



Empathetic Chatbot: Enhancing Medical Education with Artificial Intelligence

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Abstract. This article discusses the development of a chatbot that is designed to assist medical students in practicing empathetic communication skills with simulated patients. Empathy is critical in clinical outcomes and can improve the provider-patient relationship. The chatbot provides personalized learning support to students and is created using an artificial intelligence (AI) intent framework, with a natural language processor (NLP) interface and uses a Dialogflow intent process framework. Additionally, the article considers the cost-saving benefits of incorporating chatbots in medical education as a potential cost benefit to standardized patient scenarios. Finally, it summarizes the studies that have demonstrated the effectiveness of chatbots as a learning tool and underscore their potential to enhance the learning process in medical education.

Keywords: Chatbots, Medical Education, Empathy, Natural Language Processor, Dialogflow, Artificial Intelligence, AI, Simulated Patients, Standardized Patient, Educational Technology, Conversational Agent.

1 Introduction

Effective communication and empathetic skills are essential for healthcare professionals to build strong and trusting relationships with their patients, which can significantly improve clinical outcomes. In recent years, conversational agents or chatbots have become increasingly popular as a tool for medical education, offering personalized learning support to students. This article explores the potential of chatbots for medical education, with a specific focus on teaching empathy, and outlines the development of a chatbot framework that can assist in the creation of a natural language processing (NLP) interface. The article also highlights the potential cost savings of using chatbots as simulated patient encounters. This research can help streamline terminology and enhance clarity in the field of conversational agents within medical education while providing an innovative solution to one of the critical challenges in healthcare education.

2 Review of the Literature

2.1 Chatbots for Learning

Conversational agents (CA) are becoming more common in healthcare, and medical education. “The primary definition of conversational agents is related to a computer program or artificial intelligence able to hold a conversation with humans through natural language processing” (p. 56) [1]. A scoping review conducted by Powell et al. identified over 1300 unique research publications related to the use of conversational agents within medical education [2]. Vanichvasin concluded that the chatbot technology was a valuable learning tool designed to provide personalized learning support to students and “was effective according to students’ perceived effectiveness and increased research knowledge after the chatbot use” (p. 50) [3]. While chatbots can be used in

a variety of methods, such as keeping time or reminding one of an upcoming task, Powell et al. additionally outlined the type of health-specific medical education that was distributed through the agent [2]. This research will help streamline terminology and enhance clarity within this space.

Developed in 1964, Eliza was the first chatbot and could mimic an understanding of natural language [4]. These conversational chatbots have an opportunity to enhance the learning process within medical education. Rooein et al. identified that “chatbots do not need to be “truly humans,” but conversations should be rich and fluent, to engage users, in particular for complex tasks” (p. 911) [5]. This situation can be challenging for script developers as they try to develop scripts that are adaptive, rich, and engaging.

2.2 Teaching Empathy

Teaching medical students to practice empathy during patient encounters has recently become more prominent in medical education. Empathy expressed by providers within a clinical environment has been directly attributed to more positive outcomes by both the medical provider, as well as the patient [6]. While understanding empathy can be a holistic process for medical students, medical educators are tasked with effectively teaching empathetic skills to future providers.

According to Fortin [7], an empathetic conversation between the medical provider and the patient should include five skills: Reflection, Validation, Support, Partnership, and Respect.

When practicing empathy, practitioners should initially reflect upon the patient’s emotions by identifying any potential emotional barriers the patient may be communicating either verbally or nonverbally. The next step is to validate the patient’s emotions by normalizing the emotion. The third step is to express support for the patient’s emotions, and in the fourth step express your partnership for seeking a shared conclusion. The last step is to display respect for the patient and their feelings by acknowledging their experience.

2.3 Chatbot Framework

Christopherjames et al. proposed a chatbot system flowchart to assist in the development of understanding the user’s intent [8]. Intents are the various intentions a user might present when interacting with the chatbot [9]. Response intents are prompts that should respond to the user’s statement or query [10]. The Dialogflow interface, an NLP platform designed to integrate conversation into a user interface, includes four elements within each intent script, the training phase, the action phase, parameters, and responses [11].

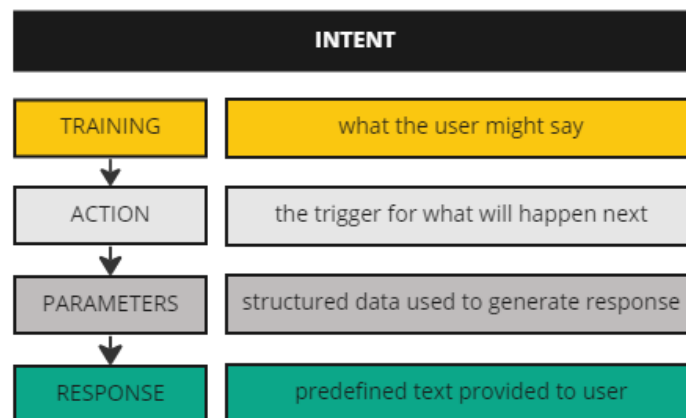


Fig. 1. Dialogflow intent process framework.

The training phase includes examples of what the user might say and uses machine learning to fill in various possibilities of the user’s intent; the action is the trigger for what will happen next once the intent of the request is identified; the parameter is the structured data that can be used to generate a response; and the response is the predefined text to be displayed to the user.

2.4 Empathy Chatbot Design Framework

To connect the chatbot discussion with the intent structure of the Dialogflow interface and the empathy stages in Fortin (2019), a worksheet was developed to assist in designing the chat script (Figure 2).

EMPATHY SKILLS	DIALOGFLOW	ROLE	ACTION
GREETING	Intent		Greeting Intent
	Training	Student	How are you today What can I help you with What brings you in today I'll be taking care of you today How can I help you today
	Action		none
	Parameters		none
	Response	Patient-bot	Well, Doctor, am I having a heart attack? Hi Doctor. Am I having a heart attack? Hi Doc, I feel like I am having a heart attack.
REFLECTION	Intent		Reflection Intent
	Training	Student	It sounds like our tests haven't reassured you. Our tests don't seem to have reassured you much
	Action		none
	Parameters		none
	Response	Patient-bot	Wouldn't you still be worried if you thought you were working up to a heart attack?
VALIDATION	Intent		Validation Intent
	Training	Student	You're understandably worried... I understand.
	Action		
	Parameters		
	Response	Patient-bot	Why do I have this pain Then why is this so painful
SUPPORT	Intent		Support Intent
	Training	Student	That must have been horrible
	Action		none
	Parameters		none
	Response	Patient-bot	You can't imagine how awful it was. Every time I think of it I get upset. Sometimes it even brings on this chest pain. I've been thinking about him more and more lately, especially when I go to sleep at night. It makes me afraid to fall asleep. I'm afraid I'm not going to wake up.
PARTNERSHIP	Intent		Partnership-Intent
	Training	Student	If the pain gets worse or you develop new systems, call me immediately If the pain gets worse, then call me I'll see you in a few weeks.
	Action		none
	Parameters		none
	Response	Patient-bot	Thanks, Doc. See you in a few weeks.
RESPECT	Intent		Respect-Intent
	Training	Student	I'm sure you really feel pain, and I suspect your heart still aches for your father. It's pretty hard to lose a father. Now, you know there's a pretty strong connection between the body and the mind, and if you've been worrying

Fig. 2. Empathy Chatbot Design Framework.

Figure 2 incorporates the patient case example provided by Fortin [7] and aligns the patient-provider conversation with the Dialogflow intent framework [11]. Each stage of the empathetic conversation is outlined within each intent.

The training phase considers the possible statements that the student, playing the role of the provider, may say when interacting with the patient. The response phase includes the predefined text the chatbot may use to respond, as playing the role of the patient. Figure 2 includes a string of six intent structures, which include all five stages of empathy as well as a greeting intent.

As an example, the Greeting Intent includes a training phase that will include various content versions of the phrases that the student may ask the chatbot/patient, such as “What brings you in today?” The action and parameter phases will not be utilized for the initial iteration of the chatbot. The response phase will be the preprogrammed response that the chatbot will say when prompted with the training phrase, such as “Hi Doctor, I feel like I’m having a heart attack.” The student will continue the conversation beyond the Greeting Intent, navigating through the Empathy Chatbot Design Framework which includes the Reflection Intent, Validation Intent, Support Intent, Partnership Intent, and Respect Intent.

2.5 Potential Cost Savings

The average cumulative tuition cost for attending medical school is approximately \$220,000, with a steady annual rise between \$6,000 and \$10,000 compounding each year [12]. Leveraging technology with devices, such as chatbots, may help to reduce educational costs and these cost-savings could be passed on to the student.

Standardized patients have been common in medical education since 1963. A simulated patient is commonly an actor who is hired to simulate a patient with a medical condition [13]. Bosse et al. identified that a total of 172 hours were spent on hiring, training, and employing standardized patients, actors who portray patient scenarios

for clinical skill practice and assessments [14]. This research identified that approximately \$40 per standard patient encounter per student was passed along to the student's tuition cost (Bosse, 2015). Research conducted by Bosse et al. was completed seven years before the writing of this paper and based on the steady increase in medical school tuition costs, one can also infer that the standardized patient rates have also increased over the last seven years [14].

Western University of Health Sciences hires standardized patients to work approximately eight hours per encounter and compensates their standardized patients an average of \$23 per hour, with the average standardized patient working eight days per month [15]. According to this, each standardized patient can earn approximately \$180 per day and over \$1,450 per month. If the university employs multiple standardized patients, then the costs associated with this learning method will multiply depending on the number of individuals employed.

3 Discussion

While the cost of utilizing standardized patient programs can be a significant expenditure for a university, no research has been identified that connects these programs directly with a course teaching patient empathy. Language is complex and includes numerous variable responses to any conversational prompt, and it is near impossible to predict the ongoing path of a conversation [4]. Chatbot script designers have a challenging task in developing intents and responses to simulated conversations. The development of an empathy chatbot project will include the four phases outlined within the Dialogflow interface [11] with the foundation of empathetic skills rooted in the research of Fortin [7], which include reflection, validation, support, partnership, and respect. Additionally, innovations within the everchanging landscape of chatbots and artificial intelligence may have an impact on the research.

4 Conclusion

The use of chatbots can be an effective tool in enhancing the learning process in medical education. The development of chatbot technology that incorporates artificial intelligence and natural language processing in medical education can provide personalized learning support to students, which can be used as a valuable learning tool for teaching empathy to future medical providers. While it may be difficult for developers to create a chatbot that can mimic human conversation, chatbots have the potential to reduce educational costs for students and provide increased value to their learning. This innovative use of chatbots in medical education could potentially improve clinical outcomes while reducing the financial burden on students. Furthermore, the use of a chatbot-based simulation for medical students to practice empathy can improve the provider-patient relationship through the strengthening of humanistic encounters, thereby improving clinical outcomes.

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