

Effective Empathy Training for Dementia Caregivers Using Virtual Reality

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Abstract

The study uses HTC Vive and DayDream for participants to experience the behavioral feelings of dementia patients (first-person). Can first-person experience enhance caregivers understand dementia patients? Findings indicated that 44 subjects reached 93.9% agreement in HTC Vive and the learning effect of dementia was significantly improved ($p = .000 ***$). Post-test of 79 participants wearing DayDream reached 89.1% consistency and it achieved a significant improvement in learning effect of dementia ($p = .000 ***$).

Key words: empathy, dementia caregivers, virtual reality

Introduction

A. Research Motivation

In recent years, human society has gradually changed into an aging society. The older people get, the higher the possibility of suffering from dementia. For those who live to be over 80 years old, one of five suffers from dementia; the proportion of elderly people over the age of 90 who suffer from mental illness is higher than one third. However, today's understanding of dementia is quite limited. Dementia may affect life functions or interpersonal relationships, and the care provided for patients with dementia is very important. Therefore, this study uses virtual reality to allow caregivers to experience the perspective of the mentalist (first person), explore the problems and challenges that situational learning may encounter, and understand the causes of psychological anxiety and confusion in patients with dementia. By experiencing the emotional factors and challenges of cognitive dementia patients, the empathy level for dementia patients and the empathy training effectiveness of the VIVE experience are enhanced.

B. Research Purposes

According to previous studies, virtual reality lets learners invest in the process of experiential learning, learn from observation, and experiment and practice; it also facilitates learners' reflection on learning to achieve the effect of improving learning. However, so far, no complete research projects have intervened to improve the effectiveness of dementia experience activities. Therefore, this study uses virtual reality to allow users to experience dementia patients circumstances in the first person and experience how to care for dementia patients. Various cognitive dysfunction problems have emerged. The interactive content of the virtual reality empathy training course is designed as an intervention measure, and we hope that the caregivers, students and family members of patients in domestic nursing institutions will participate and experience the circumstances of dementia patients going

through physical and mental changes. This experience can cultivate their empathy for patients, strengthen service attitude and care skills, enhance willingness to care for dementia patients, and thus improve the care for these patients. In addition, use (HTC Vive and DayDream) to experience the situation of the mentalist (first person), and explore contextual learning to enhance the caregiver for dementia.

Methods

The purpose of this study is to use VR (virtual reality) immersive technology to enable the experienter to experience the setbacks and difficulties encountered by people with dementia in their daily lives from a first-person perspective, and then learn about loss through interaction with their families.

Different from general flat film, the advantage of VR film is that it has all the visual range of the experience covered by panoramic images. Japanese color scholar Nomura Shunichi mentioned in his book "The Secret of Color" that the ratio of the five senses is as follows: 87% vision, 7% hearing, 3% touch, 2% smell, and 1% taste [2]. When wearing headphones, one can completely replace the two most important perceptions of the five human senses, visual and auditory, and bring an immersive quality to the experience, so that the experience is like being in another world. Therefore, this study uses VR shooting technology to experience the feelings of people with dementia through a VR helmet (HMD). This lets the experienter experience what it is like to people with dementia, thereby generating empathy and allowing the experienter to put themselves in the position of dementia patients.

In this study, when the project began to shoot, the device used six GoPro Omni lenses for VR360 film shooting, but in the post-production process, it was found that the stitching technology of VR360 film was quite difficult to implement, and the film was too large and difficult to store. At present, the VR HMD (Head-mounted display) on the market only supports up to 4K image quality, so it is less useful for stitching 8K movies. In addition, in order to capture the first person perspective, the study attached the camera to the head of the photographer (de-smart simulator), but this method causes the camera to shake sharply, which conflicts with the balance of the experienter's body, leading to a strong sense of dizziness. Thus, this study searched for look for alternative ways of shooting.

In 2016, when VR technology became popular, VR movies were presented in a 360-degree environment, but in early 2018 YouTube announced that it would cut half of the 360-degree VR movies that had been popular. Later Google DayDream team and Lenovo, LG, launched a "VR180" video format for film creators. However, since we already have VR360 film production technology, introducing the VR180 video format

seems to be a step backward. Google explained in an official blog post that 75% of 360-degree movie viewers only look at the block in front of them. The other half of the image behind the viewer is not so important. The shooting of VR360 images also requires the photographer to have access to a mirror, and involves problems of post-image stitching and synchronization. It can be said that the post-processing is quite complicated and does not necessarily meet the needs of general film shooters. Using VR180 film shooting technology lets us shoot from the first person perspective, effectively reduces the size of the video file, improves the quality VR movies, and still allows viewers to experience the immersion of VR360 film. In addition, because the size of an VR180 video file is relatively simple, we can use Pisces lens to shoot binocular parallax, allowing the experiencer to be more immersed in the virtual environment of VR through stereoscopic presentation. With current VR360 cameras, it difficult to achieve these results. After evaluating various factors, this study decided to use the VR180 film format to achieve the best stereo immersion effect.

TABLE 1
ANALYSIS OF ADVANTAGES AND DISADVANTAGES
OF VR 180/VR 360

Comparison	VR180 (Lenovo Mirage Cam)	VR360 (GoPro Omni)
Video file size	small	big
Film quality	high	low
Film viewing angle	180	360
Post production time/difficulty	low	high
Hardware specification	Low	high
3D stereoscopic rendering	with	without
First-person perspective	can	cannot
Streaming platform viewing	easy	hard

The hardware devices used in this study are as follows:
Shooting: Lenovo Mirage Cam (Fig. 1)
Shifter: Google VR Creator
Post-software: Adobe Premiere Pro CC
Playback software: Deo VR Player/ VaR's VR Player



Fig. 1 Lenovo Mirage Camera

Among the VR player selections, this study provides the Deo VR Player/VaR's VR Player for players to choose from, including the Deo VR Player for the Google Daydream VR HMD (Head-mounted display). 1) The co-released player can be used with the Daydream Controller (Figure 2) to let the "experiencer" directly perform movie operations. However, in

view of the fact that the operation mode of the VR device is currently not familiar to the general public, we also provided VaR's VR Player equipped with the ApowerMirror mobile phone screen mirroring device, allowing the helper to monitor from the computer screen and directly from the computer mouse device.



Fig. 2 Google Daydream VR Helmet Controller

The questions are given for data collection. They are listed below. The questionnaire is a 5 rating scale that has been accordingly developed.

- Watching immersive VR movies lets me feel the difficulties that dementia patients encounter in their daily lives.
- After watching the VR videos of people with dementia, I can better understand how to cope with and get along with people with dementia.
- After watching the immersive film, I can feel that the dementia patient does not find the toilet because of the loss of orientation.
- After watching the immersive film, I am more likely to feel that people with dementia forget who their family is because of cognitive decline.
- After watching the immersive film, I can feel that the patients with dementia have insufficient concentration and are easily affected by surrounding things.
- After watching the immersive film, I can feel that people with dementia forget what they have done because of memory loss.
- After watching the immersive film, I can feel that the dementia patients have an illusion of fantasy, and always suspect that the people around them will harm them.
- Watching VR movies can let the content of the film stay in my mind.
- I feel that I can easily operate the Daydream VR device.
- I feel that the operation of the Daydream VR device is very difficult.
- I use the controller of the Daydream VR device as a mouse.
- I would recommend that others watch VR movies.
- When I watch a VR movie, I would like another person to assist me in the operation.

Results

This study lets learners experience the life of people with dementia from a first-person perspective through virtual reality. From observation, experimentation and implementation, this study defines empathy as understanding the feelings and emotions of others, and being able to convey the meaningful message to the right square. Empathy itself is a kind of "complex form of psychological reasoning, which needs to combine observation, memory, knowledge and reasoning to provide insight into the thoughts and feelings of others, by experiencing how to take care of the various types of people with dementia." [1] Cognitive dysfunction problems improve empathy for demented patients. The following is an analysis of

pre- and post-tests results using Vive and DayDream.

A. Vive Pre-Test Reliability Analysis

The reliability analysis assesses the reliability of the entire scale. The reliability assessment of this study is based on the Cronbach's Alpha test. The pretest reliability estimate for the "Efficacy Questionnaire for the Use of VIVE Experience Dementia Caregivers" is shown as follows.

TABLE 2
ANALYSIS OF PRE-VIVE RELIABILITY

	Subject to standardization projects	Cronbach's Number of Alpha items
Cronbach's Alpha	.894	20
.897		

Table 2 shows that the reliability coefficient Alpha is Cronbach's α .897, and the normalized reliability coefficient is .894. The normalized α represents the effect of considering the unequal volatility of each subject, and the corrected coefficient. For the 44 VIVE pretests, the overall reliability was 89.7%.

B. Vive Post-Test Analysis

Again, the reliability analysis assesses the reliability of the entire scale. The reliability assessment of this study is based on Cronbach's Alpha test for the use of VIVE experience dementia caregivers' empathy training effectiveness questionnaire. The results are shown as follows.

TABLE 3
ANALYSIS OF RELIABILITY AFTER VIVE

	Cronbach's based on standardized projects	Number of item
Cronbach's Alpha	.943	20
.939		

Table 3 shows that the reliability coefficient Alpha is Cronbach's α .939, and the normalized reliability coefficient is .943. The normalized α represents the effect of considering the unequal volatility of each subject, and the corrected coefficient. For the 44 VIVE testers, the overall reliability is 93.9%.

C. T-Test Before and After Vive

In order to understand the learning outcomes of the empathy textbooks of 44 VIVE-experienced dementia caregivers, this study used the mean difference test (t-test) to compare the subjects' average number of empathic responses before and after the experiment. Results are shown in Table 4.

TABLE 4
PAIRED SAMPLE VERIFICATION

Pairs	Average value	Standard deviation	t	Significance (two-tailed)
VAR2-VAR3	-.89	.58	-10.21	.000

*** Correlation is significant at 0.001 level (two-tailed)

Table 4 shows the test results of t. The difference between the mean before and after is -887750, which is calculated by pairwise variables. The value of t is obtained by dividing the standard error, and the significance is .000, which is a significant level. This indicates that the subjects who used the proposed VIVE empathy textbook experience significant improvement in learning for the phenomenon of dementia.

D. DayDream Pre-Test Reliability Analysis

The reliability analysis assesses the reliability of the entire scale. The reliability assessment of this study is based on the "DayDream Experience Dementia Caregiver's Empathy Training Effectiveness Questionnaire" for Cronbach's Alpha detection. Pre-test reliability estimation was analyzed as shown in Table 5.

TABLE 5
DAYDREAM PRE-TEST RELIABILITY
ANALYSIS

	Cronbach's based on standardized projects	Number of item
Cronbach's Alpha	.852	23
.847		

Table 5 shows that the reliability coefficient Alpha is Cronbach's α .847, and the normalized reliability coefficient is .852. The normalized α represents the influence caused by the unequal variation of each subject, and the corrected coefficient. In total, 79 participants tested DayDream, and overall reliability reached 84.7% consistency.

E. DayDream Post-Test Reliability Analysis

Again, reliability analysis assesses the reliability of the entire scale. The reliability assessment of this study is based on Cronbach's Alpha test for the use of DayDream to show the results of the empathy training for dementia caregivers. Results are shown as follows.

TABLE 6

DAYDREAM POST-TEST RELIABILITY ANALYSIS

Cronbach's based on standardized projects		Number of items
Cronbach's Alpha	Alpha	
.891	.907	23

Table 6 shows that the reliability coefficient Alpha is Cronbach's α .891, and the normalized reliability coefficient is .907. The normalized α represents the influence of the unequal variation of each subject, and the corrected coefficient. A total of 79 subjects tested for DayDream, and the overall reliability reached 89.1% consistency.

F. DayDream Before and After T-test Analysis

In order to understand the learning outcomes of the empathy textbooks used by 79 DayDream experience dementia caregivers, this study used the mean difference test (t-test) to compare the subjects' average empathy before and after the experiment. The results are shown in Table 7.

TABLE 7

EMPATHY BEFORE AND AFTER USING DAYDREAM

Pairs	Mean	SD	95% confidence		t-test significance
			Interval for difference		Two-tailed
			Upper limit	Lower limit	
VAR2 – VAR3	-.83405	.45900	-.93686	-.73124	.000

***Correlation is significant at 0.001 level.

Table 7 shows the results of t- test. The difference between the mean before and after is -8330, which is calculated by the pairwise variable. The value of t is obtained by dividing the standard error, and the significance is .000, which is a significant level. This indicates that the subjects who used the proposed DayDream empathy textbook experience significant improvement in learning for the phenomenon of dementia. The study found that 44 subjects had a 93.9% agreement in the HTC Vive posttest. The subjects experienced VIVE and found that the learning effect of dementia was significantly improved ($p = .000$ ***). Post-testing of 79 participants using the DayDream experience reached 89.1% consistency. It was found that the DayDream empathy material has achieved a significant improvement in the learning effect of dementia ($p = .000$ ***). The experience of caring for people with dementia is a factor that influences the effect of empathy learning and reaches a very significant level ($p = .000$ ***). The results support the view that virtual reality immersive learning can stimulate learners' reflections, attract learners' attention, and stimulate learning motivation in ways that traditional learning methods cannot.

Discussion

This study developed a dementia simulator in which caregivers experience the feeling of dementia. The simulator attempts to increase the sympathy and understanding of the caregivers for patients, thereby reducing the burden on their own caregivers. Participants of the study pointed out that the teaching materials provided good insight into the lives of people with dementia and promoted better care. Participants also stated that they often reviewed their experiences in the simulation to better understand the behavior of people with dementia. Related studies [1] [2] [3] have also mentioned that informal caregivers often experience psychological distress due to the functional changes of the dementia patients they care for. The improvement of understanding of dementia patients can reduce psychological distress. To enhance the understanding and compassion of caregivers, innovative technologies using virtual reality interventions have been developed, including virtual reality simulation films and e-courses.

This study confirmed that experiencing the patient's symptoms and deepening the understanding of the symptoms will help the caregiver take care of the patient in the future. Findings were the same as those of related studies [1] [4] [5]. In this study, DayDream used the questionnaires before and after the test to collect the experience of the experience of dementia. With an effective DayDream experience, participants understood dementia patients' experiences. Therefore, DayDream can help improve the care of informal caregivers.

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