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FROM KNOWING TO FEELING: CULTIVATING SOCIAL WORK EMPATHY THROUGH EMBODIED EXPERIENCE IN VIRTUAL REALITY

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Abstract

Acknowledging the constraints inherent in conventional teaching approaches for cultivating empathy, the present study sought to assess the efficacy of an immersive Virtual Reality (VR) training intervention tailored for social work students. Utilizing a quasi-experimental design with pre-test and post-test measures alongside a control group, the research involved 82 participants enrolled in social work programs. The experimental cohort ($n = 40$) participated in a 15-minute immersive VR simulation portraying a high-risk family scenario, whereas the control cohort ($n = 42$) engaged with an equivalent text-based case study. Empathy levels were quantified using the Interpersonal Reactivity Index (IRI). Analysis of Covariance (ANCOVA) indicated that participants in the VR condition exhibited significantly greater enhancements in Perspective-Taking (PT) and Empathic Concern (EC) relative to those in the control condition ($p < .001$). Additionally, the degree of experienced presence within the VR environment was positively associated with an increase in empathy. These results offer compelling empirical evidence supporting the integration of VR as an effective pedagogical instrument, promoting an embodied cognition framework within social work education and providing a validated module for the development of innovative curricular designs.

Keywords and phrases: Virtual Reality (VR), empathy training, social work education, immersive learning, perspective-taking.

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1. Introduction

1.1. Background and research motivation

Empathy is widely acknowledged as a fundamental element underpinning professionalism in social work and serves as the ethical foundation of its practice [1]. It constitutes an essential prerequisite for establishing trusting relationships and facilitating effective communication with clients, as well as a critical competency for accurately assessing client needs and delivering appropriate interventions. Deficiencies in empathic engagement may result in secondary harm to clients, deterioration of professional relationships, and increased risk of burnout among social workers themselves [2, 3]. Consequently, the effective cultivation of empathy within social work education remains a central concern for both scholars and practitioners.

Conventional approaches to empathy training predominantly involve classroom lectures, case discussions, role-playing exercises, and field internships. While lectures and case discussions provide theoretical frameworks and indirect experiential learning, they often remain abstract and insufficiently engage students' emotional involvement [4, 5]. Role-playing facilitates simulated interpersonal interactions; however, the artificiality of scenarios, performative nature of participants, and environmental constraints limit the capacity to authentically replicate the complex, high-stakes, and nuanced realities faced by clients [6, 7]. Although field internships offer real-world exposure, disparities in placement opportunities, variability in supervision quality, and students' initial lack of experience may hinder deep understanding of clients' internal experiences or provoke defensive responses due to cultural dissonance [8].

A pervasive limitation of these traditional methodologies is the restricted depth of perspective-taking. Students predominantly assume roles as "external observers" or "simulated role-players" rather than as "immersed experiencers" capable of fully inhabiting the client's life context. This indirect and distanced pedagogical approach constrains the concurrent development of both affective empathy and cognitive empathy [9]. In this context, emerging immersive technologies, particularly Virtual Reality (VR), present novel opportunities to overcome these educational challenges.

1.2. Literature review and research gaps

Virtual Reality (VR) technology, utilizing head-mounted displays, immerses users within a 360-degree computer-generated virtual environment, engendering a pronounced sense of presence and immersion [9, 10]. Rather than passively observing through a screen, users experience being "inside" the virtual setting. Recently, VR has been applied across diverse domains including medicine, psychotherapy, and military training. For instance, VR has been

employed to simulate combat scenarios for exposure therapy targeting PTSD (Posttraumatic Stress Disorder) patients [11, 12], and to enable medical students to experience sensory impairments associated with aging, thereby enhancing empathy toward elderly patients [13]. These investigations preliminarily demonstrate that VR, by facilitating first-person embodied cognitive experiences, effectively promotes perspective-taking and induces significant emotional and cognitive transformations [11, 14].

Nonetheless, within social work education, despite widespread recognition of VR's potential, rigorous empirical research remains limited. Existing studies are largely descriptive, involve small-scale pilot implementations, or focus primarily on subjective measures of student satisfaction [9, 15]. Few employ controlled experimental designs to quantitatively assess VR training efficacy, nor do they thoroughly examine how VR experiences differentially influence various empathy components, such as perspective-taking, empathic concern, and personal distress. Furthermore, the journal's thematic emphasis on Human-Computer Interaction (HCI), Learning Analytics, and immersive educational technologies necessitates interdisciplinary research that integrates pedagogical objectives, technological applications, and evaluative methodologies to address this scholarly gap.

1.3. Research objectives and contributions

In response to the identified gaps, this study aims to design and implement a VR-based empathy training program tailored for social work students and to systematically evaluate its effectiveness in enhancing empathy through a quasi-experimental research design. Specifically, the study seeks to address the following research questions:

(1) Relative to traditional text-based case discussions, do social work students who engage in VR immersive learning experiences exhibit statistically significant improvements in empathy, particularly in the domains of perspective-taking and empathic concern?

(2) Is there a correlation between the degree of presence experienced during the VR intervention and subsequent changes in empathy measures?

(3) What qualitative feedback do students provide following the VR experience, and how do they perceive its impact on their professional understanding and cognitive frameworks?

The study's academic and practical contributions are delineated as follows:

(1) Theoretical contribution: By applying embodied cognition and immersive learning theories within the context of social work education, this research provides empirical evidence supporting VR as an effective pedagogical tool for fostering "deep perspective-taking", thereby extending theoretical frameworks of technology-enhanced learning in the humanities and social sciences.

(2) Practical implications: The study offers social work educators a validated, operational VR empathy training module accompanied by an evaluative framework. The findings can inform innovative curriculum design in social work programs, facilitating the development of practitioners with heightened empathy and humanistic sensitivity.

2. Methodology

2.1. Research design

This investigation utilized a quasi-experimental design featuring pre-test and post-test assessments with a control group. This approach enabled a rigorous comparison of changes in empathy scores between participants exposed to the experimental intervention - VR training - and those engaged in a conventional text-based case discussion, while statistically controlling for baseline empathy levels. Participants were allocated non-randomly into either the experimental cohort (VR group) or the control cohort (text group). Both groups completed the empathy measurement instrument prior to (pre-test) and following (post-test) the intervention.

2.2. Participants

The sample comprised 82 third-year social work students enrolled at some universities located in southern Taiwan. These students had completed foundational coursework, including “Introduction to Social Work” and “Human Behavior and the Social Environment”, thereby possessing foundational knowledge of social work principles but had not yet commenced full-time agency internships. This population was selected due to their critical phase in professional identity development, wherein empathy training is deemed essential for their forthcoming professional practice.

Participants were assigned by class designation: Class A ($n = 40$) constituted the experimental group, while Class B ($n = 42$) served as the control group. All participants were fully informed about the study’s objectives and procedures and provided written informed consent. To mitigate potential confounding variables, demographic information (age, gender) and prior experience with VR technology were collected prior to the intervention.

2.3. Research instruments and materials

2.3.1. Experimental intervention: VR immersive scenario

The primary intervention for the experimental group was a VR immersive scenario entitled “Emma’s Home: An Invisible Corner”, collaboratively developed by the research team and a VR content development firm. This scenario simulated a home visit to a high-risk family environment.

Hardware utilized included the Meta Quest 2 head-mounted VR display.

Scenario narrative. Participants experienced the scenario from a first-person, invisible observer perspective, entering the confined rental residence of Emma, a single mother, and her seven-year-old son. The approximately 15-minute scenario encompassed the following key elements:

(1) Environmental exploration: Participants could freely navigate the virtual home, observing details such as scattered medication bags, unpaid electricity bills on a table, expired food items in the refrigerator, mold stains resulting from water leaks, and children’s scribbles on the walls.

(2) Auditory immersion: Ambient sounds included external traffic noise, neighbor disputes, and the mother’s suppressed coughing.

(3) Key interactions (non-interactive): Participants witnessed the mother’s anxiety following a rent collection phone call and the child’s hunger-induced crying, with the mother attempting to soothe him helplessly. The scenario deliberately avoided depictions of violence or extreme conflict, instead emphasizing the quotidian atmosphere of poverty and stress.

System architecture. Figure 1 depicts the overall architecture of the VR empathy training system employed in this study. The system comprises hardware and software components.

(1) The hardware layer includes a high-performance computer responsible for graphics processing and a VR Head-Mounted Display (HMD) delivering visual and auditory immersion.

(2) The software layer consists of a three-dimensional virtual environment developed using the unity game engine. When participants put on the HMD, the computer renders a highly realistic family scene in real time, providing an immersive audiovisual experience via the HMD’s display and headphones. Users function as passive “invisible observers”, able to rotate their viewpoint freely or move within a constrained area to experience the unfolding case narrative firsthand.

(3) The system’s core design objective is to maximize users’ sense of presence through technological means, thereby facilitating perspective-taking and emotional engagement.

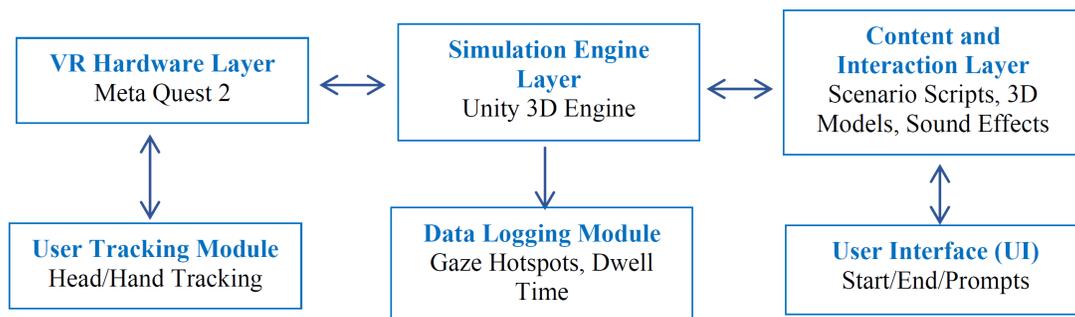


Figure 1. VR empathy training system architecture diagram.

2.3.2. Control group materials: text-based case

The control group engaged with a text-based case narrative of approximately 2,000 words, fully corresponding in content to the VR scenario. The text detailed Emma's family background, economic circumstances, living environment, interactions with her child, and the pressures she faced. The narrative was presented objectively and in detail to ensure equivalence of core information across groups.

2.3.3. Measurement instruments

Interpersonal Reactivity Index (IRI). Empathy was assessed using the Interpersonal Reactivity Index developed by Davis [16] and adapted into Chinese. This validated instrument measures multidimensional empathy through 28 items distributed across four subscales:

- (1) Perspective-Taking (PT): Assesses the cognitive tendency to adopt others' viewpoints.
- (2) Empathic Concern (EC): Evaluates emotional responses characterized by sympathy and concern for others' misfortunes.
- (3) Personal Distress (PD): Measures self-oriented feelings of anxiety and discomfort when witnessing others' adverse experiences.
- (4) Fantasy (FS): Captures the propensity to imaginatively transpose oneself into fictional characters' emotions via literature or film.

This study primarily focused on the PT and EC subscales, given their relevance to social work practice. Responses were recorded on a 5-point Likert scale. Internal consistency reliability coefficients (Cronbach's α) ranged from .75 to .86 in pre-test data, indicating satisfactory reliability.

Presence Questionnaire (PQ). Following the VR intervention, participants in the experimental group completed an adapted presence questionnaire based on Witmer and Singer [17]. This 10-item instrument assessed dimensions of immersion, realism, and involvement within the virtual environment. The data served to evaluate the quality of the VR experience and informed subsequent analyses.

2.4. Research procedure

The study adhered strictly to a predetermined protocol, as illustrated in Figure 2. All assessments were conducted individually within a quiet laboratory setting to minimize external distractions.

2.5. Data analysis

Quantitative data were analyzed using SPSS version 26.0.

- (1) Descriptive statistics, including means and standard deviations, were computed for demographic variables and pre- and post-test scores on each scale for both groups.

(2) Analysis of Covariance (ANCOVA) was employed to compare post-test empathy subscale scores between groups while controlling for corresponding pre-test scores. Group membership (experimental vs. control) served as the independent variable, post-test scores as dependent variables, and pre-test scores as covariates. This approach provides a more robust comparison than simple gain score analyses.

(3) Pearson correlation coefficients were calculated to examine associations between presence questionnaire scores and changes in empathy scores (post-test minus pre-test) within the experimental group.

(4) Qualitative content analysis: Semi-structured interviews with 10 participants were audio-recorded, transcribed verbatim, and subjected to thematic analysis to identify salient themes and illustrative quotations regarding the VR learning experience.

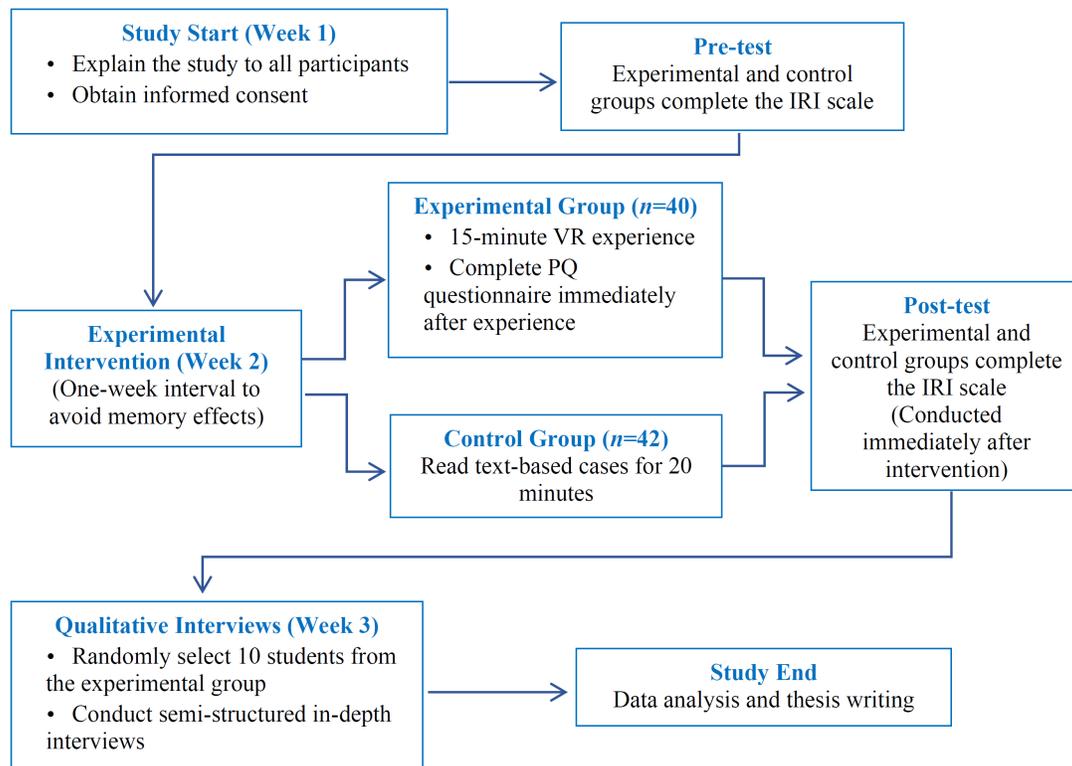


Figure 2. Research procedure flowchart.

3. Results and Discussion

3.1. Sample characteristics

This study obtained 82 valid responses, comprising 40 participants in the experimental group and 42 in the control group. No statistically significant differences were observed between the groups regarding gender distribution (80% female in the experimental group

versus 82.5% in the control group) or mean age (experimental group: $M = 21.3$ years, $SD = 1.1$; control group: $M = 21.5$ years, $SD = 1.3$), indicating comparability between cohorts.

3.2. Impact of VR intervention on empathy: quantitative findings

To evaluate the efficacy of the VR training, separate Analyses of Covariance (ANCOVA) were conducted on the four empathy subscales. Table 1 summarizes the means, standard deviations, and ANCOVA outcomes for pre- and post-intervention scores across both groups.

Table 1. Descriptive statistics and ANCOVA outcomes for empathy subscales pre- and post-intervention in experimental and control groups (Note: Statistical significance denoted by $p < .05$; ηp^2 represents partial eta squared effect size)

Subscale	Group	Pre-test ($M \pm SD$)	Post-test ($M \pm SD$)	Adjusted post-test mean (Adjusted M)	F-value	p-value	ηp^2
Perspective Taking (PT)	Experimental Group ($N = 40$)	3.45 \pm 0.55	4.25 \pm 0.48	4.26	21.45	<.001	.212
	Control Group ($N = 42$)	3.51 \pm 0.61	3.65 \pm 0.59	3.64			
Empathic Concern (EC)	Experimental Group ($N = 40$)	3.88 \pm 0.52	4.51 \pm 0.44	4.50	18.92	<.001	.193
	Control Group ($N = 42$)	3.82 \pm 0.49	3.95 \pm 0.51	3.96			
Personal Distress (PD)	Experimental Group ($N = 40$)	2.85 \pm 0.68	2.95 \pm 0.71	2.94	0.89	.348	.011
	Control Group ($N = 42$)	2.91 \pm 0.74	2.99 \pm 0.70	3.00			
Fantasy (FS)	Experimental Group ($N = 40$)	3.62 \pm 0.77	3.75 \pm 0.75	3.76	1.02	.315	.013
	Control Group ($N = 42$)	3.55 \pm 0.81	3.61 \pm 0.80	3.60			

Key findings include:

(1) Perspective Taking (PT): Controlling for baseline scores, the adjusted post-test mean for the experimental group (4.26) was significantly greater than that of the control group (3.64), $F(1, 79) = 21.45$, $p < .001$, with a large effect size ($\eta p^2 = .212$).

(2) Empathic Concern (EC): Similarly, the experimental group's adjusted post-test mean (4.50) exceeded that of the control group (3.96), $F(1, 79) = 18.92$, $p < .001$, also reflecting a large effect size ($\eta p^2 = .193$).

(3) Personal Distress (PD) and Fantasy (FS): No significant between-group differences were detected at post-test ($p > .05$).

These results substantiate that immersive VR experiences significantly enhance social work students' cognitive empathy (perspective taking) and affective empathy (empathic concern), outperforming traditional text-based case discussions. Figure 3 visually depicts the pre- to post-test score changes in these two critical dimensions for both groups.

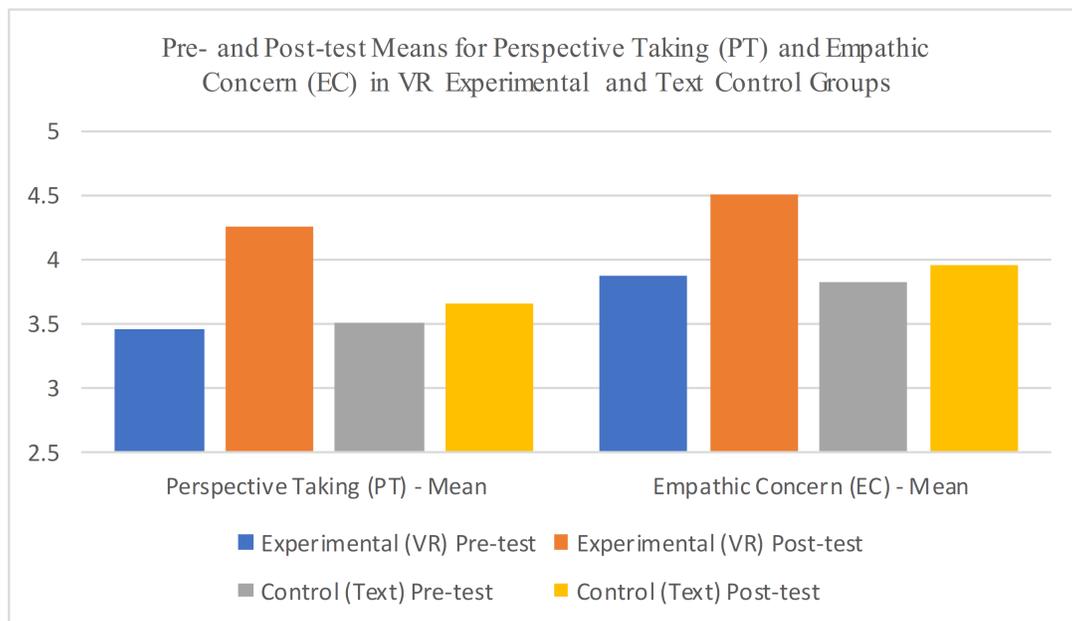


Figure 3. Comparative pre- and post-test scores on Perspective Taking (PT) and Empathic Concern (EC) between experimental and control groups.

3.3. Association between presence and empathy changes

Participants in the experimental group reported an average Presence Questionnaire (PQ) score of 5.8 out of 7.0 ($SD = 0.9$), indicating a moderate to high sense of presence induced by the VR system. Pearson correlation analyses revealed significant positive associations between total PQ scores and improvements in Perspective Taking ($r = .48, p = .002$) as well as Empathic Concern ($r = .41, p = .009$).

These findings suggest that greater immersion and perceived realism within the VR environment correspond to more pronounced enhancements in both cognitive and affective empathy, empirically supporting the conceptualization of presence as a pivotal mediating factor in VR-based empathy training.

3.4. Qualitative interview insights: the core of immersive experience

Interviews conducted with ten experimental group participants yielded three principal themes:

Theme 1. Transition from “Knowing” to “Feeling”

Participants reported that while textbook knowledge provided intellectual awareness of the hardships faced by impoverished families, the VR experience elicited a profound embodied understanding. One participant remarked:

“The textbook mentions ‘bare walls’, which I vaguely imagined. However, in VR, I truly ‘stood’ there - I observed wall cracks, sensed dampness (albeit imagined, yet vividly real), and could look around to see children curled in a corner. This was not mere sympathy for a story but witnessing a lived reality. The emotional impact transcended what words can convey.”

Theme 2. Assigned observational perspective: experiencing powerlessness in details

The VR design positioned students as “invisible observers”, unable to intervene, which directed attention to subtle environmental and interpersonal cues conveying a sense of helplessness.

“I noticed a crumpled electricity bill beside a cheap instant noodle pack. While a text case might state ‘financial strain’, the VR image communicated far more. I saw the mother nervously gripping her shirt during a phone call - small gestures laden with anxiety and despair, impossible to replicate in role-play.”

Another participant reflected:

“What distressed me most was my inability to act. Witnessing a hungry child and a crying mother while being restricted to observation evoked a sense of helplessness. It prompted me to consider whether social workers sometimes feel powerless confronting systemic issues, deepening my reflection on the profession’s challenges.”

Theme 3. From judgment to reflection: internalizing professional ethics

Several students indicated that the VR experience challenged their implicit biases and moral judgments by fostering client-centered perspectives rather than external critique.

“Initially, reading the text, I might have thought, ‘Why don’t they work? Why is their home untidy?’ But after 15 minutes immersed in that environment, I wondered, ‘If I lived daily amid noise, poverty, and stress, would I have the energy to clean or be kind to my children?’ This shifted my mindset from ‘why’ to ‘what if it were me,’ embodying true perspective taking.”

This theme aligns closely with the quantitative increase observed in Perspective Taking scores, illustrating how VR creates a safe space for suspending judgment and prioritizing empathetic understanding in ethically complex scenarios.

3.5. Integrated discussion

The findings robustly support the central hypothesis that *VR-based immersive learning more effectively cultivates empathy among social work students compared to traditional text-based methods*. Quantitative analyses demonstrated significant improvements in cognitive and affective empathy dimensions within the experimental group, accompanied by substantial effect sizes. Qualitative data elucidated the underlying mechanisms, highlighting how VR-induced presence transforms learners from passive recipients of information into embodied experiencers, facilitating a qualitative shift from intellectual knowledge to emotional engagement.

These results corroborate prior research in medical education, such as Dyer et al. [13], who reported enhanced empathy through sensory limitation simulations. This study extends such findings to social work education, demonstrating VR's capacity to simulate multifaceted social, economic, and psychological stressors. Contrasting with the abstraction inherent in conventional pedagogies noted by Nembhard et al. [4], VR embodies "situated cognition", wherein knowledge and emotion coalesce within a highly realistic context.

Importantly, Personal Distress (PD) scores did not increase significantly, a favorable outcome given that excessive distress may precipitate avoidance or burnout [1]. The VR scenario was intentionally designed to foster understanding and compassion without inducing trauma, effectively eliciting constructive empathy (PT and EC) while mitigating adverse emotional responses. The stability of Fantasy (FS) scores aligns with its characterization as a relatively stable personality trait, unlikely to be influenced by a single intervention.

Furthermore, the positive correlation between presence and empathy enhancement offers valuable insights for Human-Computer Interaction (HCI) research, emphasizing that educational technologies should prioritize immersive, high-fidelity experiences to facilitate perspective taking and emotional resonance. Future technological developments should focus on optimizing factors such as visual resolution, auditory fidelity, and interaction fluidity to maximize educational impact.

3.6. Study limitations

Despite yielding meaningful insights, this study is subject to several limitations:

(1) Sample representativeness. Participants were exclusively recruited from a social work department at a university in southern Taiwan, potentially limiting the generalizability of findings to broader or more diverse populations.

(2) Research design. The quasi-experimental design, despite employing ANCOVA to control for baseline differences, lacked full randomization, leaving open the possibility of selection bias.

(3) Single scenario. The investigation utilized only one VR scenario centered on poverty and family stress; thus, the applicability of results to other social work domains (e.g., mental health, domestic violence, substance abuse) remains to be established.

(4) Absence of longitudinal assessment. Post-intervention measurements were conducted immediately after the VR experience, precluding evaluation of the durability of empathy gains over time or their translation into professional practice.

3.7. Theoretical and practical implications

Notwithstanding these limitations, the study contributes significantly to both theory and practice:

(1) Theoretical contribution. The research provides robust empirical validation for the application of embodied cognition and immersive learning theories within professional ethics education. It identifies presence as a critical mediating construct linking technological immersion to psychological transformation and proposes a mixed-methods evaluative framework for future investigations.

(2) Practical contribution. The findings endorse VR as an innovative pedagogical tool for empathy development, offering advantages unattainable through conventional methods. This evidence supports the integration of VR technology into social work curricula, particularly in courses such as Social Work Practice and Human Behavior and the Social Environment. Additionally, the scenario design principles employed - non-interventionist observation, emphasis on environmental detail, and avoidance of traumatic content - may inform the development of further VR educational materials, enhancing instructional quality and providing safe, effective pre-service training for social work practitioners.

3.8. Directions for future research

Building upon the current findings and addressing identified limitations, future research avenues include:

(1) Longitudinal studies. Implement follow-up assessments at intervals such as three and six months post-intervention, including during field internships, to evaluate the persistence of empathy enhancements.

(2) Randomized controlled trials. It employs rigorous randomized controlled designs to strengthen causal inferences and internal validity.

(3) Scenario diversification and comparative analysis. It develops and compares VR scenarios addressing varied social work topics (e.g., elder care, mental illness, cross-cultural communication) to examine differential impacts on empathy dimensions.

(4) Interactive VR development. It creates interactive VR environments permitting participant decision-making and consequence observation to assess whether interactivity further augments learning outcomes and ethical reasoning.

(5) Integration of physiological measures. It incorporates concurrent physiological monitoring (e.g., heart rate variability, galvanic skin response) during VR exposure to triangulate subjective reports with objective data, thereby deepening understanding of empathy's psychophysiological mechanisms.

4. Conclusion

This study sought to investigate the utilization and efficacy of Virtual Reality (VR) technology as an innovative pedagogical tool aimed at enhancing empathy among social work students. Employing a quasi-experimental design, we compared pre- and post-intervention empathy scores between an experimental cohort exposed to immersive VR experiences and a control group engaged in conventional text-based case discussions. The findings robustly indicate that VR-based training significantly augmented participants' capacities for "perspective-taking" (cognitive empathy) and "emotional concern" (affective empathy), with improvements markedly exceeding those observed in the traditional instructional approach. This outcome represents a promising advancement in social work education, a discipline fundamentally dependent on interpersonal engagement and emotional insight.

Beyond quantitatively affirming VR's effectiveness, qualitative interviews elucidated the mechanisms underpinning its impact. Central to VR's advantage is its ability to engender a heightened sense of "presence", effectively transforming learners from passive recipients of textual information into active witnesses of clients' lived experiences. This immersive engagement facilitates the conversion of abstract theoretical knowledge into deeply felt personal understanding, enabling students to suspend preconceived judgments and authentically adopt others' perspectives. Furthermore, the study demonstrated that thoughtfully designed VR scenarios can evoke constructive empathy while mitigating excessive emotional distress, thereby supporting ethical instruction and safeguarding students' psychological well-being.

The contributions of this research are interdisciplinary in nature. Within social work education, it provides an empirically substantiated and replicable pedagogical innovation that addresses the persistent challenge of translating empathy-related knowledge into practical competence. In the domains of human-computer interaction and educational technology, the study offers concrete evidence that immersive technologies can transcend entertainment functions to assume a pivotal role in professional training, underscoring the critical importance of "presence" as a foundational design principle. The results advocate for strategic

investment in high-quality immersive learning content as a means to elevate higher education quality, particularly in fostering professional skills within the humanities and social sciences.

Looking forward, VR and allied immersive technologies such as Augmented Reality (AR) and Mixed Reality (MR) exhibit considerable potential for broader application in social work practice and education. Future research should prioritize longitudinal assessments of VR's impact, the development of diverse and interactive scenarios, and the incorporation of objective metrics, including physiological indicators, to construct more comprehensive theoretical frameworks. Additionally, fostering collaboration between academic researchers and practitioners is recommended to extend these technologies into advanced training for practicing social workers, enhance cross-cultural sensitivity, and support public advocacy on social issues. While technology cannot supplant authentic human interaction, it can function as a conduit - facilitating deeper, more compassionate understanding of others' experiences prior to real-world engagement. This study establishes a robust foundation for the continued development of such transformative educational bridges.

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