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Do medical students respond empathetically to a virtual patient?

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Abstract

Background: Significant information exchange occurs between a doctor and patient through nonverbal communication such as gestures, body position, and eye gaze. In addition, empathy is an important trust-building element in a physician: patient relationship. Previous work validates the use of virtual patients (VP) to teach and assess content items related to history-taking and basic communication skills. The purpose of this study was to determine whether more complex communication skills, such as nonverbal behaviors and empathy, were similar when students interacted with a VP or standardized patient (SP).

Methods: Medical students (n = 84) at the University of Florida (UF) and the Medical College of Georgia (MCG) underwent a videotaped interview with either a SP or a highly interactive VP with abdominal pain. In the scenario, a life-sized VP was projected on the wall of an exam room in SP teaching and testing centers at both institutions. VP and SP scripted responses to student questions were identical. To prompt an empathetic response (ie, acknowledging the patients' feelings), during the interview the VP or SP stated "I am scared; can you help me?" Clinicians (n = 4) rated student videotapes with respect to nonverbal communication skills and empathetic behaviors using a Likert-type scale with anchored descriptors.

Results: Clinicians rated students interacting with SPs higher with respect to the nonverbal communication skills such as head nod (2.78 ± .79 vs 1.94 ± .44, $P < .05$), and body lean (2.97 ± .94 vs 1.93 ± .58, $P < .05$), level of immersion in the scenario (3.31 ± .49 vs 2.26 ± .52, $P < .05$), anxiety (1.16 ± .31 vs 1.45 ± .33, $P < .05$), attitude toward the patient (3.24 ± .43 vs 2.89 ± .36, $P < .05$), and asking clearer questions (3.06 ± .32 vs 2.51 ± .32, $P < .05$) compared to the VP group. The students in the SP group also had a higher empathy rating (2.75 ± .86 vs 2.16 ± .83, $P < .05$) and better overall rating (4.29 ± 1.32 vs 3.24 ± 1.06, $P < .05$) than the VP group. Empathy was positively correlated with the observed nonverbal communication behaviors. Eye contact was the most strongly correlated with empathy ($r = .57$, $P < .001$), followed by head nod ($r = .55$, $P < .001$) and body lean ($r = .49$, $P < .001$).

Conclusions: Medical students demonstrate nonverbal communication behaviors and respond empathetically to a VP, although the quantity and quality of these behaviors were less than those exhibited in a similar SP scenario. Student empathy in response to the VP was less genuine and not as sincere as compared to the SP scenario. While we will never duplicate a real physician/patient interaction, virtual clinical scenarios could augment existing SP programs by providing a controllable, secure, and safe learning environment with the opportunity for repetitive practice.

Keywords: Communication skills; Empathy; Virtual reality; Virtual patients

We have previously reported our efforts to create, evaluate, and refine an interactive virtual abdominal pain scenario using a life-sized virtual patient (VP) and virtual instructor (VI) to teach medical students history-taking and communication skills [1–4]. Preliminary studies reveal that most students would use the virtual teaching tool in preparation

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for their interaction with standardized and real patients [1]. In addition, studies comparing VPs to traditional methods for teaching and testing communication skills using standardized patients (SP) show no difference in students asking 12-core history-taking questions and generating a differential diagnosis between the groups [4]. Therefore, preliminary data validate the use of a virtual scenario to teach and assess content items related to history taking.

Significant information exchange occurs between a doctor and patient through nonverbal communication such as gestures, body position, and eye gaze. In addition, empathy is an important trust-building element in a physician/patient relationship. Therefore, the purpose of this study was to determine whether more complex communication skills, such as nonverbal behaviors and empathy, were similar when students interacted with a VP versus an SP.

Methods

Through an interdisciplinary collaboration involving medical educators and computer scientists, we created an interactive, life-sized VP with acute abdominal pain (Fig. 1). In the virtual scenario, the VP (DIgital ANimated Avator, DIANA) is projected on the wall of a standard examination room in SP teaching and testing centers at the Medical College of Georgia (MCG) and the University of Florida (UF). Prior to beginning the VP interaction, the student spends 10 minutes creating a voice profile and receives basic instructions on how to communicate with a computer (ie, cues to use if the VP does not answer questions with voice recognition). The VP is programmed with specific answers to questions based on phrases asked by students. In the current study, second-year medical students (n = 84) at MCG and UF were randomly assigned to undergo a videotaped abdominal pain scenario with either an SP or a VP with identical scripted responses (Fig. 2). A VI or real instructor provided the initial goals of the exercise but the students were not specifically told the purpose of the study (ie, to compare empathetic responses and nonverbal communication skills between an SP and VP). They were given identical instructions to take a history from a patient (VP or SP) with abdominal pain. At the end of the virtual interaction, the VI asked the student to offer a differential diagnosis and provided learner feedback regarding the answers.

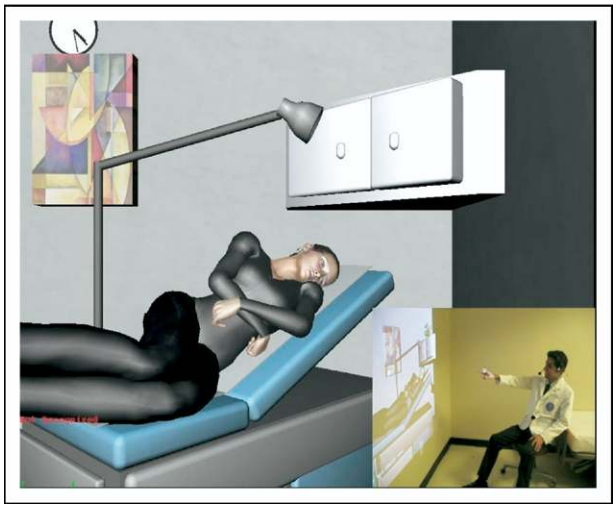

Fig. 1. The virtual scenario. A female virtual patient, DIANA, complains of abdominal pain. (Inset) Medical student interacting in the virtual scenario.

To prompt empathetic student responses (ie, acknowledging the VP or SP's feelings), a challenge was built into the scenario in which the VP or SP stated; "I am scared; can you help me"? A standardized scoring sheet was developed through a consensus of experienced clinician raters to assess nonverbal communication elements considered important in a physician/patient interaction. After a training session in which key elements of nonverbal communication skills and the assessment instrument were reviewed, clinicians (n = 4) rated videotaped student interactions with respect to these skills (eye gaze, head nod, and body lean), empathetic behaviors, level of immersion, anxiety, attitude, and overall rating for the interaction using a Likert-type scale with anchored descriptors (Table 1). These measures were chosen because of their importance in effective communication [5]. Cronbach's alpha was used to determine whether each construct of interest (ie, anxiety, attitude, empathy, etc) was measured consistently. Differences in content items (ie, core questions asked), nonverbal behaviors and other communication elements between students interacting with VPs versus SPs were compared using the Student *t* test. Pearson's correlation coefficient was used to test the assumption that nonverbal communicative behaviors were correlated with the observed measure of empathy. The University of Florida Institutional Review Board (IRB) and Medical College of Georgia Human Assurance Committee (HAC) granted approval for the study and informed consent was obtained on all participants.

Results

Table 2 shows a comparison of student behaviors when interacting with a VP versus an SP. Students interacting with SPs were more likely to demonstrate greater head nod and body lean compared to the VP group, while there was no difference in eye contact observed between the 2 groups. Clinicians rated students interacting with SPs higher with respect to level of immersion in the scenario, anxiety, attitude toward the patient, and asking clearer questions compared to the VP group. The students in the SP group also had higher empathy (2.75 vs 2.16, $P < .05$) and better overall rating (4.29 vs 3.24, $P < .05$) than the VP group. Cronbach's alpha for the measured constructs ranged from .66 to .92, indicating a satisfactory inter-rater consistency [6].

Table 3 shows examples of student responses to the empathetic challenge by the VP or SP. Figs. 3 and 4 illustrate the differences in body lean seen between the 2 groups. Students interacting with the SP demonstrated a more profound body lean in an effort to engage the SP. Table 4 shows the correlation between observed student behaviors and empathy ratings. Empathy was positively correlated with eye contact, body lean, head nod, and level of immersion. Eye contact was the most strongly correlated with empathy ($r = .57$, $P < .001$), followed by level of immersion ($r = .56$, $P < .001$), head nod ($r = .55$, $P < .001$), and body lean ($r = .49$, $P < .001$). Anxiety was significantly although weakly correlated with empathy ($r = .22$, $P < .05$).

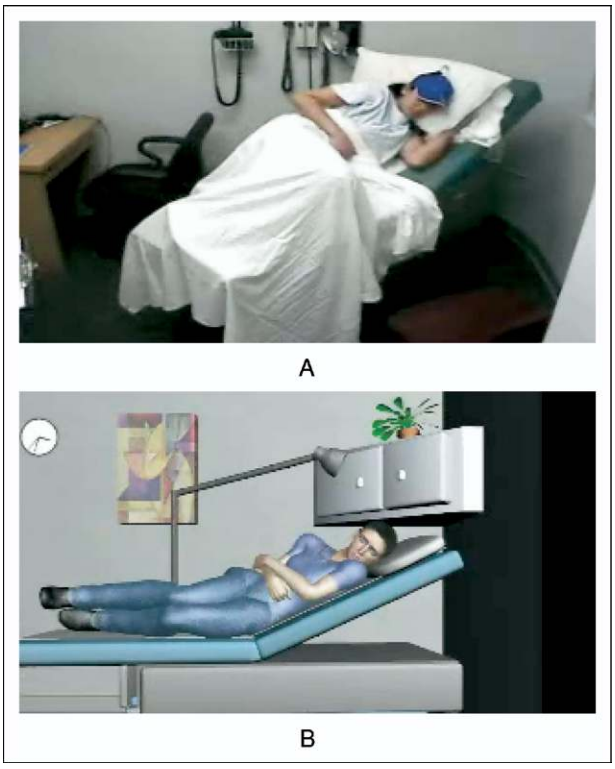

Fig. 2. (A) VP and (B) SP with identical abdominal pain scenarios.

Comments

Effective communication skills are essential for good medical practice. Interpersonal communication is the primary method by which a physician and patient exchange information. While verbal communication skills are important, significant information exchange occurs between a doctor and patient through nonverbal communication such as gestures, body position, and eye gaze. The appropriate use of nonverbal communication skills is positively correlated with patient satisfaction [7]. In addition, empathy is an important trust-building element in a physician/patient relationship. Cohen-Cole and Bird [8] have identified several types of empathetic responses including the use of reflective and legitimating statements such as "I can see that you are . . ." and "I can understand why you feel . . .," as well as supportive statements such as "I want to help . . ." Empathy shows an appreciation for the patient's emotional situation and leads to a shared understanding of the patient's response to illness.

At most medical schools, communication skills are taught and assessed through SP interactions. Despite having advantages over real patients, SP training requires substantial effort and expense, and students have limited access to SPs. Computer simulation and virtual reality (VR) represent innovative technological teaching tools. Virtual characters, or computer-based representations of humans, have been previously employed in several interpersonal training scenarios [9,10]. These studies demonstrate that virtual interactions produce emotional effects that are comparable to real human interactions [11]. VPs are defined as interactive computer programs that simulate real-life clinical scenarios in which the learner acts as a healthcare professional obtaining a history and physical examination and making diagnostic and therapeutic decisions. VPs offer several potential advantages over SPs such as limiting the effort and

Table 1
Instrument used to assess VP and SP interaction

Eye contact
1- Little or no eye contact
2- Some eye contact
3- Appropriate eye contact at most times
4- Appropriate eye contact at all times
Body lean
1- Little or no forward body lean
2- Some forward body lean
3- Appropriate forward lean at most times
4- Appropriate forward lean at all times
Head nod
1- Little or no head nodding
2- Some head nodding
3- Appropriate head nodding at most times
4- Appropriate head nodding at all times
Immersion level
1- Did not appear to be immersed at any time
2- Appeared to be immersed some of the time
3- Appeared to be immersed most of the time
4- Appeared to be immersed at all times
Anxiety
1- Appeared anxious at all times
2- Appeared anxious at most times
3- Had some anxiety during the interview
4- Little or no anxiety
Attitude
1- Made judgmental comments, criticized patient; OR talked down to patient
2- Made 1-2 comments with inappropriate affect
3- No judgmental comments; talk to patient as an equal
4- No judgmental comments; talked to patient as equal and offered praise/encouragement when opportunity arose
Empathy
1- Offered no empathetic comments; No encouragement or support (did not state intention to help)
2- Offered only brief supportive or empathetic comments and only in response to a distinct emotional statement by patient; comments may seem prospective or forced.
3- Offered empathetic or supportive comments OR stated intention to help
4- Offered empathetic or supportive comments OR stated intention to help; despite limited time, seemed to be on the way to establishing a caring relationship
Question clarity
1- Frequent unclear questions; patient had difficulty in understanding what was being asked
2- Some unclear questions; patient had difficulty once or twice understanding what was being asked
3- Mostly clear questions
4- Clear questions
Overall rating
1- Unsatisfactory
2- Unsatisfactory
3- Unsatisfactory
4- Satisfactory
5- Satisfactory
6- Satisfactory
7- Superior
8- Superior
9- Superior

Table 2
Comparison of student behaviors interacting with a VP or SP

Student behaviors	Videotape ratings		
	VP (n = 51)	SP (n = 33)	Cronbach's alpha
Eye contact*	2.59 ± .51	2.90 ± .91	.90
Head nod*	1.94 ± .44	2.78 ± .79‡	.84
Body lean*	1.93 ± .58	2.97 ± .94‡	.92
Immersion level*	2.26 ± .52	3.31 ± .49‡	.82
Anxiety*	3.55 ± .33	3.84 ± .31‡	.66
Attitude*	2.89 ± .36	3.24 ± .43‡	.82
Question clarity*	2.51 ± .32	3.06 ± .32‡	.69
Empathy rating*	2.16 ± .83	2.75 ± .86‡	.92
Overall rating†	3.24 ± 1.06	4.29 ± 1.32‡	.87

* Likert-type scale (1 = least, 4 = most).
† Likert-type scale (1 = unsatisfactory, 9 = superior).
‡ $P < .05$ analyzed by Student t test.

expense associated with SP training, creating diverse virtual clinical scenarios that are difficult to duplicate with SPs, and providing a controllable, secure, and safe learning environment with the opportunity for extensive repetitive practice. VP scenarios have the potential to accelerate student learning and enhance traditional SP teaching and testing programs.

We have previously reported our initial interdisciplinary efforts to create, evaluate, and refine a highly immersive interaction with a VP with abdominal pain as a method to teach medical students basic history taking and communication skills. Preliminary studies reveal that most students would use the virtual teaching tool in their preparation for interaction with SPs and real patients [1–4]. In addition, a study comparing student interaction between VPs and SPs showed no difference in students asking 12-core history-taking questions and generating a similar differential diagnosis between the 2 groups [4]. However, the main purpose of the current study was to determine whether more complex communication skills, such as nonverbal behaviors and empathy, were similar when students interacted with a VP or SP.

We found that medical students demonstrate nonverbal communication behaviors and respond empathetically to a VP, although the quantity and quality of these behaviors were less than those exhibited in a similar SP scenario. Clinicians rated videotapes of students interacting with SPs higher with respect to head nod and body lean. In addition, clinicians rated student SP interactions higher than VP exchanges for the level of immersion in the scenario, anxiety, attitude toward the patient, and in asking clearer questions. In a previous study, medical students responded in a post-encounter survey that they felt less anxious when interacting with a VP than an SP [1]. In this study, however, clinicians viewing the videotaped encounter rated student more anxious when interacting with a VP than an SP. It is possible that clinician raters construed students to be anxious when they experienced some frustration interacting with computer when repeating or rephrasing questions that were not immediately recognized by the VP. While there was no difference in eye contact between the VP and SP groups, this finding may have been the result of rater difficulty determining eye contact from videotape review. In fact, what was actually measured in this study was probably student head gaze or head direction. It is very possible for a students head gaze to be directed towards the SP or VP while actual eye gaze is looking in a different direction.

Table 3
Selected student responses to the VP/SP empathetic challenge

Student responses
"I'm sorry you are having so much pain."
"Don't be scared, I will help you."
"We will definitely do everything we can."
"I understand and I can imagine it is very scary for you."

Fig. 3. Body lean—SP. The student is leaning forward and actively engaging the SP.

As shown in Table 3, student empathetic responses to the VP and SP paralleled those identified by Cohen-Cole and Bird [8]. While students responded empathetically to a VP, their responses were less genuine and not as sincere as in the SP scenario. Student responses to the VP empathetic challenge lacked emotion. This difference in empathetic responses may be due to the artificial nature of the VP interaction and improvements in the VP's expressiveness (ie, voice volume, tone and facial expressions) may augment student empathetic responses. Nonverbal communication skills did correlate with empathy rating as shown in Table 4. In other words, students who were rated higher in nonverbal communication skills were also rated higher with respect to empathy. Although one would expect a less anxious stu-

Fig. 4. Body lean—VP. The student is leaning back in the chair.

Table 4
Correlation between nonverbal communication measures and empathy

	Empathy	Eye contact	Body lean	Head nod	Anxiety level	Level of immersion
Empathy	1.00					
Eye contact	.57*	1.00				
Body lean	.49*	.51*	1.00			
Head nod	.55*	.68*	.73*	1.00		
Anxiety level	.22*	.19	.20	.29*	1.00	
Level of immersion	.56*	.60*	.69*	.63*	.38*	1.00

* $P < .05$ analyzed by Pearson's correlation coefficient.

dents to be more empathetic, in our study, student anxiety weakly correlated with empathy. However, it is possible that anxious students can still be empathetic. Another potential source of error in our study was rater bias resulting from an inability to blind our raters to the videotaped SP or VP interaction. Raters may have simply rated the SP interaction higher due to their inherent biases that it was a more "real" interaction.

While we will probably never fully simulate the physician: patient interaction, VP scenarios could have a role early in the medical curriculum when students are learning basic communication skills. As demonstrated in the present study, however, current technological limitations may limit their use in teaching and assessing higher order communication skills such as empathy, negotiation, and conveying bad news. It is important to understand that VR is a dynamic technology and this study represents a single point in its development. Refinements in the VP interaction could allow for its future use in the teaching and assessment of higher order communication skills.

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