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Impact of 360°VR on Pre-Service Teachers' Empathy——Taking Educational Equity as an example

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Abstract:

Under the goal of promoting a more equitable, inclusive, and resilient education system, how to use innovative learning technologies to develop teachers' empathy is a hot research topic in the field of educational equity. Recent research has emphasized the potential of 360°VR to bolster empathy. The underlying mechanisms of such outcome are, however, underexplored. The present study applied three types of educational equity learning materials, including 360°VR, 2D video, and graphic, to pre-service teachers' empathy development. Randomly assigned participants viewed a documentary featuring a group of children living in rural and urban areas in a 360°VR or 2D video or graphic format, and measures of empathy (in terms of perspective taking and empathic concern), immersion, enjoyment and discomfort were collected. Results indicated that the virtual reality experience resulted in a higher level of empathy but this effect was not significant in terms of perspective taking. Immersion is the process of linking virtual reality experience with empathy, and 360°VR brings higher immersion by triggering the illusion of spatial presence which was associated with higher levels of empathy. Implications of the study include: it is feasible to use 360°VR to develop teacher empathy training, but needs to be combined with effective instructional activity design and scaffolding design; using empathy as an entry point can develop a two-way structure for teachers' cognitive and affective cultivation of educational equity; and teachers' empathy cultivation needs to build a long-term, incremental cultivation system.

Keywords: Empathy, 360-degree video, education equity, pre-service teacher

1. Introduction

As pre-service reserve teachers, normal students will face the development of cross-regional and cross-cultural diversified teaching activities in the future. The students they train also come from regions where the development of educational resources is unbalanced. Their empathy ability from the perspective of educational equity has been determined as Key characteristics of being effective in diverse teaching as described above (DarlingHammond, 2000).In this regard, empathy is considered as part of a caring, supportive and responsive teaching style (McAllister, 2002), which is beneficial for teachers to respond to students' cognitive and emotional needs, and to care about the impact of students' life circumstances and prior knowledge on their academic development, especially those in less developed areas, to achieve student-centered teaching practices, and to build trust in relationships with students. (Warren, 2013). However, research on the empathy of primary and secondary school teachers from the perspective of educational equity shows that most teachers' knowledge and practice in educational equity are not in sync. Although some teachers acknowledge that equity is one of the basic principles of interaction with students in the classroom Although some teachers acknowledge that equity is one of the basic principles of interaction with students in class, they still have strong biases in teaching practice in terms of students' gender, personality and social background.

360°VR is known as an empathy machine in terms of enhancing empathy because of its immersive, interactive nature (accessed Sept. 15, 2019). However, the current research on 360 ° VR technology and teacher training focuses on the training of teachers' teaching knowledge and skills in VR environment, and involves less in the field of emotional cognition such as empathy cultivation. Based on this, this study attempts to compare the effects of learning materials presented by different streaming media on the empathy ability of pre-service teachers, analyze the possible factors affecting the empathy ability of pre-service teachers. The following research questions are proposed:

RQ1:What are the differences in pre-service teachers' empathy from an educational equity perspective in the presentation of 360VR videos, 2D videos and graphic materials?

RQ2:How do user experiences such as immersion and engagement in 360VR environments impact on empathy? And what are the interactions within them?

2. Method

A total of 88 participants (46.2% identifying as female, 52.3% male, and 1.5% other) were recruited from a Normal University in China. The experimental group presented the learning materials in 360VR(360VR GROUP, n=28) and the control group presented the same learning materials as the 360VR condition in 2D format(2D GROUP, n=32) or graphic format (Graphic GROUP, n=32) respectively. The learning material is a short documentary comparing the living and educational environment of rural and urban children. Participants in the 360VR group wore VR headset and observe the video environment from inside the spherical space created by VR. The 2D format was created by cropping the center frame of a panoramic version of the 360 documentary, retaining a third of the original field of view. The graphic version was created by intercepting key frames from the 2D video with a narration adapted from the video commentary.

Participants completed a total of three questionnaires before and after the experiment.The personal information questionnaire used before the experiment recorded the participants' personal information such as gender, major and grade, which was used to record information of participants and to test the success of the randomization.The empathy scale used after the experiment is adapted from Davis' Interpersonal Reactivity Index (Davis, 1983). two main dimensions of Perspective Taking and Empathic Concern (six items in total) were selected for measurement. The IVR user experieces questionnaire used after the experiment was based upon previously established instruments developed to measure immersion (Charlene Jennett, 2008), engagement (Jeanne H. Brockmyer · 2009) and discomfort (Sara Ventura, MD · 2020), a total of 10 items are included.

3. Results

Research question 1 inquired what are the differences in pre-service teachers' empathy from an educational equity perspective in the presentation of 360VR videos, 2D videos and graphic materials. The ANOVA test for the empathy scale shows there was a significant difference in empathy among the three groups ($F=3.128$, $p=0.005<0.05$) and this difference was also significant in the dimension of Empathy Concern ($F=5.901$, $p=0.013<0.05$), which is similar to previous studies. Moreover, no significant difference in Perspective taking among the three types of material presentation, possibly because the Perspective taking dimension is a more stable trait at the level of personal values that is not influenced by short-term experimental training.Using the games-howell method to test empathy after the event (see Table 2), the result shows that the empathy of learners using 360VR learning materials is significantly higher than that of learners using 2D materials, and is not lower than that of learners using graphic materials. The use of 360VR technology has a good effect on the cultivation of learners' empathy ability, which answers the first research question. In contrast to previous studies, the results also indicated that the graphic materials were more effective than the 2D materials in promoting empathy.

Research question 2 inquired how do user experiences such as immersion and engagement in 360VR environments impact on empathy. The result shows the correlations of the focal variables involved in the study. The results show that in terms of the internal correlation among VR user experiences, discomfort and immersion showed a statistically significant negative correlation ($r=-0.514, p<0.01$) and immersion and engagement showed a significant positive correlation, ($r=0.395, p<0.05$). In terms of the external correlation between VR user experiences and empathy, the correlation between empathy and immersion was also statistically significant,($r=0.387, p<0.05$). These findings suggest that positive IVR user experiences should be helpful in promoting empathy. Conversely, as well as negative IVR user experiences might have negative impacts. There is an internal offsetting relationship between these two experiences.

4. Discussion

Virtual reality experience resulted in a higher level of empathy and also led to higher levels of empathic attention in empathy for an individual featured in the virtual reality material compared to control conditions presenting the same material in a non-virtual reality formats. This finding is similar to previous research findings (Schutte, 2017 & Chien, 2020). In virtual environment, viewers may feel their emotions or situations more strongly as they are close to them and sharing the same space. Contrary to our initial hypothesis, the virtual reality experience had no significant effect on perspective taking. According to Davis' research, the perspective taking is different from the empathic care and is associated with relatively less emotional reactivity and higher interpersonal functioning and self-esteem. The virtual reality materials selected for this study focus more on the emotional aspects of urban and rural education equity stories, rather than promoting the cognitive perspective, which is one of the reasons why the choice of perspective for learners in the 360VR environment has not been significantly improved.

Furthermore, the immersion triggered by virtual reality reinforces various emotional and cognitive responses, thus enhancing empathy. 360VR blurs the boundary between the real world and the virtual world by creating a virtual reality environment that closely resembles the real physical space, viewers gain an immersive virtual reality media experience, generating the feeling of sharing the same time and space as the characters in the video, and promoting empathy through the sharing of perspectives. The discomfort of virtual reality experiences, such as dizziness and vomiting, can inhibit viewers' empathic feelings. This is because the high-dimensional perceptual nature of virtual reality technology can place a degree of cognitive load on the learner, resulting in negative reactions such as vertigo. As a psychological trait, empathy is related to an individual's physical condition. Negative physical experience will inhibit an individual's cognitive and emotional experience, thereby preventing the emergence of empathy to a certain extent. In previous studies, the immersion provided by virtual reality environments was a key factor in triggering high levels of empathy. However, the conclusions of this study show that the advantages of virtual reality technology related to immersion do not necessarily lead to a high level of empathy. Immersion itself is not enough to generate concrete and contextual cognition, and it must be accompanied by high-quality learning content. In these teaching practices, we should not be limited to simply converting 2D video into panoramic video playback, but should take advantage of the immersion and participation of 360VR, take advantage of technology to carry out effective teaching activity design, and integrate teaching intervention into pre-service teachers' VR experience.