

Can Virtual Reality Simulations be used as a Research Tool to Study Empathy, Problems Solving and Perspective Taking of Educators? Theory, Method and Application

Sharon Tettegah*¹ Kona Taylor¹ Eun Won Whang¹ Simon Meistininkas² Robert Chamot²
University of Illinois at Urbana-Champaign
Department of Curriculum and Instruction¹, Department of Computer Science²
Primary contact: stettega@uiuc.edu

Abstract

Simulations in virtual environments are becoming an important research tool for educators. These simulations can be used in a variety of areas from the study of emotions and psychological disorders to more effective training. The current study uses animated narrative vignette simulation technology to observe a classroom situation depicting a low level aggressive peer-to-peer victim dyad. Participants were asked to respond to this situation as if they were the teacher, and these responses were then coded and analyzed. Consistent with other literature, the pre-service teachers expressed very little empathic concern, problem-solving or management of the situation with the victim. Future direction and educational implications are presented.

Keywords: simulation, education, animation, web based applications, peer victimization.

1 INTRODUCTION

The World-Wide Web and digital multimedia such as simulations can be a powerful means of assessing behavioral constructs such as pre-service teacher's empathy related to perceptions of peer victimization. Integrating Web technology with the aim of improving our ability to understand, model and analyze social behaviors of complex systems can be extremely useful as we explore pre-service teacher's cognitions and intended behaviors. This research demonstrates one way vignette simulations, that are situated in web based virtual environments, can be used to help identify and assess pre-service teacher's empathic responses, cognitions, understanding, and problem solving methods involving conflictive classroom interactions by using Animated Narrative Vignette (ANV) simulations developed from a real-life narrative (Author, 2005).

Yet, it is important to keep in mind that virtual reality simulations aid both subject and researcher. Bowman et al. (1999) states it most clearly argues,

The goal of virtual environment (VE) research is not to produce more realistic environments, faster 3-D graphics, better sensory cues, or low latency. Rather, all of these are only the means by which we hope to achieve the actual end: useful applications that will benefit people. (p. 317)

In this paper, we will provide a review of research on the benefits of virtual environments, then a review of relevant empathy literature, followed by methods, analysis and finally a discussion and conclusions.

Virtual environments (VE's) are most useful when they are believable to the user. The environment should allow individuals to immerse themselves in an experience that is both functional and easy to relate too. Bowman, Hodges, Allison, and Wineman (1999) state that in order for a virtual environment to be effective, it must tightly couple both experiential and abstract information into one package. Experience gained from the VE is only one aspect to virtual reality, there must also be some type of abstract information given so that the user is able to link what they have seen and known to what is to be learned from the simulation. Virtual reality simulations depend heavily on the environment they create therefore researchers that choose this method must be able to accurately depict scenarios that give test subjects the stimulus to produce accurate data for their research. Using this type of virtual reality environment, Waterworth, Haggkvist, Jalkanen, Olsson, Waterworth, & Wimelius (2003) discuss the "great potential in evoking both feelings and emotions in users" (p. 190).

There are several examples of how virtual environments have allowed researchers and their subjects to overcome barriers that would have otherwise hindered true progress. The range of research that has been done using virtual reality simulations will be discussed further, but most important are the implications for its use as a research tool that may become indispensable to the study of empathy.

2 Prior Research in Social Simulations and Virtual Reality

Previous research has shown that virtual reality can be used to treat a variety of phobias and psychological disorders. Some of these include social phobias (Klinger, Bouchard, Legeron, Roy, Lauer, Chemin, & Nuges, 2005), panic disorders and agoraphobia (Botella, Villa, Garcia-Palacios, Banos, & Perpina, 2004; Vincelli, Anolli, Bouchard, Wiederhold, Zurloni, & Riva, 2003), nicotine cravings (Lee, Lim, Graham, Kim, Wiederhold, Wiederhold, Kim, & Kim, 2004). Additionally, Rothbaum and Hodges (1999) reviewed additional uses of virtual reality environments for such anxiety disorders as fear of heights and flying, as well as potential uses for post traumatic stress disorder. Rothbaum and Hodges conclude that, "VRE has the advantage of conducting time-consuming exposure therapy without leaving the therapists office, with more control over exposure stimuli, and less exposure of the patients to possible harm or embarrassment" (p. 522-523).

Thus, the uses for simulated virtual reality environments are vast, and a main component is their use as a research tool for

further understanding of human behavior. Rizzo, Klimchuk, Mitura, Bowerly, Buckwalter, et al. (2005) note:

VR offers the potential to create systematic human testing, training and treatment environments that allow for the precise control of complex, immersive, dynamic 3D stimulus presentations, within which sophisticated interactions, behavioral tracking and performance recording is possible. Much like an aircraft simulator serves to test and train piloting ability, virtual environments (VE's) can be developed to present stimulations that assess and rehabilitate human functional performance under a range of stimulus conditions that are not easily deliverable and controllable in the real world. (§ 1)

Accordingly, simulations can be utilized across a range of different circumstances, where it might normally be impossible or very difficult methodologically to create a certain environment or situation for research purposes.

Recent research has attempted to recreate the experience of schizophrenia in a virtual reality environment. Tichon, Banks, and Yellowlees (2003) researched the psychological and physical feelings of a schizophrenic episode. In this study, the authors worked with one patient to develop a replication of some of the symptoms experienced during a psychotic episode within a virtual reality environment. Some of these symptoms within the environment included the instances of 'hearing voices' and various hallucinations. This type of study has many practical benefits including patient therapy and to help professionals and family members better empathize and understand persons suffering from this disorder.

Other uses of simulations to study empathy include work done by Pavia, Dias, Sobral, Aylett, Woods, et al. (2005), who looked at teachers and students empathic feelings towards animated students using a simulated classroom bullying event. Pavia et al. found "significantly more children (80%) expressed feeling sorry for the characters compared to teachers and experts (70%)" (p. 262). Also, "significantly more children (71%) expressed cognitive empathy towards characters compared to experts (47%) and teachers (28%)" (p. 262). These results illustrate some of the possible research uses for virtual reality environments.

Consequently, another use for virtual reality simulations is for assessment and training purposes, especially within an educational setting. Rizzo et al. (2005) noted,

"VR offers the option to produce and distribute identical 'standard' environments. Within such digital assessment and rehabilitation scenarios, normative data can be accumulated for performance comparisons needed for assessment, diagnosis and for training purposes" (§ 3).

Thus, virtual reality simulations are also important for training, and fits ideally as an appropriate research tool for this work.

Janda, Matthews, Nattestad, Wagner, Nebel, et al. (2004) found that the dental students who were trained using a virtual patient not only asked more relevant questions and took more time discussing patient issues, but also seemed to show more empathy for their patients than the students who hadn't trained on the virtual patient. Other research by Ahlbert, Heikkinen, Iselius, Leijonmark, Rutqvist, et al. (2002) did not

find improved performance in medical students who had trained using a surgery simulator. Yet, there was a significant correlation between the experimental student's performance during their training and their measured surgical performance. Students who performed well on one also performed equally as well on the other.

While these results do not add evidence towards using simulator training to improve performance, they do seem to be a good predictor of future outcomes in performance. Also, while performance on a specific task might not be improved, behavioral outcomes may be affected, including empathy and problem solving. Parsons and Mitchell (2002) found "role-play within virtual environments could promote the mental simulation of social events, potentially allowing greater insight into the minds" of participants who are engaged in the virtual reality environment (p. 430). Additionally, the "practice of behaviors, both within and across contexts, could also encourage a more flexible approach to problem solving" (Parsons & Mitchell, p. 430).

3 Why Simulations in VRE?

Virtual reality environments (VRE) are an important new research tool that can be used to expand the learning of both the participants and researchers in multiple ways. Aylett and Louchart (2003) examined virtual reality (VR) as a narrative form. They compared 4 aspects of classical narrative forms (cinema, traditional theater, and literature) to VR narratives: interactivity, physical reality, presentation of imagery, and sense of time and space. VR emerged as an excellent narrative form due to the possibility of real-time story telling and interaction while providing an immersive stage unlike any classical narrative forms can provide. Virtual reality environments "allow students to visualize abstract concepts, and to visit environments and interact with events that distance, time, or safety factors make unavailable" (Youngblut, 1998, p.11).

In the current study, participants were able to observe another event in someone's lived experience, which without the use of the virtual environment would have been impossible. This allowed them the opportunity to see into the life of another person using media and the web. The current study investigates (1) students perceptions of two victims, (2) level of empathy for the victim, (3) the strategies of action suggested by the respondents, and (4) the type of behavioral change focused on by the participants using a multimedia simulations delivered through the World Wide Web.

4 METHODOLOGY

This study employed a two-part methodology involving qualitative and quantitative analyses. The qualitative data analysis occurred in three phases, by coding open-ended responses to a web-based animated narrative vignette (ANV) before using the categories (Phase 1, 2, 3). An iterative process was involved in the first set of data analysis. The objective of the quantitative phase was to test for any differences between various participant subgroups, including gender, race, and major.

Participants: Three hundred and fifty-nine students (310 women, 46 men, & 3 missing) from a Midwestern university participated in this study. The participants consisted of pre-service teachers (38%), psychology majors (32%), and various other undergraduate majors (30%). The mean age of the participants was 21.61 ($SD = 3.04$). Most of the participants were white (78%), while the other 22% consisted of African Americans, Asian, Hispanic, and Native American. The location

the students either lived or taught in was made up of 31% from rural, 47% from suburban, and 22% from urban areas. The participants were recruited from the Education Department subject pool as well as several teacher education programs from different disciplines on campus. Participants received extra credit for their participation.

Procedure: Participants were randomly assigned to different computer labs to complete the vignette. One lab was a Personal Computer lab and the other a Macintosh computer lab. They completed an online demographic questionnaire and were required to register on a website and establish a pseudonym. The participants were instructed to use their same pseudonym for both their vignette and survey responses. After viewing the vignette, the participants typed a response to a vignette, or completed the survey. The participants clicked on a *submit* button to finalize their responses to the vignette. The process of submission sent the data to a secure database. The participants were informed that their responses were anonymous, and tracked only by their pseudonym.

4.1 Materials

Demographic questionnaire: A 16-item survey was designed to gather information about each participant's age, sex, location of residency and location of teaching position, years taught, if any, and subject area interest or experience.

Vignette: An animated narrative vignette was used to gather data from participants through the World Wide Web. The duration of the animated narrative vignette was two minutes. This simulation contained one vignette that depicted an interaction in the classroom between two children (Maria, a 10-year old Latina, & Kristen, 10-year old White American girl), and one teacher (Ms. Green). During the vignette, Maria and Kristen are on the playground jumping rope. Maria and Kristen engage in an argument about whose turn it is (see Figure 1).

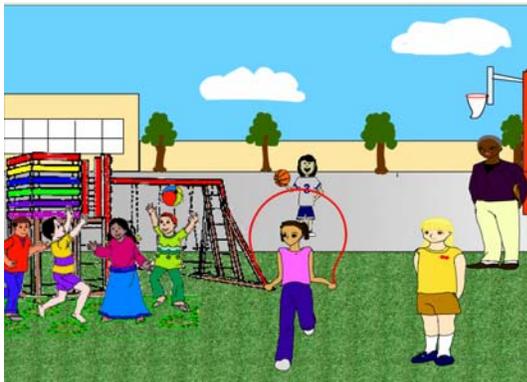


Figure 1. Peer victimization simulation: Playground.

The argument ends with the girls using derogatory comments towards one another and going to the teacher to tell on each other. The teacher then talks to the girls about how it is wrong to call each other names (See Figure 2).

After viewing the vignette, participants were asked, "What would you do if you were the teacher in this situation?" The question was asked to elicit responses from the pre-service teacher's perspective and role-taking. Participants were instructed to type their response in a textbox and were given unlimited time and space to respond to the question (see Figure 1). Cohen

Kappa's agreement coefficients were calculated on the variables derived from the codes with a range of 0.76-0.93.



Figure 2. Peers reporting victimization with teacher interaction

4.2 Vignette Coding

Phase 1: The methodology for this research employed a grounded theory approach by organizing, coding, generating categories, testing emerging categories, and searching for hypotheses and explanations from the vignette responses (Marshall & Rossman, 1989, 1999). Participants' responses were subjected to a "line-by-line" content analysis (Charmaz, 1995, 2003; Marshall & Rossman, 1989). This involved the research team, consisting of the principal investigator and one research assistant, examining each line of the 359 vignette responses. Each vignette response was different. Some had 3 paragraphs, while some had 5 lines.

Upon examination of the responses, we noticed that many of the responses did not include any reference to the victim. As a result, a coding schema was generated consisting of four distinct response categories. After reviewing the data, the following four factors emerged, using a grounded theory approach, to measure empathy: concern for the victim, problem solving with the victim, mention the victim and management of the situation with the victim. Based from these categories, the investigator, in particular, sought to answer the following questions: (1) Do pre-service teachers express empathy for the main characters in the ANV, if so with whom? (2) For whom is the respondent expressing concern?; (4) What are the strategies of action suggested by the respondents?; and (5) What type of behavioral change and management are utilized by pre-service teachers? Additionally, the researcher sought to examine any gender and race differences in the responses.

Phase 2: Four experienced graduate students served as independent raters. They raters were divided into two pairs. The first pair was required to allocate randomly ordered statements derived from the sample of 359 pre-service teacher responses to the four response categories derived in Phase 1. The raters were also asked to provide feedback regarding the clarity of the category labels, and the categories were adjusted as necessary. These refined categories and their randomly ordered statements were then sent to the second pair of raters and this process was repeated. This provided a measure of reliability for the process of coding participants' responses.

Phase 3: Two additional graduate students served as independent raters for Phase 3. These raters were advised to use

the coding schema derived in Phases 1 and 2 to score all of the responses. The raters were instructed to score the responses as follows: if a statement or sentence within the responses was applicable to a category, the number 1 was to be placed in the respective box according to the nature of that statement. For example, if a participant stated, "if I had been in the position of Ms. Green, I would have been a little more considerate of the girls problems," the rater would place a 1 in the category indicating that there was concern, and a 3 in the category indicating that the concern was for both of the girls. If the response included statements such as the following, "in addition, I would talk to Maria, and ask her how she felt in the situation," the rater would allocate a score of 1 in the category indicating empathy, and a 1 for indicating empathy for Maria. Raters were instructed to allocate a statement to multiple categories if applicable. The following is an example of a response that focused on managing the behavior with Maria and Kristen, "If I were the teacher, I would have sat down with both girls. I would have asked Maria to tell Kristen how he made her feel."

Analysis of responses included the following response categories or themes: Recognition (i.e., did the participant mention either girl?); 2) Expression of empathic concern (i.e., did the participant express concern for either girl?); 3) Managing the situation (i.e., did the participant respond to how they would manage the situation with the girls versus others in the situation?); 4) Problem-solving strategies (i.e., in what ways did the participants indicate that they would address the problem?). Four options within this category included strategies that focused on either or both girls, on the class as a whole, and/or on the families of the girls.

6 RESULTS

Quantitative: Most of the participants mentioned (93%) the victims, either referring to both girls (91%) or Kristen alone (1%). Similarly, 92% of the participants managed the situation with either both girls (90%) or Kristen (2%). However, 71% of the participants did not exhibit any empathy, and for the participants who did empathize with the victims, 25% empathized with both victims, while 1% empathized with Kristen and 1% with Maria respectively. For manage the victim, 92% of the participants indicated that they would manage the situation, while 90% indicated managing both girls, while 2% managed with Kristen only. Slightly more than half of the participants problem solved in the scenario (58%), yet of the participants who problem solved only 57% problem solved with both girls, while 1% problem solved just for Kristen. Only 5% and 3% of the participants problem solved with the class or the girls families respectively.

When the data was looked at statistically, a significant relationship was found between gender and problem solving with the class, $\chi^2(1, N = 356) = 10.68, p < 0.01$. Male participants were more likely than expected to problem solve with the family, while female participants were slightly less likely than expected. Using gender, race, and major as the independent variables there were no other relationships found for the other dependent variables. Yet, the participants' responses were also looked at to see if any interesting existed between Education, Psychology, and other majors. Education majors did indicate slightly higher percentages of mentioning, managing, and problem solving with the victim. However, psychology majors were slightly more likely to manage with the family, and other majors indicated higher levels of empathy and problem solving with the class.

Qualitative: Examples of some of these expressions of empathy and strategies suggested for managing and problem solving were revealed by responses from some of the following participants:

Response 1. I would continue to talk to the girls about how it hurt their feelings no matter who called a name first. If they don't like being called a name, then they shouldn't call others names. They need to remember that what hurts them hurts others too. It would be important for me to make sure that both girls understand that it isn't okay to call names even if someone else called them a name, because it is just a vicious circle.

Response 2. I would sit down with both of the girls and ask them what provoked the disagreement in the first place. When I discovered that this had to do with sharing, I would tell the girls to take turns in the future. Then I would talk to them about the name calling issue. I would first explain the significant impact words can have upon a person. I would ask each of them how they felt about themselves now. Then I would explain that the words that the other one had said to them had really hurt the other one. I would then tell them to remember how much it hurts to be called a name. I would explain other more positive ways of dealing with disagreements such as compromising.

Response 3. This is an all too common occurrence in schools. Name calling is a reality amongst both children and adults. I think the key to resolving this problem is helping students feel a certain level of empathy for those who are victimized. There is a game that deals with labels. I would love to play this game with my students. You make a host of labels and you tape them to the backs of the students. Before you begin you start off with letting them know that you will treat the person according to their label. They will not know what their label is but you will. But remember everyone has one. This will help them see what it is like to be mistreated.

Response 4. If I were the teacher, I would talk to the two girls together. I would explain that name-calling is not polite and it hurts others' feelings. I would point out to the first girl that it must have hurt when the other called her fat, but she did not need to respond by calling her a name too. She could have come to me first without responding to her insult, or she could have just walked away from the situation. I might ask the girls to each say something nice about the other girl and apologize for calling each other names. I would give each of the girls an equal chance to use the jump rope or encourage one of them to play another game. I would say all of this because it is important that children understand that name-calling hurts others, and it is important to be kind and respectful to others, even if they are not kind to us first.

Response 5. If I were the teacher, I would talk to the two girls together like the teacher did in this example. I would explain that name-calling is not polite and it hurts others' feelings. I would point out to the first girl that it must have hurt when the other called her fat, but she did not need to respond by calling her a name too. She could have come to me first without responding to her

insult, or she could have just walked away from the situation. I might ask the girls to each say something nice about the other girl and apologize for calling each other names. I would give each of the girls an equal chance to use the jumprope or encourage one of them to play another game. I would say all of this because it is important that children understand that name-calling hurts others, and it is important to be kind and respectful to others, even if they are not kind to us first.

Response 6. I would explain to the girls that name calling is not nice. I would then ask them how they would feel if they were called fat or if their native language was made fun of. People come in all shapes, sizes, colors, and speaking different languages. This does not make one person better than the other one...it just means that we are all individuals, and have unique qualities in abilities. I would help them to understand that they should appreciate each others' differences, and not to criticize or make fun of them.

The previous responses are examples of how the respondents expressed empathy for both girls having their feelings hurt, as well as different problem solving strategies for helping to stop this situation from happening again. It is also important to note that in these responses Kristen and Maria are mostly referred to as "the girls" (91%) or not mentioned at all (8%), which was a very common occurrence in general for the responses.

In regards to differentiating between the girls and their experience, overall, 92% of the participants did not differentiate between the girls at all when writing up their response to the vignette, but just referred to them as, "the girls" instead of by individual name. For the 8% of participants who did differentiate between the girls, most referred to both girls by name as illustrated below in the following responses.

Response 7. If I were the teacher in this situation I would do exactly what the teacher did and tell both of the girls that name calling is not nice. When Kristin responds that Maria called her a name first I would tell Kristin that instead of calling Maria a name back she should have instead come right to me because this way the situation doesn't get any worse and I could have dealt with Maria alone. I would also tell the girls that if either of them called anyone else a mean name in the future they would have to go speak to the principal and maybe have a call home to their parents.

Response 8. I would have dealt with this situation in a similar way that this teacher did. I would explain that it is rude to name call and that nobody likes to be called names because Maria and Kristen need to learn that they should always respect their classmates by never saying anything rude about them. I would remind them both how it feels to be called a name and that neither of them should retaliate to being called a name with name calling because it doesn't help the situation.

In these responses, the participants responded to both girls equally. However, some participants referred to only Maria by name and just referred to Kristen as "the blond girl", as illustrated below.

Response 9. I would ask the two girls to walk around in the other's shoes. How would Maria feel if someone called her fat? How would the blonde girl feel if

someone told her she didn't speak well? I would ask the girls to think about these questions, and next time they argued to please come see the teacher if they need help resolving a problem.

It is interesting that some participants who mentioned Maria by name, mentioned Kristen not by name but by a physical characteristic. No one mentioned Maria as the dark haired girl, so why did people mention Kristin as the blond girl?

Additionally, for the participants who only referred to one of the girls in their response (1%), all mentioned only Kristen, but never by name. Examples of this are illustrated in the following responses.

Response 10. I would explain to the blonde-haired girl that it does not matter who started the name-calling. From the perspective of the adult, each child was involved in name-calling, and thus should be held equally accountable.

Response 11. I think that what the teacher did was correct. She addressed the situation and told both of them they were wrong to call each other names. When the blond girl said "She called me a name first" I would tell her that two wrongs don't make a right. You need to treat others the way you would like to be treated, even though it can be hard sometimes.

Response 12. If I were one of the children who was called fat, I would probably walk away, cry, and sulk by myself because the comment would really press on my insecurities. I would not retaliate because I would be too embarrassed.

8 CONCLUSIONS

As illustrated above, the participants who mentioned only Kristen never mentioned her by name, only referred to her as the blond girl or the girl who was called fat. These findings as well as previous findings have interesting implications on why participants singled Kristen out instead of Maria. What was it that the participants identified with, possibly being made fun of because of her weight or was it that she was white and blond haired? Regardless, all of these issues have serious implications on the empathy expressed for the students.

Discussion

Simulations, based on personal experiences that engage pre-service and in-service teachers in interpreting and problem solving can help to facilitate an understanding of how educators think about school interactions of students. Responses to simulations can be used to engage educators in using and sharing their responses to others in developing an awareness of student who have been victimized. Understanding how pre-service teachers perceive peer victimization and relational aggression using animated narrative simulations can be very informative for teaching and learning environments.

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