 4—Very (4)
- ○ 5—Extremely (5)

Q2 How aware were you of the real world surrounding while navigating in In the Virtual Reality environment? (i.e. sounds...)

- ○ 1 —Not at all (1)
- ○ 2—Slightly (2)
- ○ 3—Moderately (3)
- ○ 4—Very (4)
- ○ 5—Extremely (5)

Q3 I still paid attention to the real environment.

- ○ 1 — Strongly disagree (1)
- ○ 2 — disagree (2)
- ○ 3— Neutral (3)
- ○ 4 — Agree (4)
- ○ 5— Strongly agree (5)

Q4 How real did the Virtual Reality environment seem to you?

- ○ 1 —Not at all (1)
- ○ 2—Slightly (2)
- ○ 3—Moderately (3)
- ○ 4—Very (4)
- ○ 5—Extremely (5)

Q5 How much did your experience in In the Virtual Reality environment seem consistent with your

real world experience?

- ○ 1 —Not at all (1)
- ○ 2—Slightly (2)
- ○ 3—Moderately (3)
- ○ 4—Very (4)
- ○ 5—Extremely (5)

Q6 I did not feel present in In the Virtual Reality environment.

- ○ 1 — Strongly disagree (1)
- ○ 2 — disagree (2)
- ○ 3— Neutral (3)
- ○ 4 — Agree (4)
- ○ 5— Strongly agree (5)

Q7 I had a sense of acting in In the Virtual Reality environment rather than operating something from

outside.

- ○ 1 — Strongly disagree (1)
- ○ 2 — disagree (2)
- ○ 3— Neutral (3)
- ○ 4 — Agree (4)
- ○ 5— Strongly agree (5)

End of Block: Sense of presence

Start of Block: BAIT

JS

Q1 Click the link below for the next question. Do not close the current questionnaire window. After you complete the questions on Otree, you will come back to this questionnaire again. Go to Otree

End of Block: BAIT

Start of Block: feedback

Q1 Do you have any feedback about this study?

_____

_____

_____

_____

_____

End of Block: feedback

Start of Block: End

Q1 Thank you for your participation. This study aims to explore how people behave in a Virtual Reality environment, specifically whether their reactions differ depending on the coach's ethnicity (same or different) and whether the coach is framed as a human or an AI. If you have any questions, please feel free to contact me, Ying-Ju Chou, via email 656209yc@eur.nl

End of Block: End

Appendix B: SPSS Output

Confirmatory factor analysis –warmth

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.697
Bartlett's Test of Sphericity	Approx. Chi-Square	159.193
	df	3
	Sig.	<.001

Reliability Statistics

Cronbach's Alpha	N of Items
.815	3

Item Statistics

	Mean	Std. Deviation	N
Warmth_1	3.57	.898	151
Warmth_2	2.97	1.023	151
Warmth_3	2.83	1.048	151

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Warmth_1	5.80	3.560	.618	.795
Warmth_2	6.40	2.882	.730	.678
Warmth_3	6.54	2.970	.662	.753

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
9.37	6.462	2.542	3

Reliability Statistics

Cronbach's Alpha	N of Items
.815	3

Confirmatory factor analysis –competence

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.652
Bartlett's Test of Sphericity	Approx. Chi-Square	152.200
	df	3
	Sig.	<.001

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.113	70.419	70.419	2.113	70.419	70.419
2	.609	20.311	90.730			
3	.278	9.270	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component 1
Competency_3	.892
Competency_1	.875
Competency_2	.743

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Reliability Statistics

Cronbach's Alpha	N of Items
.789	3

Confirmatory factor analysis –anxiety (pre-session)

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.856
Bartlett's Test of Sphericity	Approx. Chi-Square	428.958
	df	10
	Sig.	<.001

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.512	70.237	70.237	3.512	70.237	70.237
2	.547	10.931	81.168			
3	.388	7.755	88.923			
4	.335	6.698	95.621			
5	.219	4.379	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component 1
AnxietyPre_3	.892
AnxietyPre_2	.847
AnxietyPre_5	.825
AnxietyPre_1	.817
AnxietyPre_4	.807

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Reliability Statistics

Cronbach's Alpha	N of Items
.893	5

Confirmatory factor analysis –anxiety (post-session)

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.854
Bartlett's Test of Sphericity	Approx. Chi-Square	422.992
	df	10
	Sig.	<.001

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.462	69.248	69.248	3.462	69.248	69.248
2	.533	10.653	79.901			
3	.485	9.696	89.597			
4	.324	6.479	96.076			
5	.196	3.924	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component 1
AnxietyPost_3	.893
AnxietyPost_5	.886
AnxietyPost_1	.828
AnxietyPost_4	.793
AnxietyPost_2	.752

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Reliability Statistics

Cronbach's Alpha	N of Items
.889	5

Confirmatory factor analysis –positive emotion (pre-session)

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.615
Bartlett's Test of Sphericity	Approx. Chi-Square	107.855
	df	3
	Sig.	<.001

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.949	64.977	64.977	1.949	64.977	64.977
2	.697	23.235	88.212			
3	.354	11.788	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component 1
PANASPre_2	.880
PANASPre_1	.823
PANASPre_3	.705

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Reliability Statistics

Cronbach's Alpha	N of Items
.729	3

Confirmatory factor analysis –emotion (post-session)

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.648
Bartlett's Test of Sphericity	Approx. Chi-Square	116.273
	df	3
	Sig.	<.001

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.004	66.789	66.789	2.004	66.789	66.789
2	.641	21.374	88.163			
3	.355	11.837	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component 1
PANASPost_1	.870
PANASPost_2	.845
PANASPost_3	.730

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

a. Only one component was extracted. The solution cannot be rotated.

Reliability Statistics

Cronbach's Alpha	N of Items
.751	3

Two-way ANOVA

IV: dummy code coach ethnicity match, and dummy code coach type framing

DV: anxiety (post-session)

Univariate Analysis of Variance

Between-Subjects Factors

			N
dummy code ethnicity match	.00	different	77
	1.00	same	74
dummycode coach type	.00	AI	78
	1.00	Human	73

Descriptive Statistics

Dependent Variable: Anxiety Post Mean

dummy code ethnicity match	dummycode coach type	Mean	Std. Deviation	N
.00 different	.00 AI	1.9590	.81587	39
	1.00 Human	2.2947	.77213	38
	Total	2.1247	.80723	77
1.00 same	.00 AI	2.3231	.93653	39
	1.00 Human	1.8000	.70794	35
	Total	2.0757	.87128	74
Total	.00 AI	2.1410	.89158	78
	1.00 Human	2.0575	.77780	73
	Total	2.1007	.83678	151

Tests of Between-Subjects Effects

Dependent Variable: Anxiety Post Mean

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7.307[a]	3	2.436	3.664	.014	.070
Intercept	660.931	1	660.931	994.212	<.001	.871
dummyeth	.161	1	.161	.242	.624	.002
dumcoaty	.330	1	.330	.497	.482	.003
dummyeth * dumcoaty	6.947	1	6.947	10.451	.002	.066
Error	97.723	147	.665			
Total	771.360	151				
Corrected Total	105.030	150				

a. R Squared = .070 (Adjusted R Squared = .051)

Repeated Measures ANOVA

IV: dummy code coach ethnicity match, and dummy code coach type framing

DV:

Time 1: anxiety(pre-session)

Time 2: anxiety(post-session)

Descriptive Statistics

	dummy code ethnicity match	dummycode coach type	Mean	Std. Deviation	N
AnxietyPreMean	Different	AI	2.4769	.73070	39
		Human	2.6474	.78971	38
		Total	2.5610	.76022	77
	Same	AI	2.6103	.97111	39
		Human	2.2971	.65865	35
		Total	2.4622	.84719	74
	Total	AI	2.5436	.85639	78
		Human	2.4795	.74591	73
		Total	2.5126	.80285	151
Anxiety Post Mean	Different	AI	1.9590	.81587	39
		Human	2.2947	.77213	38
		Total	2.1247	.80723	77
	Same	AI	2.3231	.93653	39
		Human	1.8000	.70794	35
		Total	2.0757	.87128	74
	Total	AI	2.1410	.89158	78
		Human	2.0575	.77780	73
		Total	2.1007	.83678	151

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	12.898	1	12.898	52.647	<.001	.264
	Greenhouse-Geisser	12.898	1.000	12.898	52.647	<.001	.264
	Huynh-Feldt	12.898	1.000	12.898	52.647	<.001	.264
	Lower-bound	12.898	1.000	12.898	52.647	<.001	.264
time * dummyeth	Sphericity Assumed	.035	1	.035	.143	.706	.001
	Greenhouse-Geisser	.035	1.000	.035	.143	.706	.001
	Huynh-Feldt	.035	1.000	.035	.143	.706	.001
	Lower-bound	.035	1.000	.035	.143	.706	.001
time * dumcoaty	Sphericity Assumed	.009	1	.009	.038	.845	.000
	Greenhouse-Geisser	.009	1.000	.009	.038	.845	.000
	Huynh-Feldt	.009	1.000	.009	.038	.845	.000
	Lower-bound	.009	1.000	.009	.038	.845	.000
time * dummyeth * dumcoaty	Sphericity Assumed	.663	1	.663	2.707	.102	.018
	Greenhouse-Geisser	.663	1.000	.663	2.707	.102	.018
	Huynh-Feldt	.663	1.000	.663	2.707	.102	.018
	Lower-bound	.663	1.000	.663	2.707	.102	.018
Error(time)	Sphericity Assumed	36.013	147	.245			
	Greenhouse-Geisser	36.013	147.000	.245			
	Huynh-Feldt	36.013	147.000	.245			
	Lower-bound	36.013	147.000	.245			

Repeated Measures ANOVA

IV: dummy code coach ethnicity match, and dummy code coach type framing

DV

Time 1: positive emotion(pre-session)

Time 2: positive emotion(post-session)

Descriptive Statistics

	dummy code ethnicity match	dummycode coach type	Mean	Std. Deviation	N
PositiveEmotionPreMean	0 Different	0 AI	2.9829	.68803	39
		1 Human	3.2368	.68404	38
		Total	3.1082	.69341	77
	1 Same	0 AI	3.2991	.70418	39
		1 Human	3.3048	.60699	35
		Total	3.3018	.65554	74
	Total	0 AI	3.1410	.70969	78
		1 Human	3.2694	.64468	73
		Total	3.2031	.67984	151
Positive Emotion Post Mean	0 Different	0 AI	3.2821	.71549	39
		1 Human	3.3070	.81052	38
		Total	3.2944	.75891	77
	1 Same	0 AI	3.4701	.66543	39
		1 Human	3.3238	.78585	35
		Total	3.4009	.72355	74
	Total	0 AI	3.3761	.69290	78
		1 Human	3.3151	.79328	73
		Total	3.3466	.74125	151

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	1.473	1	1.473	7.094	.009	.046
	Greenhouse-Geisser	1.473	1.000	1.473	7.094	.009	.046
	Huynh-Feldt	1.473	1.000	1.473	7.094	.009	.046
	Lower-bound	1.473	1.000	1.473	7.094	.009	.046
time * dummyeth	Sphericity Assumed	.151	1	.151	.729	.395	.005
	Greenhouse-Geisser	.151	1.000	.151	.729	.395	.005
	Huynh-Feldt	.151	1.000	.151	.729	.395	.005
	Lower-bound	.151	1.000	.151	.729	.395	.005
time * dumcoaty	Sphericity Assumed	.683	1	.683	3.289	.072	.022
	Greenhouse-Geisser	.683	1.000	.683	3.289	.072	.022
	Huynh-Feldt	.683	1.000	.683	3.289	.072	.022
	Lower-bound	.683	1.000	.683	3.289	.072	.022
time * dummyeth * dumcoaty	Sphericity Assumed	.028	1	.028	.135	.714	.001
	Greenhouse-Geisser	.028	1.000	.028	.135	.714	.001
	Huynh-Feldt	.028	1.000	.028	.135	.714	.001
	Lower-bound	.028	1.000	.028	.135	.714	.001
Error(time)	Sphericity Assumed	30.530	147	.208			
	Greenhouse-Geisser	30.530	147.000	.208			
	Huynh-Feldt	30.530	147.000	.208			
	Lower-bound	30.530	147.000	.208			

Multiple Regression

IV: dummy code coach ethnicity match, and dummy code coach type framing

DV: warmth

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	dummy_coachtype, dummy_ethnicitymatch[b]	.	Enter

a. Dependent Variable: Warmth Mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.150[a]	.022	.009	.84341	.022	1.698	2	148	.187

a. Predictors: (Constant), dummy_coachtype, dummy_ethnicitymatch

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.415	2	1.208	1.698	.187[b]
	Residual	105.277	148	.711		
	Total	107.692	150			

a. Dependent Variable: Warmth Mean

b. Predictors: (Constant), dummy_coachtype, dummy_ethnicitymatch

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.232	.118		27.480	<.001
	dummy_ethnicitymatch	-.251	.137	-.148	-1.825	.070
	dummy_coachtype	.030	.137	.017	.215	.830

a. Dependent Variable: Warmth Mean

Multiple Regression

IV: dummy code coach ethnicity match, and dummy code coach type framing

DV: competence

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	dummy_coachtype, dummy_ethnicitymatch[b]	.	Enter

a. Dependent Variable: Competence Mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.136[a]	.018	.005	.86153	.018	1.393	2	148	.251

a. Predictors: (Constant), dummy_coachtype, dummy_ethnicitymatch

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.069	2	1.034	1.393	.251[b]
	Residual	109.850	148	.742		
	Total	111.919	150			

a. Dependent Variable: Competence Mean

b. Predictors: (Constant), dummy_coachtype, dummy_ethnicitymatch

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.952	.120		24.572	<.001
	dummy_ethnicitymatch	-.229	.140	-.133	-1.634	.104
	dummy_coachtype	-.052	.140	-.030	-.373	.710

a. Dependent Variable: Competence Mean

Simple Linear Regression

IV: dummy code ethnicity match

DV: warmth

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	dummy code ethnicity match[b]	.	Enter

a. Dependent Variable: Warmth Mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.149[a]	.022	.016	.84070	.022	3.371	1	149	.068

a. Predictors: (Constant), dummy code ethnicity match

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.382	1	2.382	3.371	.068[b]
	Residual	105.310	149	.707		
	Total	107.692	150			

a. Dependent Variable: Warmth Mean

b. Predictors: (Constant), dummy code ethnicity match

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.247	.096		33.889	<.001
	dummy code ethnicity match	-.251	.137	-.149	-1.836	.068

a. Dependent Variable: Warmth Mean

Simple Linear Regression

IV: dummy code coach ethnicity match

DV: competence

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	dummy code ethnicity match[b]	.	Enter

a. Dependent Variable: Competence Mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.133[a]	.018	.011	.85904	.018	2.663	1	149	.105

a. Predictors: (Constant), dummy code ethnicity match

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.965	1	1.965	2.663	.105[b]
	Residual	109.954	149	.738		
	Total	111.919	150			

a. Dependent Variable: Competence Mean

b. Predictors: (Constant), dummy code ethnicity match

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.926	.098		29.893	<.001
	dummy code ethnicity match	-.228	.140	-.133	-1.632	.105

a. Dependent Variable: Competence Mean

Simple Linear Regression

IV: dummy code coach type framing

DV: warmth

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	dummycode coach type[b]	.	Enter

a. Dependent Variable: Warmth Mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.021[a]	.000	-.006	.84998	.000	.063	1	149	.802

a. Predictors: (Constant), dummycode coach type

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.045	1	.045	.063	.802[b]
	Residual	107.647	149	.722		
	Total	107.692	150			

a. Dependent Variable: Warmth Mean

b. Predictors: (Constant), dummycode coach type

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.107	.096		32.282	<.001
	dummycode coach type	.035	.138	.021	.251	.802

a. Dependent Variable: Warmth Mean

Simple Linear Regression

IV: dummy code coach type framing

DV: competence

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	dummycode coach type[b]	.	Enter

a. Dependent Variable: Competence Mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.028[a]	.001	-.006	.86635	.001	.114	1	149	.736

a. Predictors: (Constant), dummycode coach type

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.086	1	.086	.114	.736[b]
	Residual	111.833	149	.751		
	Total	111.919	150			

a. Dependent Variable: Competence Mean

b. Predictors: (Constant), dummycode coach type

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.838	.098		28.927	<.001
	dummycode coach type	-.048	.141	-.028	-.338	.736

a. Dependent Variable: Competence Mean

Multiple Linear Regression

IV: competence and warmth

DV: anxiety (post-session)

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Competence Mean, Warmth Mean[b]	.	Enter

a. Dependent Variable: Anxiety Post Mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
					R Square Change	F Change	df1	df2	Sig. F Change
1	.225[a]	.051	.038	.82073	.051	3.963	2	148	.021

a. Predictors: (Constant), Competence Mean, Warmth Mean

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.339	2	2.669	3.963	.021[b]
	Residual	99.691	148	.674		
	Total	105.030	150			

a. Dependent Variable: Anxiety Post Mean

b. Predictors: (Constant), Competence Mean, Warmth Mean

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.811	.261		10.760	<.001
	Warmth Mean	-.154	.118	-.156	-1.307	.193
	Competence Mean	-.082	.116	-.084	-.706	.482

a. Dependent Variable: Anxiety Post Mean

Multiple Linear Regression

IV: competence and warmth

DV: positive emotion (post-session)

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Competence Mean, Warmth Mean[b]	.	Enter

a. Dependent Variable: Positive Emotion Post Mean

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.424[a]	.180	.169	.67590	.180	16.205	2	148	<.001

a. Predictors: (Constant), Competence Mean, Warmth Mean

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.806	2	7.403	16.205	<.001[b]
	Residual	67.612	148	.457		
	Total	82.418	150			

a. Dependent Variable: Positive Emotion Post Mean

b. Predictors: (Constant), Competence Mean, Warmth Mean

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.177	.215		10.117	<.001
	Warmth Mean	.201	.097	.229	2.068	.040
	Competence Mean	.193	.095	.225	2.029	.044

a. Dependent Variable: Positive Emotion Post Mean

Participant demographics

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
How old are you?	151	18	32	21.05	2.638
Valid N (listwise)	151				

What is your gender? - Selected Choice

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	70	46.4	46.4	46.4
	Female	80	53.0	53.0	99.3
	Non-binary / third gender	1	.7	.7	100.0
	Total	151	100.0	100.0	

What is your race?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Black	2	1.3	1.3	1.3
	White/ Caucasian	124	82.1	82.1	83.4
	Asian(East/ South)	14	9.3	9.3	92.7
	Others	11	7.3	7.3	100.0
	Total	151	100.0	100.0	

What is your nationality?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Austria	1	.7	.7	.7
	Azerbaijan	2	1.3	1.3	2.0
	Belgium	2	1.3	1.3	3.3
	Bulgaria	4	2.6	2.6	6.0
	Chile	1	.7	.7	6.6
	China	2	1.3	1.3	7.9
	Denmark	1	.7	.7	8.6
	Finland	1	.7	.7	9.3
	France	9	6.0	6.0	15.2
	Georgia	1	.7	.7	15.9
	Germany	13	8.6	8.6	24.5
	Greece	5	3.3	3.3	27.8
	Hungary	5	3.3	3.3	31.1
	India	2	1.3	1.3	32.5
	Indonesia	1	.7	.7	33.1
	Iran	1	.7	.7	33.8
	Italy	6	4.0	4.0	37.7
	Japan	2	1.3	1.3	39.1
	Latvia	1	.7	.7	39.7
	Lithuania	1	.7	.7	40.4
	Luxembourg	1	.7	.7	41.1
	Moldova	1	.7	.7	41.7
	Morocco	1	.7	.7	42.4
	Netherlands	61	40.4	40.4	82.8

	New Zealand	1	.7	.7	83.4
	Norway	1	.7	.7	84.1
	Poland	3	2.0	2.0	86.1
	Portugal	1	.7	.7	86.8
	Russia	2	1.3	1.3	88.1
	Slovakia	2	1.3	1.3	89.4
	Spain	5	3.3	3.3	92.7
	Suriname	1	.7	.7	93.4
	Sweden	3	2.0	2.0	95.4
	Tunisia	1	.7	.7	96.0
	Turkey	1	.7	.7	96.7
	United Kingdom	2	1.3	1.3	98.0
	Uruguay	1	.7	.7	98.7
	Vietnam	2	1.3	1.3	100.0
	Total	151	100.0	100.0	

What is your religion? - Selected Choice

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Buddhism	2	1.3	1.3	1.3
	Christianity	34	22.5	22.5	23.8
	Hinduism	3	2.0	2.0	25.8
	Catholicism	9	6.0	6.0	31.8
	Islam	11	7.3	7.3	39.1
	Free Thinker (I won' t believe something just because a religion says it' s true—I need to think it through myself.)	17	11.3	11.3	50.3
	Agnostic (I' m not sure if gods exist or not.)	21	13.9	13.9	64.2
	Atheist (I don' t believe in any gods.)	50	33.1	33.1	97.4
	Others (please specify)	4	2.6	2.6	100.0
	Total	151	100.0	100.0	

What is the highest level of education you have attained?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High school graduate	82	54.3	54.3	54.3
	Some College	2	1.3	1.3	55.6
	Bachelor' s Degree (e.g., BA, BS)	50	33.1	33.1	88.7
	Master' s Degree (e.g., MA, MS, MBA)	17	11.3	11.3	100.0
	Total	151	100.0	100.0	

Chi-square _Manipulation check

Row: Coachethinicitymatch (e.g., 1 = same ethnicity, 2 = different ethnicity)

Column: Manipulation question 1

Manipulation check response ("Same" or "Different")

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Coach ethinicity match * Does the coach avatar appear to be of the same or a different ethnicity as you?	151	100.0%	0	0.0%	151	100.0%

Coach ethinicity match * Does the coach avatar appear to be of the same or a different ethnicity as you? Crosstabulation

			Does the coach avatar appear to be of the same or a different ethnicity as you?		
			Same ethnicity	Different ethnicity	Total
Coach ethinicity match	Same	Count	71	3	74
		Expected Count	36.3	37.7	74.0
	Different	Count	3	74	77
		Expected Count	37.7	39.3	77.0
Total		Count	74	77	151
		Expected Count	74.0	77.0	151.0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	127.945[a]	1	<.001		
Continuity Correction[b]	124.288	1	<.001		
Likelihood Ratio	158.809	1	<.001		
Fisher's Exact Test				<.001	<.001
Linear-by-Linear Association	127.098	1	<.001		
N of Valid Cases	151				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 36.26.

b. Computed only for a 2x2 table

Chi-square _Manipulation check

Row: CoachType(e.g., 1 = same ethnicity, 2 = different ethnicity)

Column: Manipulation question 2

Manipulation check response ("Same" or "Different")

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Coach type framing * Do you think the VR coach was operated by a human or an AI language model?	151	100.0%	0	0.0%	151	100.0%

Coach type framing * Do you think the VR coach was operated by a human or an AI language model? Crosstabulation

			Do you think the VR coach was operated by a human or an AI language model?		
			Human	AI	Total
Coach type framing	Human	Count	18	55	73
		Expected Count	14.5	58.5	73.0
	AI	Count	12	66	78
		Expected Count	15.5	62.5	78.0
Total		Count	30	121	151
		Expected Count	30.0	121.0	151.0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.037[a]	1	.154		
Continuity Correction[b]	1.496	1	.221		
Likelihood Ratio	2.044	1	.153		
Fisher's Exact Test				.161	.111
Linear-by-Linear Association	2.023	1	.155		
N of Valid Cases	151				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 14.50.

b. Computed only for a 2x2 table

ANCOVA

Dependent Variable: Anxiety(post-session)

Fixed Factors: Coach ethnicity match, Coach type

Covariate: PerceivedCoachType

Univariate Analysis of Variance

[DataSet1] D:\Thesis\SPSS\Dataset0627.sav

Between-Subjects Factors

		Value Label	N
Coach ethinicity match	1.00	Same	74
	2.00	Different	77
Coach type framing	1.00	Human	73
	2.00	AI	78

Descriptive Statistics

Dependent Variable: Anxiety Post-session Mean

Coach ethinicity match	Coach type framing	Mean	Std. Deviation	N
Same	Human	1.8000	.70794	35
	AI	2.3231	.93653	39
	Total	2.0757	.87128	74
Different	Human	2.2947	.77213	38
	AI	1.9590	.81587	39
	Total	2.1247	.80723	77
Total	Human	2.0575	.77780	73
	AI	2.1410	.89158	78
	Total	2.1007	.83678	151

Tests of Between-Subjects Effects

Dependent Variable: Anxiety Post-session Mean

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7.331[a]	4	1.833	2.739	.031
Intercept	529.670	1	529.670	791.531	<.001
Coachethinicitymatch	.159	1	.159	.238	.627
CoachType	.306	1	.306	.457	.500
PerceivedCoachType	.023	1	.023	.035	.852
Coachethinicitymatch * CoachType	6.936	1	6.936	10.365	.002
Error	97.699	146	.669		
Total	771.360	151			
Corrected Total	105.030	150			

a. R Squared = .070 (Adjusted R Squared = .044)

Parameter Estimates

Dependent Variable: Anxiety Post-session Mean

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intercept	1.964	.134	14.708	<.001	1.700	2.228
[Coachethinicitymatch=1.00]	.364	.185	1.965	.051	-.002	.730
[Coachethinicitymatch=2.00]	0[a]	.	.	.	.	.
[CoachType=1.00]	.338	.187	1.810	.072	-.031	.708
[CoachType=2.00]	0[a]	.	.	.	.	.
PerceivedCoachType	-.031	.168	-.187	.852	-.363	.301
[Coachethinicitymatch=1.00] * [CoachType=1.00]	-.858	.267	-3.219	.002	-1.385	-.331
[Coachethinicitymatch=1.00] * [CoachType=2.00]	0[a]	.	.	.	.	.
[Coachethinicitymatch=2.00] * [CoachType=1.00]	0[a]	.	.	.	.	.
[Coachethinicitymatch=2.00] * [CoachType=2.00]	0[a]	.	.	.	.	.

a. This parameter is set to zero because it is redundant.

Multiple linear regression with covariate

Dependent Variable: Warmth

Fixed Factors: Dummy code Ethnicity Match, Dummy code Coach Type Framing,

Covariate: PerceivedCoachType

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
dummy code coach ethnicity match	.00	Different	77
	1.00	Same	74
dummy code coach type framing	.00	AI	78
	1.00	Human	73

Descriptive Statistics

Dependent Variable: Warmth Mean

dummy code coach ethnicity match	dummy code coach type framing	Mean	Std. Deviation	N
Different	AI	3.1453	.80856	39
	Human	3.3509	.95530	38
	Total	3.2468	.88424	77
Same	AI	3.0684	.70578	39
	Human	2.9143	.88319	35
	Total	2.9955	.79284	74
Total	AI	3.1068	.75496	78
	Human	3.1416	.94104	73
	Total	3.1236	.84732	151

Tests of Between-Subjects Effects

Dependent Variable: Warmth Mean

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2.452[a]	3	.817	1.141	.334
Intercept	1164.665	1	1164.665	1626.799	<.001
dummyeth	2.377	1	2.377	3.320	.070
dumcoaty	.025	1	.025	.035	.852
PerceivedCoachType	.036	1	.036	.051	.822
Error	105.241	147	.716		
Total	1581.000	151			
Corrected Total	107.692	150			

a. R Squared = .023 (Adjusted R Squared = .003)

Parameter Estimates

Dependent Variable: Warmth Mean

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Intercept	3.001	.130	23.112	<.001	2.745	3.258
[dummyeth=.00]	.251	.138	1.822	.070	-.021	.523
[dummyeth=1.00]	0[a]	.	.	.	.	.
[dumcoaty=.00]	-.026	.139	-.187	.852	-.300	.248
[dumcoaty=1.00]	0[a]	.	.	.	.	.
PerceivedCoachType	.039	.174	.226	.822	-.304	.383

a. This parameter is set to zero because it is redundant.

Multiple linear regression with covariate

Dependent Variable: Competence

Fixed Factors: Dummy code Ethnicity Match, Dummy code Coach Type Framing,

Covariate: PerceivedCoachType

Univariate Analysis of Variance

Between-Subjects Factors

		Value Label	N
dummy code coach ethnicity match	.00	Different	77
	1.00	Same	74
dummy code coach type framing	.00	AI	78
	1.00	Human	73

Descriptive Statistics

Dependent Variable: Competence Mean

dummy code coach ethnicity match	dummy code coach type framing	Mean	Std. Deviation	N
Different	AI	2.9060	.84101	39
	Human	2.9474	.98799	38
	Total	2.9264	.91066	77
Same	AI	2.7692	.73011	39
	Human	2.6190	.87874	35
	Total	2.6982	.80177	74
Total	AI	2.8376	.78541	78
	Human	2.7900	.94527	73
	Total	2.8146	.86379	151

Tests of Between-Subjects Effects

Dependent Variable: Competence Mean

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3.046[a]	3	1.015	1.371	.254
Intercept	922.198	1	922.198	1245.149	<.001
dummyeth	2.017	1	2.017	2.724	.101
dumcoaty	.189	1	.189	.255	.615
PerceivedCoachType	.977	1	.977	1.320	.252
Error	108.873	147	.741		
Total	1308.111	151			
Corrected Total	111.919	150			

a. R Squared = .027 (Adjusted R Squared = .007)

Parameter Estimates

Dependent Variable: Competence Mean

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	2.620	.132	19.833	<.001	2.358	2.881
[dummyeth=.00]	.231	.140	1.650	.101	-.046	.508
[dummyeth=1.00]	0[a]	.	.	.	.	.
[dumcoaty=.00]	.071	.141	.505	.615	-.208	.350
[dumcoaty=1.00]	0[a]	.	.	.	.	.
PerceivedCoachType	.203	.177	1.149	.252	-.146	.552

a. This parameter is set to zero because it is redundant.

Appendix C: Declaration Page: Use of Generative AI Tools in Thesis

Student Information
Name: Ying-Ju, Chou
Student ID: 656209
Course Name: Master Thesis CM5000
Supervisor Name: dr. HH (Vivian) Chen
Date: June 30, 2025

Declaration:

Acknowledgment of Generative AI Tools
I acknowledge that I am aware of the existence and functionality of generative artificial intelligence (AI) tools, which are capable of producing content such as text, images, and other creative works autonomously.

GenAI use would include, but not limited to:

- Generated content (e.g., ChatGPT, Quillbot) limited strictly to content that is not assessed (e.g., thesis title).
- ~~Writing improvements, including~~ grammar and spelling corrections (e.g., Grammarly)
- Language translation (e.g., DeepL), without generative AI alterations/improvements.
- Research task assistance (e.g., finding survey scales, qualitative coding verification, debugging code)
- Using GenAI as a search engine tool to find academic articles or books (e.g.,

☒ I declare that I have used generative AI tools, specifically [Name of the AI Tool(s) or Framework(s) Used], in the process of creating parts or components of my thesis. The purpose of using these tools was to aid in generating content or assisting with specific aspects of thesis work.

☐ I declare that I have NOT used any generative AI tools and that the assignment concerned is my original work.

Signature: [digital signature]

Date of Signature: [Date of Submission]

Extent of AI Usage

☒ I confirm that while I utilized generative AI tools to aid in content creation, the majority of the intellectual effort, creative input, and decision-making involved in completing the thesis were undertaken by me. I have enclosed the prompts/logging of the GenAI tool use in an appendix.

Ethical and Academic Integrity

☒ I understand the ethical implications and academic integrity concerns related to the use of AI tools in coursework. I assure that the AI-generated content was used responsibly, and any content derived from these tools has been appropriately cited and attributed according to the guidelines provided by the instructor and the course. I have taken necessary steps to distinguish between my original work and the AI-generated contributions. Any direct quotations, paraphrased content, or other forms of AI-generated material have been properly referenced in accordance with academic conventions.

By signing this declaration, I affirm that this declaration is accurate and truthful. I take full responsibility for the integrity of my assignment and am prepared to discuss and explain the role of generative AI tools in my creative process if required by the instructor or the Examination Board. I further affirm that I have used generative AI tools in accordance with ethical standards and academic integrity expectations.

Signature:

Date of Signature: June 30, 2025

Appendix

I used generative AI tools, including ChatGPT and Grammarly. These tools were prompted to assist with proofreading, identifying grammar errors and typos, and generating references in APA format.