LEARNING EMPATHY THROUGH VIRTUAL REALITY: A MIXED METHODS STUDY

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Abstract

Longitudinal empathy measurement amongst rising physicians suggests a decline that begins when medical students transition from their pre-clinical to clinical years and residency training. Current empathy interventions such as mindfulness and neurobiology of empathy workshops have shown mixed results, are difficult to scale and are time consuming. Virtual reality is an emerging technology being used increasingly in the non-medical educational field. It has recently been used for empathy training in the medical education setting. Therefore, our aim was to investigate the effectiveness of virtual reality in empathy training using a mixed methods study design. For the quantitative component, we ran a randomized controlled trial with 17 students randomized to the VR-based curriculum intervention group and 17 students to the education as usual control group. Associative analysis between learner background and baseline empathy scores showed a statistically significant interaction between empathy and speaking more than two languages, being part of a minority group and studying humanities as an undergrad ($p=0.01$). Additionally, the intervention group's baseline empathy increased significantly by 5.1 points, while the control by 1.5 points ($p=0.01$). For the qualitative component, we explored two questions: the effectiveness of VR in empathy training through qualitative analysis and the utility of VR in medical education. In the qualitative program evaluation, we found that VR trigger affective emotional responses (Level 1 Kirkpatrick) from learners that are identical to patients' reaction. We also found generated empathic concern towards patients and their caregivers (Level 2) along with examples of behavioral intentions expressed by students (Level 3). In terms of barriers to empathy we found that 1) self and 2) Macrosystem, both acted as barriers to empathic concern. For self-barriers, 1) Time, 2) Attention and 3) Fear were key players. For the macrosystem, 1) Moral injury, 2) Educational policies, 3) Management policies and 4) Organizational culture were macrosystem barriers. In relation to the question around utility of VR in medical education, we found that its utility was in 1) Creating a psychologically safe environment for learning, 2) Promoting humanism in healthcare, 3) Bridging experiential, immersive and situated learning for constructivism, 4) Enhancing emotional intelligence and 5) Facilitating personalized learning. Subsequently, we hypothesize a theoretical model describing how VR triggers empathy towards patients.

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Chapter 1: Background & Methodology

1.1 Introduction

Ethical erosion and empathic decline are well documented and closely linked phenomena in medicine. In fact, longitudinal empathy measurement amongst rising physicians suggests a decline that begins when medical students transition from their pre-clinical to clinical years and residency training[1]. This decline is significant because it results in potential negative impact on the quality of care delivered to patients such as suboptimal outcomes, lower satisfaction, reduced trust and increased likelihood of provider litigation[2]. Additionally, waning empathy is a key component of physician burnout, contributing to an epidemic of mental health among physicians, under-recognized suicide and a thinning workforce, especially among primary care.

The concept of empathy is grounded in four dimensions: cognitive, affective, behavioral and moral[2]. The cognitive construct entails understanding of someone else's perspective[3] or what is termed "detached concern"[4]. The affective (emotional) construct refers to one's ability to have an appropriate emotional response to someone else's mental state[5] and the ability to encompass the same emotions as that of others[6]. Both the cognitive and affective constructs are necessary to have behavioral empathy as a skill[7]. The last construct, moral empathy, entails the internal motivation for relieving the suffering of others[8].

Physicians who demonstrate high empathy towards their patients are able to increase their patient's level of adherence to clinical management plans[9][10], build trust in the doctor-patient relationship[11], increase their patients' and caregivers' satisfaction with clinical care and even reduce patient likelihood of provider litigation[12]. Overall, this directly contributes to improving healthcare outcomes and quality of care[13][14][15].

Due to predictable negative effects of waning empathy, multiple interventions have been developed to address various aspects of empathy with a goal of preserving or enhancing empathetic thoughts and actions among trainees. For example, investigators have developed drama and arts sessions[17][18], mindfulness sessions, communication skills training[19] and empathy focused training[20][21]. These interventions primarily tackle the cognitive construct of empathy alone, and while this may produce a short-term boost in empathy, long lasting behavioral change and preservation of empathy continues to be lacking. Additionally, current educational interventions are also logistically time consuming and hard to integrate into medical curricula.

Immersive learning through virtual reality, is an established educational tool that can enhance both the cognitive and emotional constructs of empathy that are necessary for behavior change[22]. Virtual reality, a technological advance that allows individuals to immerse themselves and interact with a realistic environment, has been utilized as a skill-based training tool within medicine. The ability to learn within a virtual allows for a safe training environment and an opportunity to correct errors before they occur in the real-world. Other potential advantages of a VR-training curriculum include its portability, and adaptable training conditions that allows individuals to access and

use curricula on demand. While outcomes of VR-based training have demonstrated acceptance among trainees, there is little experience translating the potential effectiveness of VR into empathy training. Importantly, unlike other educational interventions that only address the cognitive construct of empathy, VR can address the cognitive and affective aspects of empathy through its immersive nature as a storytelling tool and evoke strong emotional reactions towards these experiences. By influencing the manner in which individuals respond to stories and the evoked emotions, VR may enhance and maintain empathy among trainees at the point in training where empathy begins to wane. Accordingly, this thesis evaluates and explores the effectiveness of virtual reality as a tool in teaching empathy for medical students.

The outcomes are divided into three different sections each with its own results, discussion and conclusion. Chapter 2 is a randomized controlled trial assessing the effectiveness of virtual reality in teaching empathy. Chapter 3 is a qualitative study that explores the effectiveness of virtual reality in teaching empathy through the Kirkpatrick model in program evaluation and Chapter 4 is a qualitative study that explores the utility of virtual reality as an emerging technology tool in the field of medical education.

1.2 Quantitative Methods

Study design & setting

      An educational randomized controlled trial with a pre/posttest was designed to assess the effectiveness of a VR-based educational curriculum in cultivating empathy amongst medical students at Harvard Medical School (HMS). The study was approved by The Academy at Harvard Medical School and the Harvard Longwood Institutional Review Board (IRB).

Inclusion & exclusion criteria

      Clinical year medical students, second to fourth year, were eligible to enroll. We excluded individuals with history of seizures disorder or loss of consciousness while gaming or below 18 years of age. Participants were recruited through emails and posted advertisements on campus. We advertised the study as a "Virtual reality experience" without an explicit mention of empathy so as to help in blinding (single-blinded). Interested and eligible participants were directed to complete a survey capturing their student information and baseline empathy score.

Data collection and confounders

      We administered a baseline quantative assessment consisting of basic demographics including gender, age, pre-med background of study and intended area of specialty. We also collected information on student ethnic background, and number of languages spoken. We asked participants to identify previous enrollment in a

communication skills program out of medical school, a mindfulness session or practice in drama/arts as a surrogate of previous empathy training.

Instruments: Toronto Empathy Questionnaire

Both the pre-test baseline empathy score and the post-test empathy scores were measured using the validated Toronto Empathy Questionnaire (TEQ). The TEQ focuses on assessing both the affective and cognitive constructs of empathy, which we hypothesized would both improve through the immersive experience. The TEQ comprises of 16-questions that are each scored from 0-4. The minimum empathy score possible is 0 and the maximum empathy score possible is 64[23]. The TEQ scores correlate positively with the Interpersonal Reactivity Index (IRI), which is another survey that assess empathy. The IRI is comprised of different subscale and the TEQ correlates with the fantasy/imaginative subscale (r=0.74, p<0.001) and the empathic concern subscale (r=0.57, p<0001).

Randomization

We used a stratified randomization approach using a computerized randomization app (RRApp, NYC).

Description of intervention and control groups

The current medical education standard for cultivating empathy is in medical school communication skills sessions and clinical interactions. Our control group underwent these sessions, which we describe as "education as usual". The

intervention group received a supplementary VR-based educational intervention. The intervention comprised of two virtual reality experiences purchased by subscription from Embodied Labs[24] followed by a debrief. The developer Embodied Labs has a library suite of a number of different experiences and we selected those that we deemed appropriate for our intervention goals. The experience portion of the intervention lasted 20 minutes, while the debrief portion ranged from 25-40 minutes. To receive the virtual reality experience, participants wear a headset. Once participants wear the headset, they become fully immersed in a scenario where they see everything from the patient point of view (POV), essentially, they become the patients and see everything from their shoes. The debrief portion focused on breaking down emotional reactions towards the experience and a reflection on clinical care (Table 1 for more details). The TEQ has high construct validity, reliability and test retest reliability[23].

Outcome

Our primary outcome was the change in empathy scores for both the intervention and control groups, which was calculated by subtracting each student's post-test empathy score from their baseline empathy score.

Statistical analysis

STATA 13 was used for statistical analysis. ANOVA was used to determine any associations between the baseline empathy score and independent variables. Wilcoxon signed-rank test was used to compare the change in scores between the intervention group and the control group. Effect size (Cohen's d) was calculated for the

primary outcome measure. Calculating the sample size for the trial, we predicted a 1-point increase in score for the control and 2 points for the intervention, with a 1-point difference. Therefore, assuming alpha level of 0.5 and 80% study power, our target population was 32.

1.3 Qualitative Methods

Purpose of the qualitative interviews

From an educational standpoint, the interviews were part of the post-experience de-brief. This in-depth debrief has two objectives: 1) To assess the impact of VR training in evoking empathy from a qualitative perspective guided by the Kirkpatrick model in program evaluation and 2) To explore the utility of using VR as a tool in medical education, including but not limited to its benefits, challenges, risks and how it compares to other forms of technology used in medical education. Therefore, the results of these interviews are reported in two individual chapters each addressing one of the objectives. The study was approved by The Academy at Harvard Medical School and the Harvard Longwood Institutional Review Board (IRB).

Description of the intervention

As described in the quantitative methods section, the VR-based curriculum comprised of two different experiences that allowed participants to embody two different patients and see the world from their eyes and shoes. The first experience allowed learners to embody a patient with macular degeneration and auditory impairment. The second experiences had learners embody a patient going through end of life care. Our educational goal for selecting the first experience was to allow learners to be immersed in a situation where they can feel what it is like living with sensory disabilities. Our goal for selecting the second experience was to help learners get an understanding of the emotional aspect in care involving not just the patients and

providers, but their caregivers and families as well. In total, both experiences

collectively lasted a total of 20 minutes.

Study design and participants

We conducted in-depth qualitative interviews as a form of debriefing for

participants who completed the VR-based empathy curriculum. The participants

included all those who participated in the intervention group for the RCT and three

additional participants from the control who did the intervention after completing their

control group phase. The interviews were conducted between December 2018 and

January 2019 and comprised a total of 20 medical students. All medical students who

participated were in their clinical years (From Year 2 to Year4.

Data collection

Participating students consented to the interview debrief after going through the

VR experience. The process was audio recorded. The experience and interviews took

place at Harvard Medical School. Students completed the interviews either

immediately after the experience or 1 hour after the experience was concluded. The

interview guide (Appendix) was designed to address both objectives. For the first

objective, the interview questions were guided by the Kirkpatrick model in program

evaluation so as to address Level 1, 2 and 3 in the model. For the second objective,

open ended interview questions were generated to explore that topic. All interviews

were conducted face-face and lasted between 20-45 minutes (30 minutes, median

timing).

Data analysis

      The data was coded using Microsoft Word using a thematic and content analysis approach. The data was then evaluated to generate concepts or theories. Both investigators independently began with open coding to generate a primary code book and minimized subjectivity. The codes were then compared and discussed to reach consensus. Subsequently, a new code book was developed for application to all interviews with the possibility of adding new codes. After coding of all interviews was complete, the investigators discussed possible themes and concepts generated from the data. This was primarily led by one of the investigators who then discussed it with the other investigator to reach consensus.

Chapter 2: Learning empathy through virtual reality - a randomized controlled trial

2.1 Results

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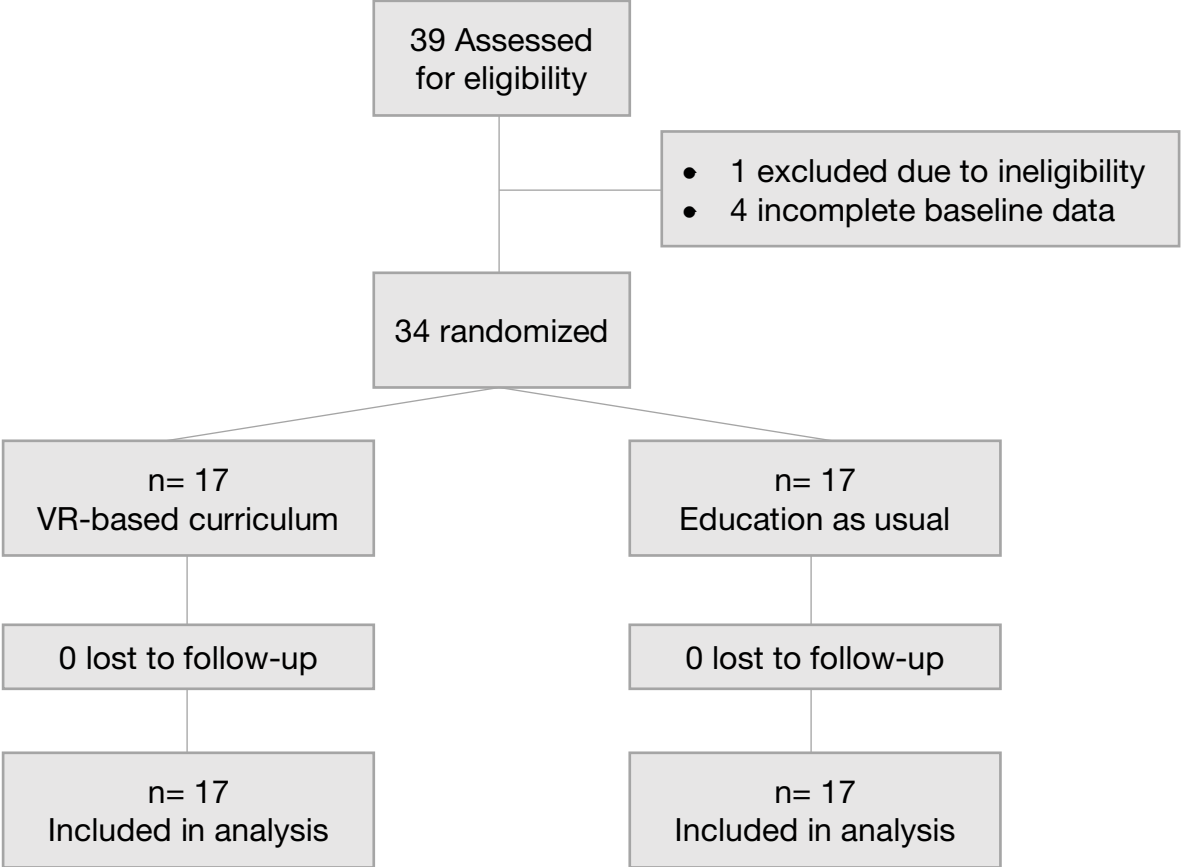
Learner background data and baseline empathy scores

Thirty-four participants were recruited in the study (Figure 1). Seventeen (50%) were randomized into the intervention group and 17 (50%) into the control group. All participants who were randomized also completed all study procedures. The average baseline empathy score was 47.3 points, which was similar to the average TEQ score reported in its validation study, 47.2[23]. There was no significant association between any of the learner background data and the baseline empathy scores.

The average baseline empathy scores for the intervention and control groups was 47.1 and 47.5 respectively. There was also no significant difference between the intervention and control groups in their baseline empathy scores after correction for confounders.

Table 1: Learner background and baseline empathy scores

Learner background data and baseline empathy scores		
	Control (N=17)	Intervention (N=17)
Mean baseline empathy score, no.	47.53	47.11
mean age, no.	26.59	25.35
Gender, no. (%)		
Male	9 (53%)	8 (47%)
Female	8 (47%)	9 (53%)
Non-binary	0 (0)	0 (0)
Ethnicity, no. (%)		
White	9 (53%)	10 (59%)
Minority group	8 (47%)	7 (41%)
Intended specialty, no. (%)		
People-oriented	12 (70%)	12 (70%)
Non-people oriented	5 (30%)	5 (30%)
Undergraduate major, no. (%)		
Sciences	14 (82%)	14 (82%)
Humanities	3 (18%)	3 (18%)
Number of languages spoken, no. (%)		
One language	11 (65%)	7 (41%)
Two or more languages	6 (35%)	10 (59%)
Prior empathy-like training, no. (%)		
Yes	9 (53%)	9 (53%)
No	8 (47%)	8 (47%)

Change in empathy scores

The average change in empathy score in the control group was an increase by 1.4 points compared to an increase by 5.0 points for the intervention group. A paired Wilcoxon-signed rank test demonstrated a significant difference in change in empathy

scores between the VR-based curriculum group (M=5.06, SD=3.2) and the education as usual group (M=1.41, SD=4.7); t (33) = 4.30, p = 0.01 at alpha level 0.01. The calculated Cohen's d was 0.89 suggesting a large effect size.

Participants with previous empathy-like training had larger increases in their empathy scores compared to those who did not receive such training. This was statistically significant for both the intervention and control groups (p=0.01). Additionally, those speaking two languages or more had a larger change in empathy scores for both groups (p=0.01).

Table2: Empathy score comparison between intervention and control groups

Variable, measure	Control no. = 17	Intervention no. = 17	Difference	p-value
Mean baseline empathy score, no.	47.53	47.11	0.42	0.88
Mean empathy score, no.	48.94	52.18	3.24	0.01
Mean change in empathy score, no.	1.41	5.06	3.66	0.01

Attitudinal reactions

Participants in both the intervention and control groups answered attitudinal questions related to patient care as part of the post-test. Respondents had to rate how true the statements were of their own self with 1 being untrue and 5 being very true.

Table 3: Cognitive empathy answer comparison between intervention and control groups

Statement	Control score	Intervention score	Difference	95% CI	p-value
It's hard for me to imagine what it's like to be in my patient's shoes	2.29	2.82	0.53	1.21, -0.15	0.06
I think that being thoughtful to patients has little impact on their outcomes	1.53	1.17	-0.35	0.15, -0.86	0.92
I believe that patient emotions shouldn't be considered when planning their management	1.35	1.71	0.36	1.08, -0.37	0.16
I can imagine what it's like for someone to lose their loved ones	3.82	3.71	-0.11	0.68, -0.92	0.62
I think that patients can be a burden for caregivers and family	3.82	3.47	-0.35	0.21, -0.92	0.89
When I meet a patient, I try to imagine what it might be like to have a serious disease like cancer	3.59	3.94	0.35	1.00, -0.29	0.14
I often think about how treatment might affect the quality of a patient's life	4.17	4.17	0.00	0.54, -0.54	0.50
I understand how an illness/symptom can affect a patient's day-to-day experience	3.47	3.24	-0.24	0.54, -1.01	0.73
I try not to think too much about the impact of illness on patients' lives	1.82	1.59	-0.24	0.24, -0.71	0.84
If I were treating a patient with a serious chronic illness, I would make sure to ask them about how they are coping with their illness	4.18	4.47	0.23	0.77, -0.18	0.11
I try to separate my feelings towards patients from my clinical judgment	3.29	3.59	0.29	0.94, -0.36	0.18

Program evaluation

Participants in the VR-intervention group completed program evaluation questions to better understand their experience. Respondents had to rate each

statement based on its level of how true it was to their experience; 1 being very untrue to their experience and 5 being very true to their experience (Table 3).

Table 4: Intervention evaluation responses

Evaluation statement	Level of truth to experience (1-5)
The instructions were clear and easy to understand	4.82
The headset gear was easy to use	4.65
It is useful as an educational tool to know more about what others go through	4.76
Self-directed experience	3.94
Thought provoking experience	4.76
Increased my self-awareness about the conditions I was immersed in	4.76
Claustrophobic	1.41
Realistic	4.18
Engaging	4.53
Helped me imagine what others go through	4.71
Made me emotional towards the experiences I was immersed in	4.71
The de-brief and reflection were useful for my learning	4.94
Would do it again	4.94
Would recommend it to a friend	4.88

2.2 Discussion

This randomized controlled trial study of a VR-based curriculum to help students learn empathy illustrates the superior effectiveness of VR in enhancing empathy compared to current practice in medical schools. The findings show that the VR-based empathy curriculum is efficacious in boosting empathy by 3.5-fold among medical students compared to the control (p=0.01). This finding is particularly significant because we demonstrated that compared to usual empathy education, a brief VR curriculum has a large effect size (d=0.89). Of note, we also demonstrated that those who were multilingual (fluent 2 or more languages) had greater increases in empathy

scores compared to those who spoke one language only (p=0.01). Answers to

attitudinal and cognitive empathic concern questions showed no significant difference

between the intervention and control, suggesting that cognitive empathic concern is

similar between both groups (Table 2). We additionally demonstrated that VR-based

empathy curricula are acceptable among medical students. The portable nature of VR

devices and the brevity of training that still has a significant effect on medical students

suggests that a VR empathy curriculum like that which we discuss in this investigation

could be integrated into existing medical school infrastructure.

     The increase in empathy scores in the intervention group could be attributed to

VR's documented ability in allowing users to experience someone else's sensory reality

in a vivid manner[25]. This permits for the appreciation of complex social interactions[26].

Additionally, it allows users to feel present and interact with the virtual environment

with their own body[27]. This allows learners to not only embody the patients they are

learning about but also feel a sense of agency. This feeling of presence that learners

experience is also visceral in nature and is a form of psychological immersion[28] [29]. The

sensation of agency captures learner's engagement and attention[28]. Therefore, the

effectiveness of VR in evoking empathy is dependent on the quality of the experience

itself in its ability to encompass those elements[30]. Furthermore, there is well

documented literature on how virtual reality triggers the brain when used for

therapeutic purposes such as pain relief[31,32], however, there is no evidence for how it

impacts empathic concern in the brain. Neuroscience research suggests a critical role

for the right supra-marginal gyrus in sound empathic judgment, social cognition and

affective states through egocentricity autocorrection[33]. Therefore, it is possible that

certain patient point-of-view (POV) experiences in VR trigger the supra-marginal gyrus

and limbic system to stimulate affective reaction and empathic concern. In fact,

embodied learning theories suggests that sensations of embodiment such as those

offered by VR, leads to activation of neural pathways that enhance learning[34] [35].

Experiential learning is known to be effective in triggering emotions[36] [37] and VR

experiences can be considered as experiential in nature albeit virtual.

Furthermore, our finding associating multilingualism and empathy supports

similar findings by Deweale et al[38] [39]. Those studies connected multilingualism with

higher cognitive empathy only and attributed the correlation between empathy and

multilingualism to multicompetence as a personality trait. The mechanism behind this

however remains unclear.

Analysis of the attitudinal statements towards patient care and empathy showed

no significant difference in responses between the intervention and control group

participants (Table). These statements solely focus on the cognitive component of

empathy rather than the affective/emotional one that is captured by the TEQ scale.

This suggests that virtual reality, as a medium, fosters affective/emotional empathic

concern responses more than merely cognitive understanding.

Furthermore, the intervention program evaluation assessment demonstrates that

the intervention was realistic, engaging and helped learners imagine what others go

through. Learners also found it to be thought-provoking and helped them increase their self-awareness about patient disease. Additionally, in relation to the logistics of the intervention, participants found the VR headset easy to use and the instructions very clear to understand. The VR empathy program is safe; we recorded no adverse incidents during the experience such as loss of consciousness or seizure. Additionally, the intervention session and debrief lasted less than 60 minutes. In comparison to other empathy training research studies such as neurobiological training programs and mindfulness that can take up to 34 hours, a VR-based curriculum is significantly shorter[40].

These findings have notable implications for medical education and training. First, the VR-based curriculum was effective in enhancing learner's empathy in a very short period of time (Less than 1 hour) with the utility of one instructor only who led the debrief. This makes the integration of such a curriculum in both the undergraduate (medical schools) and graduate medical education (residency, fellowship) settings logistically easy. Second, scaling such a curriculum to encompass a larger number of students followed by a group peer debrief is feasible. For example, institutions could invest in purchasing several VR headsets and equipment for students to share in class or check-out. Standard headsets currently cost $300 and computers that run VR software cost around $1000. New headsets that do not require computers to run software and at the same price point or existing headsets are being developed. Third, it gives education policy leaders primary evidence on the effectiveness of this tool considering the methodology design we adopted to consider confounders.

Our study has some limitations; first, the study sample of 34 students, although powered to demonstrate the potential for an effect, is relatively small. Additional investigations should enroll more students at varying medical school settings to demonstrate wider generalizability. We also did not follow-up participants to identify how long does the positive impact on affective empathy last so as to establish how regularly such an educational intervention would have to take place and establish a dose-response relationship. Second, this research focuses on its impact in the undergraduate medical education setting, further research of its impact in the graduate medical education setting would also be of interest. Research in the graduate medical education setting such as in residency can utilize patient assessment of their provider's empathy as an outcome measure. Considering this is an emergent field, there is also a need to establish education curricula design guidelines for immersive experiences in medical education. Finally, there is also a need for qualitative research exploring student's described emotional concerns after the experiences and assessing that against contemporary medical education evaluation models such as the Kirkpatrick model in program evaluation. Future investigations may link also VR experiences with real-time brain imaging like functional magnetic resonance imaging (fMRI) to understand the mechanistic effects behind a VR and emotional responses or triggers. Such investigations can be used to iteratively refine empathy interventions targeted to enriching specific neurochemical pathways.

2.3 Conclusion

In a period where medical student's and trainee physician's empathy declines as they progress through training, virtual reality appears to be an effective tool in evoking both affective and cognitive empathic concern towards patients in a very short period of time. Crafting an interpersonal skill curriculum that merges virtual reality experiences from a patient point of view with a debrief and reflection offers a safe environment for students to develop empathy towards their patients. Its ease of use makes it ideal to transform into scale longitudinally across medical school training. Its self-direct nature may also see it of utility in graduate resident training programs as well. Virtual reality offers a medium to create patient point of view storyboards and scenarios that either students do not have the ability to go through during their training or are exposed to so much that they do not have a safe environment to express their feelings and reactions. This trial offers evidence for medical education leaders to reform medical program curricula innovatively and foster humanism.

Chapter 3: Using virtual reality to learn empathy - A qualitative program evaluation using Kirkpatrick model

3.1 Results

<u>Emotional reactions</u>

All learners expressed feeling a range of emotions that resemble and mimic those that are expressed by patients in a real clinical setting. Overall the expressed emotions can be divided into four themes: vulnerability, isolation, self-blame and loss of agency. Most learners used personal pronouns when expressing these emotions that they felt whilst embodying the character of two different patients.

1. **Theme: Vulnerability**

The feeling of vulnerability was predominant amongst learners who connected it with the initial feeling of frustration as a consequence of physical disability. The physical vulnerabilities caused by feeling disabled in terms of speech, sight and hearing made learners feel disoriented and helpless. These emotions were more powerful considering learners were able to compare the loss of several physical abilities in the experience with their own abilities in the real setting, signifying the large dependency and reliance of us as humans on our sensations, that is often taken for granted. Some described this situation as almost being "infantilized" or paternalized as a consequence of the physical and social vulnerability they felt leaving them "humiliated".

2. **Theme: Isolation**

Learners expressed feeling isolated when embodying the role of patients in both experiences. This was magnified by the feelings of helplessness in not being able to do simple tasks that they know they were previously able to. They described a sensation of feeling trapped and imprisoned as a consequence of their respective illnesses and not being able to communicate that effectively and therefore internalizing those emotions because 1) They worry about being a burden on their caregivers and 2) They felt emotionally resigned.

3. Theme: Self-blame

Another predominant emotion going through learners in the experiences was that of self-blame. They described a feeling of guilt and being partly responsible for what their loved ones and caregivers have to go through as a consequence of their illness and physical disability. Some felt that they lost "sense of value" in the eyes of their caregivers and healthcare professionals. Having to process that along with coming into term with their new lifestyle and illness made them feel overwhelmed.

4. Theme: Loss of agency

Adding to the feelings of frustration and resignation was an overall sense of loss of agency. Learners felt that they no longer had the autonomy they did before whether it be in activities of daily living or the decision-making process related to their own condition. They often felt in the "back seat" having to play along with what their families and healthcare professionals preferred. It appears that their love for their families and their concern about their family wellbeing made it easier for them to accept this loss of agency even though they expressed wanting to have a more pro-active role in the decision making of their condition.

<u>Generated knowledge, attitudes and perspectives</u>

After expressing a range of emotions after the experience, learners reflected on what they found were the key takeaways for them and shared their attitudes and perspectives towards improving empathic care in the clinical setting in lieu of what they experienced. Overall, the generated knowledge, attitudes and perspectives could be broadly categorized into those that are towards patients and those towards patients' caregivers and family.

1. Towards patients

Learners expressed the need for a patient-centered clinical experience. They identified 4 key elements that served as takeaways from the experience, 1) Patients need to be empowered more than they are right now, 2) Patients' emotional wellbeing is as equally important as managing their physical disease, 3) Patients' dignity in the clinical setting needs better preservation and 4) Providers tend to underestimate what patients know and avoid addressing feelings that patients frequently internalize.

2. Towards patients' caregivers and family

For takeaways regarding patients' caregivers and family, learners identified 4 key elements as well, 1) Families are frequently in the process of denial more so than patients themselves, which tends to undermine patient agency in decision making, 2) Navigating patient and family/caregiver wellbeing is harder than we think as sometimes they are at odds, 3) Listening and being attentive to patient's families and caregivers

reveals insights regarding patients' social setting, which may inform clinical care, 4) An appreciation of the affliction caregivers and families go through.

Behavioral intentions

In lieu of their emotional reactions and generated key takeaways from the experience learners expressed 4 main behavioral intentions when going back into the clinical setting.

1. **Intention: Addressing patients' emotional wellbeing**

A key element that learners identified was addressing of patient emotional wellbeing in the conversation. Patients go through a range of emotions and feelings that are often internalized. Developing skills to recognize these subconscious cues and reacting to them was a key intention expressed by learners. Learners expressed that they would work on these skills by listening more closely to patients when they talk about non-disease related issues and asking more frequent open-ended questions around their emotional wellbeing. Learners mention that this type of wellbeing is necessary for patients to engage in a more rational conversation about their management plan and for healthcare providers to offer more realistic ones.

2. **Intention: Patient empowerment in the conversation**

After going through experiences that left them vulnerable and isolated as a consequence of disease, learners were driven to ensure their patients do not feel what they experienced in the VR curriculum. They want their patients to feel empowered and in control in the conversation. Learners mentioned that this empowerment intention may mean having to prioritize patient's concerns over those of families and caregivers

and potentially engaging in a one-one conversation with their patients before bringing the family into the picture.

3. **Intention: Closer attention to nuances in care and patient behavior - implicit and explicit cues**

Throughout the experiences, learners reflect frequently on several nuances in the clinical setting when they were in the shoes of patients. They noted that those nuances were not apparent to them as healthcare providers and as such they would like to be more attune to those aspects of care that providers are blind too (blind spot) to improve the situation for their patients. For example, closing the curtains early on to ensure patient privacy even in busy clinical environments or kneeling/sitting at eye level for the patient so that the conversation is more comfortable for them. Learners noted that as small as these acts or behaviors may seem to providers, they make a huge difference to patients – that is after they were able to see the clinical setting from the patient point of view. Beyond just nuances in care and the clinical environment, learners noted paying attention to nuances in patient behaviors that may reveal aspects of their emotional wellbeing. Learners realized that though some of these maybe explicit and easy to identify such as verbal communication by the patient, other aspects may be implicit and harder to notice and therefore require conscious identification. This could be in the form of paying attention to patient non-verbal cues and being aware of our own provider implicit biases before coming into the conversation and how that may indirectly impact the curation of management plans.

4. **Intention: Separate the disease from the patient "Mindset change"**

The next intention for learners was to do with the way their view towards patients is framed. Essentially, changing the mindset and way of interpreting things that they see in lieu of the experience. One key mindset shift was separating the disease from the patient. Learners noted how framing patients into disease categories takes away from the humanistic aspect of clinical care. They intended to look at patients as a human with a story and with feelings and not just another case of disease. Consequently, for learners this framing may change the way they interpret decisions and actions taken by patients or their families.

Barriers to empathy

Learners recognized the barriers and challenges to the behavioral intentions they had wanted to pursue after the experience. These barriers and challenges can be divided into those that relate to the "self" and those that relate to the "macrosystem" that they operate in. in relation to self, the key barriers were 1) Time, 2) Attention and 3) Fear of clouding judgment. For the barriers in the macrosystem this was 1) Moral injury, 2) Management policy, 3) Educational policy and 4) Organizational culture.

Barrier: Self

1. Theme: Time

For all learners, managing time in the clinical setting as a trainee physician was a major barrier and challenge. They mentioned the numerous clinical commitments as part of a medical team that make it hard to dedicate time for empathic concern and addressing of patient's emotional wellbeing.

2. Theme: Attention

Though time was a major self-barrier identified by all learners, some learners argued that it was self-attention to empathic concern that was the issue. Those learners described that time is frequently used as an "excuse" when in reality it is about how much you personally care about being empathic towards patients. They felt that even though time remains a barrier, one can mitigate that by giving more attention to empathy and the experience of being the patient in that setting.

3. Theme: Fear of clouding judgment

Some learners were worried that addressing patient's emotions and being empathically concerned towards them may potentially cloud their judgment. They described a fine line between what they saw as "ideal" empathy vs. "too much" empathic concern. They worried that being too empathic may risk providers losing their neutral position in identifying what is in the best interests of the patient instead of what the patients want. They found that finding the right balance is a challenge that perhaps VR can play a role in mitigating.

Barrier: Macrosystem

1. Theme: Moral injury

Learners expressed feeling saddened to the state healthcare has come to as a system. They mentioned pursuing medicine for altruistic and humanistic reasons that got forgotten as a consequence of the complex health system. The experience they went through served as a reminder of those humanistic values they believed in but

forgot to translate into practice. The manifestation of this moral injury being the feeling of burn out and having ethical concerns due to system issues.

2. Theme: Management policies

Many learners noted that current management policies and goals circulate around operational efficiency that put addressing patient emotional concerns and empathy at risk. They also noted how financial incentives are current aligned towards that operational efficiency. This misalignment of incentives risks seeing healthcare quality are improvement in outcomes only that are measured numerically rather than fulfillment in patient emotional wellbeing and them feeling that doctors were empathic towards them.

3. Theme: Educational policies

Learners note that the process of training is very demanding and there is heavy focus on "high-yield" information and attainment of diagnostic certainty. The heavy focus on diagnosis and management leaves the subject of empathy cornered or taken for granted. Learners believed that empathic concern carried equal weight to diagnosis and management, but educational training does not accurately reflect that ratio.

4. Theme: Organizational culture

It was noted that rethinking physician empathy towards patients requires a cultural change at the institutional level. Though there is no question amongst providers on the need for more empathy, not every specialty in medicine agrees to the dedication of time to exhibit that and address patient's emotional wellbeing.

Reimagining the role of a physician

The final takeaway generated by learners was the need to reimagine the role the physician as a "two-fold" role, one that "fixes the problem" and another that "takes care of the person". This further emphasizes the responsibility that lay on physicians towards empathic concern and not just excelling in clinical diagnosis and management.

Unstructured observations

Five learners were tearing and/or crying after completion of the last experience. Learners mentioned having an epiphany where they were contrasting all that they see from the provider point of view that is blind to what is perceived by patients. Three of those participants were white/non-minority and two identified with a minority group. They were all medical students in their senior years, end of Year 3 or Year 4. Some participants noted how after going through busy days at the hospital on a regular basis and now doing the VR and putting themselves in patients' shoes, they had an epiphany with regards to how emotional wellbeing of patients is rarely addressed. They highlighted that empathy became a missing component in the process of healing, which they thought was ironic.

Qualitative Program Evaluation using Kirkpatrick Model: Themes and illustrative quotes

Theme	Illustrative quote
Level 1: Emotional reactions	
Vulnerability	"It was frustrating to be in the backseat and feel like the other people are driving the car, when the car was my life" – Interview 3 "I felt my place, my sense of self, had changed, so that I would equate it to just being a child. Who's trying to behave and not getting away. Just sit there and play the part of nod along, while the adults have all the conversations." – Interview 15
Isolation	"I'm still human. I'm still alive. I'm still here. You can talk to me" – Interview 2 "You want to be able to advocate for yourself, but when no one even gives you the opportunity or just pretends you're not there it's upsetting." – Interview 11
Self-blame	"it actually felt like somehow it was my fault." – Interview 7 "I felt a little bit ashamed, oh, maybe I shouldn't—why am I like this, or I shouldn't have done that, but the same time, it wasn't intentional, and so I also felt kind of misunderstood. They don't know what I'm going through. So, yeah, a lot of emotions there." – Interview 9
Loss of agency	"You become terminally ill you just start to feel like you've lost autonomy, and that's part of the experience" – Interview 7 "I was much more frustrated by not feeling part of the conversation … I think also it's a good reminder in terms of just how easily patients can be stripped of their agency and their usual means of interacting with the world. How that would impact their sense of self and autonomy. Their role in the world is drastically altered. I think that's a really valuable thing to grapple with and to try and see from that side of things. Yeah, I thought it was really helpful." – Interview 15
Level 2: Generated knowledge, attitudes and perspectives	
Towards patients	
Patient empowerment	""I think we should probably make more of an effort for patients to feel included in their care and included in conversations about them and their care. Especially conversations that are taking place right in front of them" – Interview 11
Prioritizing patient emotional wellbeing	"I feel like at that time it was hard to process everything. I was more focusing on how everyone else was reacting, kind of noticing that. I feel like it was actually kind of hard to pay attention to what the physician was saying because everyone else's emotions were so stronger than whatever else was going on." – Interview 10
Preservation of patient dignity	"It really made me think about, at the end of life, what I personally would want and prioritize. Kind of just being in a familiar, comforting environment with people I cared about. Dying with some sense of dignity and having family surrounding me, that was very peaceful, even though I was dying" – Interview 1
Patient internalization of feelings	"The takeaway for me now is that you could still be doing everything right, essentially. You're doing all of your part. For whatever factor, whether it's a physical limitation, or they're in a bad mood, or something terrible happened that morning that you don't know about, there could be other factors that could still get in the way of optimal relationship with the patient. Just recognize there could always be something else making this harder." – Interview 13

Caregiver denial	"I could tell that the family was in some sort of denial, and that there were some kind of conflicting opinions about whether to continue with intensive chemotherapy. It seemed like everyone was just a little hesitant to begin this conversation of end of life care. Knowing what to expect and things like that. Coming to terms with the fact that this diagnosis carries a—with it a timestamp basically. It was useful to see that from the patient's perspective" – Interview 1
Caregivers can be at odds with patient	""it made me remember that there are often ones that are angrier than the actual patients. They're not always necessarily on the same page. You could have three family members, and you have three different daughters who are all differently either knowledgeable about the disease, or knowledgeable about what's been told to the patient, or just have different opinions on how things should be handled. I think that's always a challenge" – Interview 5
Can lead to insight into patient's social setting	"Even if the family's in there with the patient, you wanna talk to the patient instead of carrying on a conversation with the wife or daughter or husband, *et cetera*. Again, they can give some insight into the family situation or social setting, but I think the patient takes a lot more precedence" – Interview 6
Appreciation of their affliction	"Going through the experience of someone with fatal lung cancer, and seeing the effect on the family, I think it added the component of not only personal suffering, but also, seeing the suffering of people that you love, like you family, and so, that was like a component of the individual and the community level suffering" – Interview 9

Level 3: Behavioral intentions

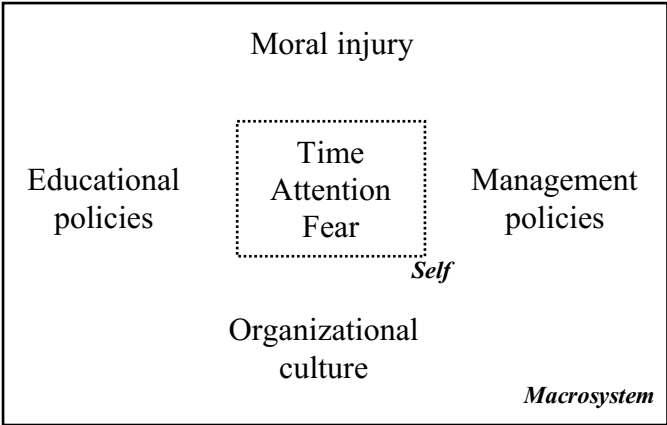|	
Addressing patient's emotional wellbeing	"It helps you understand when the patient might disagree with your recommendation. You're always trying to personalize care and see what they're dealing with. Maybe the treatment goal from the hospital guidelines are this but given this patient's situation and all the social barriers and everything that you might not be aware of from the OMR, you might come up with a more realistic treatment plan and just understanding where they're coming from." – Interview 14
Patient empowerment in the conversation	"If I could try to imagine my role as a provider and being in that office setting with the patient in the family, if I sense that the families had that strong of a presence that the daughters in the virtual reality had, I think that I would be inclined to make sure that everyone was happy because I feel like the family is a part of the care. Now that I have experienced it, I think that I honestly do not want them to have as much of a say in it. I want to make sure that the patient has more time to voice their concern. Yeah, I used to think I wanted the families to be happy too because they're as much involved in the care as the patient. I don't think so anymore" – Interview 4
Pay closer attention to nuances in care and patient behavior – implicit and explicit cues	"I connected a lot with the character or with the patient. It really just reminded me to be very conscious about the importance of communication, and to really address any barriers that may be present in administering or interpreting results or tests. I think I deep down knew that already, but to have this resurface and be more immediately reminded me" – Interview 1 "I think for all of it, the perspective you had sitting in the bed, you sometimes maybe don't realize how much you have to turn when you have people on both sides of the bed, or how hard it is to maybe see somebody in certain areas, especially when your eyes are closed." – Interview 5 "I think the experience today reemphasizes which is just that you have to pay attention to all the clues that patients give you. Some of them will be verbal and explicit but a lot of them will be implicit. Sometimes it's just the emotion they have after you share information or the way their asking questions or the interactions—the dynamics in the room between family members. I think trying

	to approach that with inquiry and curiosity is—for example, there was a scene where the wife was like, "How long?", and the doctor gave an answer." – Interview 7

"it was hard because you could tell that the providers had good intentions. Standing in front of you, right in the middle—where that's actually not what you need. It was hard because I was trying to constantly move my head. It was interesting to reflect on how we actually can't even assume that our best intentions are right, but we'll have to really try to individualize to a person." – Interview 7 |
| **Mindset change: separate the disease from the patient** | ""It's like, in psych they always tell you, don't say that this person is schizophrenic, don't say that person is bipolar. Say that this is a person with schizophrenia, this is a person with bipolar disorder. That played it more—made it more concrete. This is a person with dementia, and then dementia is that block of not being able to accomplish what you want, so, makes it more like a disability that we recognize in other people, more like it makes it seem more like a physical disability as opposed to some inherent feature about them as a person" – Interview 3

"I think that there is an element of, a big element of what I said earlier about meeting patients where they're at. Because I do think that in terms of providing for care for people, some people really want that emotional care also, but there are other people who don't necessarily need that or want that from their doctor. They get their emotional support in other places. I think it's important to try and do your best to recognize with people. Always give them space to ask for or show need for some emotional care. Give them space. Or ask them the right open-ended question to give them the space to verbalize if they need that from you, but also recognizing when people don't necessarily wanna open up and they really are there for medicine or something. Which I think is tough." – Interview 17 |

Level 3: Barriers to empathy

Self

Time management	"I think that's a major thing with any clinical interactions. How you prioritize gathering information and making decisions off of that versus the other things, including questions patients have or understanding their point of view. I think time's the biggest issue." – Interview 6
Attention	"I think the thing in biggest demand, people say time, but I actually argue that it's attention. You can give people time but not attention or you could have your own agenda and not really understand. I think too much of the time we do more talking than listening. We are quicker than we are patient. We're more focused on our own needs then really those of the patient in the room. That makes sense because we feel pressured and we feel constraints, but I think that the biggest barriers probably that you're not going to pick up on something if you're not intending to it." – Interview 7

"it just fear of time, and so just wanting to get through everything? Versus actually not noticing? I think sometimes it's actually not noticing" – Interview 7 |
| **Fear of clouding judgment** | "Obviously, there are dangers to being too empathetic. You don't want to be unable to provide care for your patients. I think that you have to be, otherwise there's no way that you'll be aligned with the goals of your patient." – Interview 15 |

Macrosystem	
Moral injury	"And that's kind of in line with feeling kind of burnt out as well. Because, if doctors are working really long hours and have a lot of patients to see, you have diminished your emotional reserve, and so—I mean, it does take a lot of attention and engagement to have one of these conversations, and it's not easy." – Interview 9 "When you're sleep deprived. When you don't have a lot of resources and you're modeling what you see off of other residents and off of attendings. It has to start somewhere" – Interview 15
Management policies	"I think that there's just too much financial incentive in everything that's done. I think everything is driven by business over patients. I have this debate with some of my friends because a lot of my family's from Canada or UK, which are very different health care systems. They're like, "Well, I hear that you have to wait forever to get—thing." I'm like, "Well, no, not really." Definitely seeing the pros and the cons of a less business-centered approach" – Interview 2 "These are all drawbacks of the system. I recognize that clinicians are there for small parts of it, even though we hold a lot of sway and a lot of decision-making power. Definitely the dynamic of all this stuff going on behind the scenes and then you find out from someone who's in a clinical role that's really not even evolved. Seeing the conversations obviously don't always happen when they should happen for lots of logistical and just practical reasons." – Interview 8
Educational policies	"I think you make time for the things that are priorities. Yeah. If administrators and deans decide one day that this is a priority, then I think that a time will be carved out, and less important things are gonna be—you figure out what's less important by deciding what's important" – Interview 3 "The difficulty is getting people to recognize that, and I think most people, once they recognize that, will do the right thing. Getting people to have the kind of—the difficulty lies in having people have the right kinds of experiences and exposed to the right situations, and then reflecting on them" – Interview 3 "in clinical care we usually focus so much on management, the right diagnosis, developing a great management plan, doing that shared decision-making process knowing that the patient is aware of that management plan and can follow through with it. Recognizing these emotions and nuances and acting upon them, what do you think this—what do you think the role of that is in managing a patient for their care?" – Interview 4
Organizational culture	"I think it would have to be a cultural change in how these conversations are approached. Because, as I said, even if some of those three domains were changed, I feel like there's—unless there's a real drive to show the importance of these conversations, then it could still not happen. And so, I'm not sure what the specifics of this cultural change are, other than just maybe being more present in curriculums or being emphasized from an attending perspective so that people for a training will also recognize that this is important." – Interview 9
Reimagining the role of the physician in care	
The two-fold role	"One of the ways that you help people is by acknowledging their emotions and not triggering them and frustrating them. Remembering that that's also part of your role. It's everyone's role, right? 'Cause everyone who comes into the allied health professions wants to help people. Recognizing that your role is two-fold. You're there to physically fix the problem but you're also there to take care of the person as an individual." – Interview 3

Table 1: Summary of themes - Virtual reality empathy training qualitative program evaluation through the Kirkpatrick framework

Level 1	Level 2	Level 3	
Emotional reactions	**Generated knowledge, attitudes and perspectives**	**Behavioral intentions**	**Barriers to empathy**
Vulnerability Isolation Self-blame Loss of agency	**Towards patients** • Patient empowerment • Prioritizing patient emotional wellbeing • Preservation of patient dignity • Patient internalization of feelings **Towards caregivers** • Caregiver denial • Families/caregivers can be at odds with patients • Lead to insight on patients' social setting • Appreciate their affliction	• Addressing patient's emotional wellbeing • Patient empowerment in the conversation • Pay closer attention to nuances in care and patient behavior – implicit and explicit cues • Mindset change: separate the disease from the patient	**Self** • Time • Attention • Fear of clouding judgment **Macrosystem** • Moral injury • Management policies • Education policies • Organizational culture
Reimaging the role of the physician			
The two-fold role concept			

Figure 1: Barriers to empathic concern

3.2 Discussion

By using the Kirkpatrick model[41] for program evaluation as the framework by which we analyzed the impact of the virtual reality intervention for empathy training, we found that virtual reality was an effective tool at triggering empathic concern towards patients and their families. Virtual reality allowed learners to embody the patients they were learning about and thus share and express the same emotions patients would. They were in their patient's shoes in a literal sense. These emotional reactions (Level 1 Kirkpatrick) allowed users to generate knowledge and attitudinal key points regarding empathic concern towards patients and their families and caregivers (Level 2 Kirkpatrick). This in turn led them to develop their own behavioral intentions to address what they saw as the blind spots in their own clinical care and reflect on what the barriers for that may be (Level 3 Kirkpatrick).

Even though the study explicitly avoided using the term "empathy" in all aspects of research including de-brief interview questions, it was apparent that the main take-home message was that trainee physicians need to show more empathy towards their patients. The brief virtual reality intervention was able to put learners in the shoes of their patients and feel their exact same emotions. It helped them generate key takeaways regarding empathic concern towards patients and their families, which was manifested in a range of behavioral intentions expressed by learners in lieu of that. Another interesting finding was that most learners used of personal pronouns to describe and express the emotions whilst embodying patients. Research suggests that

this is indicative of awareness of others[42,43], which is a critical component to both cognitive and emotional components of empathy and suggestive of emotional contagion[44 6].

In addition, based on the word descriptors used by learners to express their emotions, we note that the terms are suggestive of both sensorimotor and affective constructs that are considered cornerstone to empathic concern[45,46]. Nevertheless, descriptors that suggest "visceral" feelings, another element of empathic concern is missing. This is related to one of virtual reality's shortcomings in generating visceral sensations of pain, etc. New advances are attempting to create new headsets to generate such sensations.

Our findings pertaining to Level 2 Kirkpatrick emphasize the degree to which learners were able to generate knowledge and positive attitudes regarding empathy both towards patients and their families and caregivers. This generated knowledge is similar to concepts of compassion that are sometimes taught didactically in medical school, however, in this case it was generated by learners themselves. Additionally, the Level 2 findings are suggestive of critical thinking by learners.

Assessment of behavioral intentions amongst our learners revealed a range of specific examples for when they go back to clinical care after going through the experience. This included patient empowerment in the conversation, prioritizing patient's emotional needs, paying closer attention to implicit and explicit cues and

treating patients as individual human beings rather than another disease subject. These behavioral intentions are consistent with current conceptualizations around what empathic concern towards patients can look like[8,47–50] and suggestive of cognitive and affective understanding of patient's vulnerable states in care.

Moreover, the barriers towards empathic concern that were reflected upon by learners such as those that pertain to self and the macrosystem are almost similar to research on empathic barriers in the literature[51–54]. Though the concept of moral injury has been of increasing interest in the medical education field, barriers identified pertaining to management and educational policies along with organizational culture are not discussed.

These findings have several implications for medical education. First, our findings suggest that learning empathy through virtual reality is an effective form of pedagogy when. Second, the Kirkpatrick program evaluation model we adopted to generate takeaways and behavioral intentions by learners with regards to empathy can be replicated in post-experience de-briefing exercises.

Our study is first of its kind in adopting the Kirkpatrick framework for program evaluation to lead the qualitative inductive process in assessing the impact of virtual reality in empathy training. This program evaluation model provided us with a theoretical framework to unpack the learning students generated from this experience in a structured manner. Another strength in our study was the diversity of backgrounds

and years of study of the participants in medical school, thereby allowing for a more cohesive perspective regarding the utility of virtual reality for empathy training. Finally, students were blinded to the fact that this study was around empathy and the term "empathy" was explicitly not mentioned or references to when asking the de-brief interview questions. Instead, learners were told this was a study relating to virtual reality in medical education.

Nevertheless, our study has several limitations. First, although our study attempted to address Level 3 of the Kirkpatrick model by assessing learner's behavioral intentions after the study and their critique around empathic barriers, these remain as intentions and not actual actions that we measured or looked out for. Second, though our participants are diverse in their backgrounds, they self-selected to participate in this study. They were indeed blinded to the fact that it is on "empathy" however, their reactions may potentially reflect a bias towards interest in trying this new technology.

Future research could focus on assessing the different levels of Kirkpatrick in the longer term such as observing learner's future interactions with patients and recording structured observations.

3.3 Conclusion

Through the Kirkpatrick model of program evaluation, we found that the VR-based

curriculum was effective from a qualitative perspective in generating emotional and

affective empathic reactions (Level 1 Kirkpatrick), fostering understanding and

cognitive and affective empathic concern towards not only patients but also their

families/caregivers and healthcare providers (Level 2) and triggering behavioral

intentions towards empathy in the patient-provider relationship (Level 3).

Chapter 4: Utility of virtual reality in medical education empathy training - A Qualitative Study

4.1 Results

Participants discussed the utility of VR in medical education, their perceived risks, how it compares to current practices in simulation and where they see it being used for or integrated in the future. This led to the generation of several themes for each.

Utility of VR in medical education

1. Theme: Creates a psychologically safe environment for learning (Psychological safety & Education)

It appears that patient point of view experiences through virtual reality create a psychologically safe environment for learners to reflect and generate takeaways from. Attributing to that is perhaps what learners described as the utility of virtual reality in self-improvement. They also noted that it creates an environment where they feel not judged and can be used as a coping tool when reflecting on situations in healthcare that went wrong without the fear of consequences. It also creates a safe environment for them to learn from their mistakes. This is further amplified by what learners described as the ability of these virtual experiences in triggering their curiosity and encouragement of asking further questions. Nevertheless, learners attributed the debrief process as being the instrumental aspect facilitating the psychologically safe environment.

2. Theme: Promotes humanism in healthcare

Learners reflected on the ability of virtual experiences in helping them pay attention to implicit and explicit cues and nuances in the clinical setting. Being able to tap into the social dynamic of the family and physically embodying a patient's race allowed them to be more culturally and ethnically aware of others. This awareness is key in being able to deliver compassionate and sensitive care. Learners find such experiences a comfortable space to trigger or remind them of those humanistic values of care when being in the patient's shoes in a literal sense.

3. Theme: Constructivism: Bridges experiential, immersive and situated learning methods

POV virtual reality's ability at embodiment through experiencing physical changes that patients go through and performing tasks in a virtual setting allows it to retain aspects of both immersive learning and experiential learning through its virtual situation. Learners attributed this to several reasons including 1) Sensory stimulation, 2) Brain deception, 3) Feeling of inclusion, 4) Learning by experiencing and doing. Some learners therefore noted that it could potentially replace shadowing that is more passive. Learners noted that their mere presence in the environment allowed them to pick up nuances that they did not before.

4. Theme: Enhances emotional intelligence

Virtual reality was also seen as a tool for developing and enhancing one's emotional intelligence. The reasons for that included: 1) Helps learners identify their own blind spots are providers, 2) Increases learner awareness of implicit and explicit biases, 3) Promotes self-awareness and reflection and 4) Triggers the evaluation of preconceived

notions and assumptions. This frequently meant seeing things that they could see before or noticing aspects of care that were not obvious to them before. It also stimulates their critical thinking. Learners also noted that such experiences are very memorable for them and hard to forget.

5. **Theme: Medium for personalized learning**

Learners found virtual reality as a medium for personalized learning too. The emphasized that it could be used as a tool to focus on experiences where learners do not know about or need development in their skills for. This would thereby allow them to "self-design" a curriculum by selecting experiences with aspects they are weak in or would like to improve in.

Risks of VR in medical education empathy training

1. **Theme: Overreliance**

Learners noted that the utility of virtual reality in medical education in general should remain supplementary rather than primary. There was a fear that virtual reality's short-term success and emotional triggering may lead institutions to rely on it too much for empathy training.

2. **Theme: Illusion of knowing**

Learners expressed that some may consider aspects of certain experiences of patients going through certain diseases to be a full representation of what a patient with that disease can go through. Therefore, such learners have an illusion of knowing aspects of that condition and what the patient's emotions are like, when in reality

different patients even with the same condition can have totally difference dynamics or disease severity.

3. **Theme: Dependent on film quality**

The quality of both the filming and educational component of the storyboards in the experiences places a huge role in the amount of learning generated from them learners noted. Consequently, educational success of such experiences is highly dependent on their quality, include that of actors in the scenarios or otherwise the experience would appear less realistic.

4. **Theme: Lack of adaptive learning**

Another challenge that learners picked up on in virtual reality experience in medical education is the limited adaptive ability of those learning experiences. Consequences of certain actions are generally standardized in the experience and one cannot change the scenario. Therefore, learners are limited to the frame that is curated by those who design the experience.

5. **Theme: Requires reflection**

Learners signified that a huge component of learning from virtual reality lays in the process of de-briefing and reflecting after those experiences. They noted that this process is equally important as the experience itself. They emphasized the need for crafting time towards reflection after these experiences. They also felt that reflection should be done amongst their peers with minimal intervention by instructors or rather mere facilitation.

Compared to OSCE and simulations:

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Learners noted that virtual reality by nature of its ability is very different from OSCEs or simulations. They observed that 1) Simulations are done from the provider point of view while virtual reality can be done from the patient point of view, 2) Virtual reality's immersive ability allows for picking up insight into emotions and nuances in care compared to simulations.

Stages of integration in medical school:

Learners in our study believed that virtual reality empathy training or for medical education in general should be a component in the medical school curriculum. They noted that there should be more of it and delivered in a longitudinal fashion with frequent points of reflection and de-briefing. Some learners noted that this has higher value for students in pre-clinical years as a form of priming before going into rotations, while others found higher value in its delivery during clinical years, because of learner's ability to reflect on the real clinical setting during that stage.

Potential future applications

1. **Theme: Augmented reality and artificial intelligence**

In relation to what learners saw could be potential future applications for virtual reality in medical education from their perspective, they thought that experiences could be designed so that learners can take a more proactive role in changing the scenario such as having virtual patients respond to you based on what you are saying or using such technology to augment existing experiences such as augmenting models in clinical skills labs.

2. **Theme: Diversity and Inclusion issues**

Some learners found that virtual reality could be potentially used to addresses contemporary challenges relating to diversity, equity and inclusion. One specific example was that of transgender care, which one learner pointed POV experiences could be created for. Therefore, there is potentially for specifically designing learning opportunities to allow for empathy in certain population groups that may be at a disadvantage in clinical care.

Theoretical model: virtual reality and empathy training in medical education
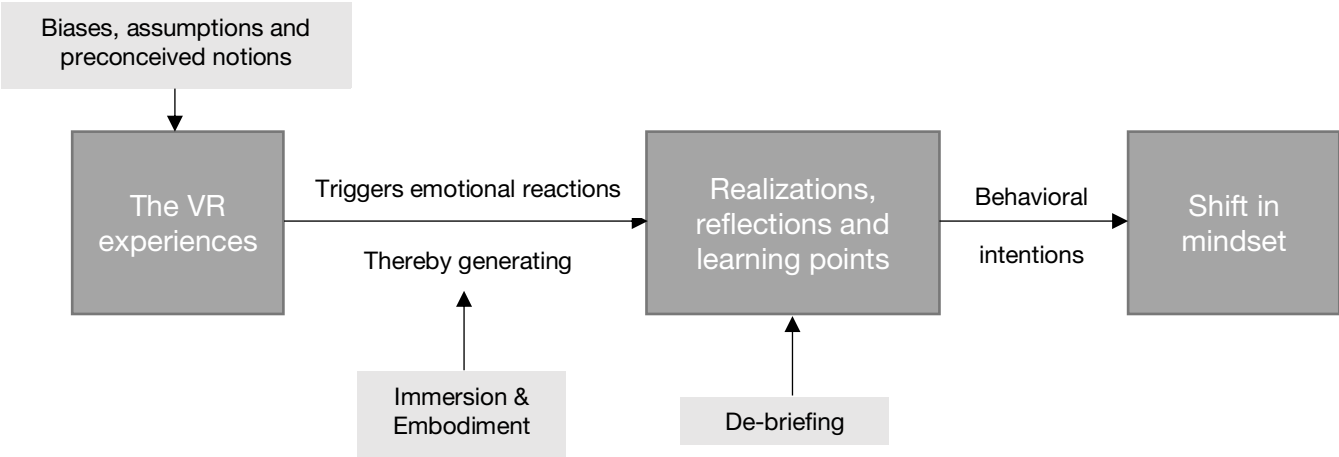
Biases and preconceived notion, Assumptions, The experience, Triggers emotional reactions, Generates realizations and learning points, Translates to behavioral intentions, New outlook

Utility of virtual reality in medical education: Themes and illustrative quotes

Theme	Illustrative quote
Utility of virtual reality in medical education	
Creates a psychologically safe environment for learning	"We can probably standardize certain ways of teaching and gain exposure to different types of cases that we might not necessarily see in clinic. I guess there's also free rein to do—to try anything that I'm not quite comfortable trying in an actual setting with a patient" – Interview 4 "I think that it would be really interesting to continue it, but also to have people reflect. Even if they can't create their own virtual reality of a patient that they saw. I think it would be super valuable to have some protected time. I don't know when that would be. Definitely not during courtship year. It should be like, "I want you to think about a patient and then actually try and figure out what their day-to-day experience is like." I don't think we have a lot of time for that. There've been some snippets of mild attempts to do that, but honestly, I don't think you really get the full picture. Unless you're spending a full day with someone or talking with their family about it. Maybe some people have had that experience. I don't think it's a formal part of the curriculum" – Interview 15 "Maybe I can—I don't know. I'm not gonna say like, oh, I wanna try to say something risky, but I would—I definitely don't think that I will feel judged" – Interview 4
Promotes humanism in healthcare	"It's just part of being empathetic and putting yourself in someone else's shoes. I think if the providers can see where the patients are coming from, they'll understand their decisions better when they might not agree with the provider's recommendation and just reminding everyone that it's the patient's wishes that are most important." – Interview 14 "I think it definitely increased my sensitivity to the nuances of care, how in terms of my management and approach to patients, not only to think through the eyes of the medical differential treatment, what's the next step, go to up to date and get those information, but how to translate that information and add humility and humanism into the care that we provide." – Interview 16
Bridges experiential, immersive and situated learning	"I think having the VR be immersive, and you're able to look around and see how you perceive the world, how you're able to see the world, and listen to—I think that the sight was probably the more striking of the two, I would say. With the sounds, you can still hear your environment, but having the headset there is block your peripheral vision, and the environment changes when you turn your head, is very realistic, and immersive, and I think VR is such a good platform for that." – Interview 16 " I was surprised by how quickly our brain can use visual cues to create a different identity. Reaching out and seeing a change in my skin color helped me to really feel like I was more embodying the role of Alfred. Also, I remember looking—in the clinic, it never said that my son was with me. I was sitting there at the clinic, I didn't expect him to be there. Then I looked around and then when I saw him, I was like, "Oh, wow. I really am an older gentleman who needs his son."" – Interview 7

Enhances emotional intelligence	"I feel like the only way you'd be able to read that is understanding the feeling in the room of what their emotional state is, their nonverbal cues, perhaps their verbal cues. You can't always count on that. That's the thing. You can't always count on it. Experiencing those emotions through this is just the richest way to build up the portfolio of possible emotions people might be experiencing and to then understand how best to address them." – Interview 13 "I think that's my biggest takeaway, like I said earlier, was the VR experience really pushes you from that, recognizing that someone could be sad because they're getting that cancer diagnosis, really having a more nuanced understanding of what that might feel like and the thoughts that could come up for you, and the helplessness, the, yeah, the frustrations" – Interview 3
Medium for personalized learning	"I think one thing that I thought about was how this—right now in the settings, everyone learns the most common things, the most common ways to be empathetic, or the most common ways to tell people bad news or deal with dying and stuff like that, but since everyone has different comfort zones, I feel like it'd be really cool to be able to pick and choose some things that you feel like you're not as comfortable with, a constant self-designing your curriculum based on your weaknesses. I thought this could be definitely a cool opportunity for that." – Interview 5
Risks of virtual reality in medical education empathy training	
Overreliance	"Overreliance. It's obviously not at that stage of probably the technology right now, but if people at some point just started slowly relying on virtual reality sorts of things instead of going through actual patient interactions or practicing on standardized patients or something of that nature, that's obviously not ideal. It should be used as an aid, not the primary teaching tool" – Interview 6
Illusion of knowing	"One of the risks, I guess, is that at the end of the day you do take off the glasses and you can come away thinking that you understand fully and yet not" – Interview 7 "You wouldn't want people to think this is representative necessarily of what a particularly type of patient. It's just being aware different patients have different experiences and needs." – Interview 11 "I think it's imperfect, obviously. I think that until you've really experienced something yourself, a 30-minute or however long VR session can give you a snapshot into it, but you can't experience what it's like to live day in and day out, right?" – Interview 2
Dependent on film quality	"The disadvantage from using virtual reality if I was the patient might be that, because I am not completely immersed in it and I know I can leave the setting, I might not feel the extent of what they feel and assume that the heartache that they feel is what's actually real, when in fact it's not. That could potentially be, if it's not accurate to a real setting, it could potentially be a waste of resources and time" – Interview 4
Lack of adaptive learning	"The fact that you are forced through a fixed narrative requires you to suspend some element of your own perceptions, your own preferences for things. If you come into it with that mindset like, "I'm gonna pretend I'm Alfred, the 74-year-old black man right now," that's an effective—everything else works if you can take that initial leap. I'm sure some people would be more resistant to take that leap than I was coming to this, signing up to do it." – Interview 13

Requires reflection	"I don't see any real drawbacks. I guess, one limitation is that there are only a limited set of experiences that you can have. You might think things happen one way, but they may not capture the entirety of what goes on. There's not always the time to reflect on the experience if you just have that available and not have structure around it. I think that there's limitations." – Interview 10

Comparison to OSCE and simulations	
	"I think this is definitely adding something to the experience, because it puts you in someone else's shoes, and be both, sort of clinically, but then, also just like situationally, and socially, allows you to see the context of having family members around, and then, going home, and then being in different settings. You're following the patient along that journey, between different medical settings, and that is not—that's just not addressed by patient, like OSCE, at all." – Interview 12

"This is essentially a way of stripping away all of the hours and hours of standing around without really fruitful experiences of still having those impactful moments. I think these can be very worthwhile in making sure in an efficient but still very realistic way you're having those experiences that you can really imprint and draw from going forward." – Interview 13 |

Stage of integration in undergraduate medical education	
Longitudinal integration	"Thought maybe we should all have to do it in medical school, honestly. Because it's so easy to just, yeah, to lose sight of what the patient experience is like. To just completely be like, "Well, I fixed their hyponatremia, so they can leave." It's like, "Okay but there's more to them than that. There's more to how you can [unintelligible 14:58] information on that. Being particularly mindful that sometimes things that we take for granted are actually just really hard for people, based on a lot of things." – Interview 15
Early or late integration	"I feel like this would be a much more engaging way of phasing out that previous model of just clicking through things. I'm also mentioning those cases to show that such a supplemental learning experience would not be unprecedented. Yeah. I feel like early clinical period would be really good for this or during the clinical period, making sure people get those certain experiences that you want them to get. Like I said, like the medicine cases" – Interview 13

Value of debrief	
Helps in mean making	"I think, most importantly whenever we do the OSCEs or anything else, like I said, I think the most precious thing is the time for reflection. Sometimes you are hit with things and you—there's a process to meaning-making. There's the experience and the sensations, then there's the perception—this is like how the brain works. There's sensation primary. There's perception, then there's meaning making, which is a higher process. I feel like sometimes it's very quick. You get the sensation. You have perception. You have a thought." – Interview 7
Stimulates critical thinking	"My greatest fear in medical school is losing empathy. I think it's something that is really–It's a risk that's very real. Data is not in my favor, for how empathetic I'm gonna be when I come out of here. Don't tell them that, but it's true. I think that, hopefully, having experiences like this, and also just taking the time to step back. Even if it wasn't a scenario that we went through. Just using this as a jumping-off point to be like, "Wow, I wonder what that's like for this patient every single day of their life." Or, "What is it like when I go into their room and they haven't slept all night? 'Cause 500 people have interrupted them, and they just got this new diagnosis." Their family may or may not be there. I think that's really a valuable thing to train and look at the monitor, I think you should be thinking to yourself, "What is it like for this patient?" Because otherwise, you

just end up seeing people as numbers and as conditions and losing sight of why you're doing this in the first place" – Interview 15

Potential future application	
Augmented reality and artificial intelligence	"I think that's just a continuous quality improvement limitation. I guess it would be cool to incorporate—I've heard of these places where you can wear age suits that make it harder to move your joints and stuff. Potentially there are some limitations to it, it's augmented but it's not fully real." - 7
Diversity and inclusion training	"This is a totally personal plug, but my other interest is in trans health. One of the things I've been thinking about in the hospital is how we strip our trans patients of literally everything that they put on themselves to make themselves feel good. Then we take them and we put them in a hospital gown and they're not allowed to have any of that stuff. I think that could be an interesting thing. Maybe a little bit more niche than some of the more common geriatric conditions, but worth thinking. How what you strip people of, their gender identity, when they put them in the hospital. Regardless of how well-intentioned we are." – Interview 15

Discussion

Our findings suggest that the use of virtual reality in the medical education setting is acceptable, engaging and fosters learning. We found that virtual reality educational interventions such as those that pertain to empathy training 1) leverage elements of both immersive and experiential learning to facilitate critical thinking and reflection, 2) It creates an environment of psychological safety for them to critically reflect back on their own clinical experiences, 3) foster and remind themselves of the values of humanism and 4) build their emotional intelligence. However, we also found that in the medical education setting, its carriers some risks and challenges namely: 1) overreliance, 2) amplification of illusions of knowing, 3) lack of adaptability, 4) highly dependent on the quality of actors and filming, 5) requires crafting time for reflection. Moreover, in relation to how virtual reality compares to simulation in medical education, learners noted the edge virtual reality has in making learners be in the shoes and embody patients and therefore allow them to see the world from the patient perspective rather than the provider one. This allowed them to identify their own blind spots and pay attention to nuances in care. Finally, learners thought that virtual reality is a creative medium that needs formal integration into medical school curricula in a longitudinal fashion. They also emphasized the need for peer de-briefing after going through such experiences.

Our findings are in accordance with several learning theories. First, the concept of experiential learning (Kolb)[55] that characterizes the process of learning as a cyclical one involving a concrete experience, reflective observation, abstract conceptualization

and active experimentation. As a medium, we found that virtual reality offers a concrete experience consistent with previous research[56] and the de-briefing process after it assist in reflective observation and abstract conceptualization. In virtual environments learners can do specific tasks while embodying another character, thereby facilitating "doing", however, we found that scenario adaptation based on learner's actions in the experience remains a challenge/pitfall in VR. Second, is the concept of immersive learning the describes learning through interaction and engagement, which is documented in the field of virtual reality and education[57–60]. We found that through sensory stimulation and virtual inclusion, virtual learning environments are able to deceive the brain into being situated and immersed in a different world. Furthermore, this immersion allows for situated learning and cognition (Lave)[61–63] in addition to learning through social dynamics in the virtual scenarios (Vygotsky)[64,65]. This in turn helps it facilitate situated cognition[66].

Furthermore, our findings suggest a role for virtual reality empathy training in building and enhancing learner's emotional intelligence (Goleman)[67] by allowing learners to identify implicit and explicit cues and increase their self-awareness of emotional implications. This facilitates learner's development of their emotional competence, which is cornerstone to empathy and empathic concern towards patients. Additionally, we found that VR empathy training can also help foster humanistic values in healthcare amongst learners due to increased awareness about others and their colleagues. This supports findings in previous research around digital

humanism through VR due to its ability in allowing learner's pay attention to intricacies around them[22,68,69].

Moreover, our learners found virtual reality to be an ideal medium for personalized learning. First, it is not time bound, which in healthcare settings would mean that learners can go through experiences at their own pace and second, learners can select experiences that they would like to learn more about and where instructors find they have weaknesses in. Recent research and development in VR and education is focusing on addressing this personalization aspect better.

We also found that VR creates an environment of psychological safety for students to learn. In education, psychological safety literature suggests that such environments need to make learners feel positive, comfortable and safe in expressing their opinions and ideas without fear[70,71]. Our findings support that and emphasize a unique role for VR in the education literature and that is as a tool for coping. Learners noted that during their clinical years they go through several traumatic experiences that they do not get a chance to process or think about. VR offers them a safe space to express their feelings and reflect with regards to what is happening around them in the real hospital setting.

Lastly, our learners found the patient point of view perspective from VR experiences to be a unique offering as opposed to simulation training. Though there were discrepancies as to which years in medical school would benefit the most from

such experiences, there was general consensus that it should be used throughout medical education in a longitudinal fashion. Our learners also feel that VR experiences can have utility in being used to tackle contemporary issues in medical education such as diversity and inclusion. Based on these findings, we hypothesize a theoretical model for how learning occurs through VR (Figure).

These findings have several implications. First, it informs medical educators and education leaders' insight into the utility of VR as an emerging technology in contributing to patient-centered care. This is of particular significance due to new generations of medical students who are keen on new modalities for learning. Second, VRs merging of several learning theories makes it a useful tool that can replace current practice of didactic and shadowing pedagogy that is used during the pre-clinical years of medical school. Third, it offers a medium to address issues of diversity, inclusion, social belonging and microaggression, which are current challenges in medical education.

Our study has several limitations. First, it was conducted in the undergraduate medical education setting and though the utility of VR in the graduate medical education would unlikely be different, the challenges and risks to VR implementation and use in empathy training in the undergraduate vs. graduate medical education settings could be different. Second, the two virtual reality experiences that we selected from the developer focused on allowing learners to 1) experience physical disability and 2) tap into the emotional dynamics of healthcare. We deem those experiences to

be of high quality. These experiences were filmed using 360-degree cameras with real actors. Some virtual experiences are completely virtual with no real actors; thus, our findings pertain to filmed VR with real actors rather than experiences with designed graphics. Third, our study was advertised as a VR study and not one related to empathy, which is a strength, however, that may also mean learners who participated may have been curious about trying out VR.

Future research could focus more on how to best integrate VR experiences for empathy training in the medical education curriculum. Our study offered insights based on student perspectives on how VR should be integrated in a longitudinal fashion. Further research gathering perspectives from medical educators, clinicians and leaders could help better identify the challenges to and mechanisms of integrating this into the curriculum from their standpoint. It would also be interesting to interview participants from the graduate medical education setting such as residents and fellows to compare if their challenges to VR differ from that of medical students.

4.2 Conclusion

In conclusion, our study suggests the virtual reality for empathy training is an acceptable and engaging tool for learners. It can help foster humanistic values in healthcare and creates an environment of psychological safety for students to learn. Pedagogically, it takes a constructivist approach to learning that merges concepts from experiential, immersive and situated learning. Learners find it superior to some simulations because it gives them a patient perspective as opposed to a provider one

and believe it should be integrated into the curriculum in a longitudinal fashion with

peer debriefing.

Appendices

A: Images of the virtual reality experience
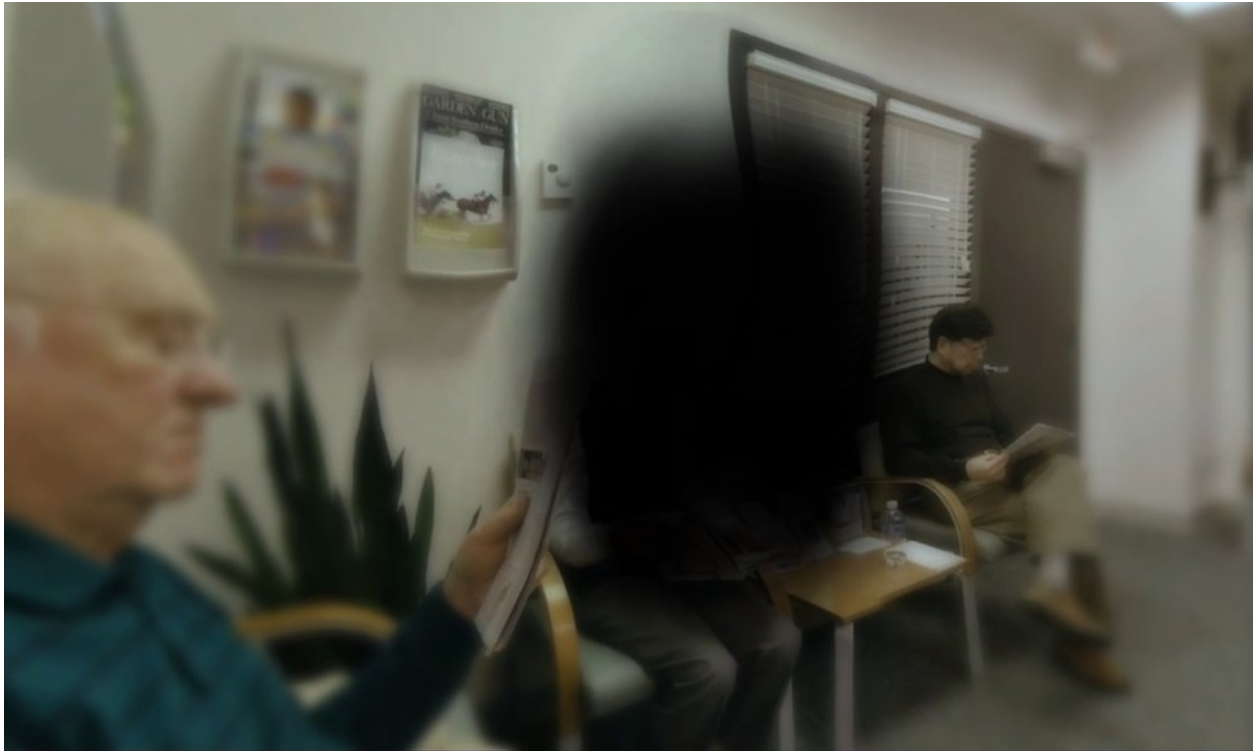
Virtual reality experience 1: Visual and hearing impairment

Virtual reality experience 2: End of life care
Source: Embodied Labs

B: Interview Guide

Interview Guide

Thank you for your participation in the virtual reality experiment to teach students core clinical skills in medical school. My name is X and I am one of the researchers conducting this experiment where we are trying to study the role of virtual reality in medical teaching. We are primarily interested in knowing more from you about your experience using virtual reality. I would like your permission to tape record this interview, so I can accurately document the information. If at any time during the interview you wish to discontinue the use of the recorder or the interview itself, please feel free to let me know. Our conversation is confidential so do feel free to share your thoughts. Do you have any questions before we begin? Awesome, let's begin!

1. Tell me more about how this immersive experience made you react and feel?
2. Prior to this experience, did you find it difficult or easy viewing things from the patient perspective?
3. You also went inside the shoes of someone with macular degeneration. Describe how this experience was for you.
    a. Was there something surprising?
    b. Did it change the way you see or think about patients with macular degeneration?
    c. How was it like not to hear?
    d. How was it like trying to do activities? (Spilling coffee, writing notes, hearing others)
4. In the end, you saw the world through the perspective of someone with a terminal illness. Describe how this experience was for you.
    a. Was there something surprising?
    b. Did it change the way you see or think about patients going through end of life care?
    c. How did you feel about your family? (Worried, concerned, looking out for your, your hallucinations, etc)
5. Does this experience make you re-think how you would interact with your patients in the future?
6. Do you think there is value in paying attention to your patient's emotions while taking history or following up with them? Why?
7. Does this experience make you re-think how you would interact with your patient families in the future?
8. What effect do you think exhibiting emotions towards patients and their families plays in patient care? You can talk about positive and negative effects.

9. How does your experience in learning empathy using virtual reality compare to how you were learning before?
10. What do you think are the advantages and disadvantages of using virtual reality in teaching?
11. Do you have any more thoughts you would like to share that we have not talked about before concluding our interview?

C: Empathy Scale (Toronto Empathy Questionnaire)

Below is a list of statements. Please read each statement carefully and rate how frequently you feel or act in the manner described. Circle your answer on the response form. There are no right or wrong answers or trick questions. Please answer each question as honestly as you can.

		Never	Rarely	Sometimes	Often	Always
1.	When someone else is feeling excited, I tend to get excited too	0	1	2	3	4
2.	Other people's misfortunes do not disturb me a great deal	0	1	2	3	4
3.	It upsets me to see someone being treated disrespectfully	0	1	2	3	4
4.	I remain unaffected when someone close to me is happy	0	1	2	3	4
5.	I enjoy making other people feel better	0	1	2	3	4
6.	I have tender, concerned feelings for people less fortunate than me	0	1	2	3	4
7.	When a friend starts to talk about his\her problems, I try to steer the conversation towards something else	0	1	2	3	4
8.	I can tell when others are sad even when they do not say anything	0	1	2	3	4
9.	I find that I am "in tune" with other people's moods	0	1	2	3	4
10.	I do not feel sympathy for people who cause their own serious illnesses	0	1	2	3	4
11.	I become irritated when someone cries	0	1	2	3	4
12.	I am not really interested in how other people feel	0	1	2	3	4
13.	I get a strong urge to help when I see someone who is upset	0	1	2	3	4
14.	When I see someone being treated unfairly, I do not feel very much pity for them	0	1	2	3	4
15.	I find it silly for people to cry out of happiness	0	1	2	3	4
16.	When I see someone being taken advantage of, I feel kind of protective towards him\her	0	1	2	3	4

Enrollment Survey

Enrollment - VR Patient Immersion Study

Q2 What gender do you identify as?

▼ Male (1) ... Do not wish to answer (4)

- -

Q3 What is your age?

▼ 18 (1) ... 60 (43)

- -

Q5 What is your ethnic background? (Select all that may apply)

- [ ] White non-hispanic (1)

- [ ] Black (2)

- [ ] LatinX (3)

- [ ] Asian (4)

- [ ] Middle Eastern/Arab (5)

- [ ] Indian (6)

- [ ] Native American (7)

- [ ] Other (8)

- [ ] Do no wish to answer (9)

Q4 What year in medical school are you in?

▼ Year 1 (1) ... Year 5+ (5)

Q15 Choose the MD program you are part of:

▼ Pathways (1) ... HST (3)

Q12 Choose the type of degree you are completing

▼ MD Only (1) ... MD/Other Masters Degree (4)

Q14 What stage in the MD program are you in?

○ Pre-clerkship phase (1)

○ PCE (2)

○ PCE (With Longitudinal Integrated Clerkship) (3)

○ Post-PCE/ASCE (4)

Q6 What was your undergraduate (pre-med) major of study?

☐ Natural sciences (1)

☐ Engineering (2)

☐ Humanities and Arts (3)

☐ Social sciences (4)

☐ Economics/Business (5)

☐ Policy/Government (6)

☐ Other (7)

Q7 How many languages can you speak fluently

▼ One language (1) ... Five or more languages (5)

Q11 Which field of medicine do you intend to or will mostly likely specialize in?

▼ Medical specialities (1) ... Non-clinical (12)

Q8 Have you had any prior training in any of the following? (Select all that apply)

☐ Communication skills (excluding those in medical school) (1)

☐ Empathy-focused training (like neurobiology of empathy) (2)

☐ Mindfulness/Reflective listening (3)

☐ Drama & Arts (4)

☐ Theatrical Improvisation (5)

☐ Non of the above (6)

Q9 Have you used a virtual reality device before? (Like Oculus or Samsung Gear, etc)

○ Yes (1)

○ No (2)

Q10 What did you use virtual reality for? (Select all that apply)

☐   Video gaming (1)

☐   Theme park games/rides (2)

☐   Educational experience (3)

☐   Other (4)

End of Block: Let's get to know you!

Start of Block: Last Question: Rate the following statements

Q1 Below is a list of statements. Please read each statement carefully and rate how frequently you feel and act in the manner described. Select your answer on the

response form. There are no correct answers or trick questions. Please answer each question as honestly as you can.

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
When someone else is feeling excited, I tend to get excited too. (1)	○	○	○	○	○
Other people's misfortunes do not disturb me a great deal. (2)	○	○	○	○	○
It upsets me to see someone being treated disrespectfully. (3)	○	○	○	○	○
I remain unaffected when someone close to me is happy. (4)	○	○	○	○	○
I enjoy making other people feel better. (5)	○	○	○	○	○
I have tender, concerned feelings for people less fortunate than me. (6)	○	○	○	○	○

When a friend starts to talk about his\her problems, I try to steer the conversation towards something else. (7)	○	○	○	○	○
I can tell when others are sad even when they do not say anything. (8)	○	○	○	○	○
I find that I am "in tune" with other people's moods. (9)	○	○	○	○	○
I do not feel sympathy for people who cause their own serious illnesses. (10)	○	○	○	○	○
I become irritated when someone cries. (11)	○	○	○	○	○
I am not really interested in how other people feel. (12)	○	○	○	○	○
I get a strong urge to help when I see someone who is upset. (13)	○	○	○	○	○

When I see someone being treated unfairly, I do not feel very much pity for them. (14)	○	○	○	○	○
I find it silly for people to cry out of happiness. (15)	○	○	○	○	○
When I see someone being taken advantage of, I feel kind of protective towards him\her. (16)	○	○	○	○	○

End of Block: Last Question: Rate the following statements

D: Post-Survey for Intervention Group

Intervention VR Patient Immersion

Q24 Your email:

_____

Q26 With 3 words, how was the vision and hearing impairment experience like?

_____

Q27 With 3 words, how was the end of life experience like?

_____

Q28 With 3 words, how was the migration disaster survivor experience like?

_____

Q1 Below is a list of statements. Please read each statement carefully and rate how frequently you feel and act in the manner described. Select your answer on the

response form. There are no correct answers or trick questions. Please answer each question as honestly as you can.

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
When someone else is feeling excited, I tend to get excited too. (1)	○	○	○	○	○
Other people's misfortunes do not disturb me a great deal. (2)	○	○	○	○	○
It upsets me to see someone being treated disrespectfully. (3)	○	○	○	○	○
I remain unaffected when someone close to me is happy. (4)	○	○	○	○	○
I enjoy making other people feel better. (5)	○	○	○	○	○
I have tender, concerned feelings for people less fortunate than me. (6)	○	○	○	○	○

When a friend starts to talk about his\her problems, I try to steer the conversation towards something else. (7)	○	○	○	○	○
I can tell when others are sad even when they do not say anything. (8)	○	○	○	○	○
I find that I am "in tune" with other people's moods. (9)	○	○	○	○	○
I do not feel sympathy for people who cause their own serious illnesses. (10)	○	○	○	○	○
I become irritated when someone cries. (11)	○	○	○	○	○
I am not really interested in how other people feel. (12)	○	○	○	○	○
I get a strong urge to help when I see someone who is upset. (13)	○	○	○	○	○

When I see someone being treated unfairly, I do not feel very much pity for them. (14)	○	○	○	○	○
I find it silly for people to cry out of happiness. (15)	○	○	○	○	○
When I see someone being taken advantage of, I feel kind of protective towards him\her. (16)	○	○	○	○	○

Q23 These are a few words and phrases about your VR experience. Rate each based on how truly they reflect your experience.

	True to my experience (6)	Somewhat true to my experience (7)	Neutral (8)	Somewhat untrue to my experience (9)	Untrue to my experience (10)
The instructions were clear and easy to understand (1)	○	○	○	○	○
The headset gear was easy to use (2)	○	○	○	○	○
Useful as an educational tool to know more about what others go through (13)	○	○	○	○	○
Self-directed experience (4)	○	○	○	○	○
Thought provoking experience (5)	○	○	○	○	○
Increased my self-awareness about the conditions I was immersed in (7)	○	○	○	○	○
Claustrophobic (10)	○	○	○	○	○
Realistic (11)	○	○	○	○	○
Engaging (12)	○	○	○	○	○

Helped me imagine what others can go through (14)	○	○	○	○	○
Made me more empathic towards the experiences I was immersed in (3)	○	○	○	○	○
Would do it again (8)	○	○	○	○	○
Would recommend it to a friend (9)	○	○	○	○	○

Q26 **Last Question: Below is a list of statements. Please read each statement carefully and rate how true that is to your own self. There is no right or wrong**

answer. Some things may be true of you and others not so much. Try to answer as honest as you can.

	Untrue of myself (18)	Somewhat untrue of myself (19)	Neutral (20)	Somewhat true of myself (21)	True of myself (22)
It's hard for me to understand what my patients go through (1)	○	○	○	○	○
It's hard for me to imagine how it's like to be in my patient's shoes (2)	○	○	○	○	○
I think that being thoughtful to patients has little impact on their outcomes (3)	○	○	○	○	○
I believe that patient emotions shouldn't be considered when planning their management (4)	○	○	○	○	○
I can imagine what its like for someone to loose their loved ones (5)	○	○	○	○	○
I think that patients can be a burden for caregivers and family (7)	○	○	○	○	○
When I meet a patient, I try to imagine what it is like for them to have their illness or symptoms (8)	○	○	○	○	○

I can easily imagine what it might be like to have a serious disease like cancer (9)	○	○	○	○	○
I often think about how treatment might affect the quality of a patient's life (10)	○	○	○	○	○
I understand how an illness/symptoms can affect a patient's day-to-day experience (11)	○	○	○	○	○
I try not to think too much about the impact of illness on patients' lives (12)	○	○	○	○	○
If I were treating a patient with a serious chronic illness, I would make sure to ask them about how they are coping with the illness (13)	○	○	○	○	○
I try to separate my feelings towards patients from my clinical judgment (14)	○	○	○	○	○

E: Post-Survey for the Control Group

Control Survey VR Patient Immersion

Q18
Control - VR Patient Immersion Study
  Thank you for enrolling. This is the control group survey for the study. It takes <2 minutes and you will get a $10 Amazon Gift Card to your email once you complete this survey!

 Click on the "NEXT" button on the bottom right-hand corner of this page to get started.

Note: Doing the VR is voluntary but would probably be cool and fun if you do! The signup link for December and January will show at the end of the survey and is also available for you on email!

Q24 **Below is a list of statements. Please read each statement carefully and rate how true that is to your own self. There is no right or wrong answer. Some things may be true of you and others not so much. Try to answer as honest as you can.**

	Untrue of myself (18)	Somewhat untrue of myself (19)	Neutral (20)	Somewhat true of myself (21)	True of myself (22)
It's hard for me to understand what my patients go through (1)	○	○	○	○	○
It's hard for me to imagine how it's like to be in my patient's shoes (2)	○	○	○	○	○
I think that being thoughtful to patients has little impact on their outcomes (3)	○	○	○	○	○
I believe that patient emotions shouldn't be considered when planning their management (4)	○	○	○	○	○
I can imagine what its like for someone to loose their loved ones (5)	○	○	○	○	○
I think that patients can be a burden for caregivers and family (7)	○	○	○	○	○
When I meet a patient, I try to imagine what it is like for them to have their illness or symptoms (8)	○	○	○	○	○

I can easily imagine what it might be like to have a serious disease like cancer (9)	○	○	○	○	○
I often think about how treatment might affect the quality of a patient's life (10)	○	○	○	○	○
I understand how an illness/symptoms can affect a patient's day-to-day experience (11)	○	○	○	○	○
I try not to think too much about the impact of illness on patients' lives (12)	○	○	○	○	○
If I were treating a patient with a serious chronic illness, I would make sure to ask them about how they are coping with the illness (13)	○	○	○	○	○
I try to separate my feelings towards patients from my clinical judgment (14)	○	○	○	○	○

Q1 **Last question: Below is a list of statements. Please read each statement carefully and rate how frequently you feel and act in the manner described. Select your answer on the response form. There are no correct**

answers or trick questions. Please answer each question as honestly as you can.

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
When someone else is feeling excited, I tend to get excited too. (1)	○	○	○	○	○
Other people's misfortunes do not disturb me a great deal. (2)	○	○	○	○	○
It upsets me to see someone being treated disrespectfully. (3)	○	○	○	○	○
I remain unaffected when someone close to me is happy. (4)	○	○	○	○	○
I enjoy making other people feel better. (5)	○	○	○	○	○
I have tender, concerned feelings for people less fortunate than me. (6)	○	○	○	○	○

When a friend starts to talk about his\her problems, I try to steer the conversation towards something else. (7)	○	○	○	○	○
I can tell when others are sad even when they do not say anything. (8)	○	○	○	○	○
I find that I am "in tune" with other people's moods. (9)	○	○	○	○	○
I do not feel sympathy for people who cause their own serious illnesses. (10)	○	○	○	○	○
I become irritated when someone cries. (11)	○	○	○	○	○
I am not really interested in how other people feel. (12)	○	○	○	○	○
I get a strong urge to help when I see someone who is upset. (13)	○	○	○	○	○

When I see someone being treated unfairly, I do not feel very much pity for them. (14)	○	○	○	○	○
I find it silly for people to cry out of happiness. (15)	○	○	○	○	○
When I see someone being taken advantage of, I feel kind of protective towards him\her. (16)	○	○	○	○	○

Q22 Thank you! You will get the Amazon Gift card via email!

To select your preferred time to do the VR (December or January): https://docs.google.com/spreadsheets/d/1kglLT6ECtVsikzZmYno7uPgB4NAeZttsinSQaTNofGM/edit?usp=sharing

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