

# AI-Powered Chatbots as Emotion-Aware Virtual Assistants: Enhancing Student Support and Engagement in Higher Education

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## ABSTRACT

The increasing complexities in higher education in addition to the increase in class sizes have motivated the need for scalable, responsive, and human like solutions for students' support. Chatbots empowered by AI have recently emerged as promising supplements to the current learning systems. This study focuses on the design, development, and pedagogical outcomes of emotion-aware chatbot used as a Virtual Teaching Assistant (VTA). The proposed VTA goes beyond providing instant answers for frequently asked questions to utilizing natural language processing to be able to ascertain cues related to students' emotional status. Based on the ascertained emotions, the proposed agent will adjust its responses with explanations and descriptions that provide encouragement and reassurance. The agent also can escalate and involve the instructor when needed. To that extent, we utilize a mixed methodology that involves analysing data from student feedback surveys combined with agent interaction logs to assess related aspects such as engagement, usefulness, emotional support, and learning experience. Preliminary analysis suggests that interacting with the agent positively influences student satisfaction, reduces frustration, and enhances perceived accessibility to academic support.

**Keywords:** Emotion-aware AI, Emotional chatbots, Virtual teaching assistant, Affective computing, Human–AI interaction, Higher education

## INTRODUCTION

The higher education environment is undergoing widespread change with the advancement of technology, growing student enrollment, and shifting student demands. The increase in the size of students attending lectures, the adoption of blended or online courses, and the varying student background are creating intense pressure on faculty for providing students with academic support. Conventional teaching practices, emphasizing direct interaction and the availability of faculty members, find it challenging (Bettinger et al., 2017; Diette & Raghav, 2015; Kara et al., 2021; Schanzenbach, 2020). Artificial intelligence (AI)-based chatbots have recently been recognized as an effective way to respond to frequent questions from students, offer immediate feedback, and facilitate learning activities after school hours (Huang et al.,

2025; Ilieva et al., 2023; Konadu & Kusi, 2025). Although the currently available educational chatbots in classrooms show efficacy in processing informational and procedural queries, most of these programs are incapable of detecting and addressing the emotional conditions of students. This aspect makes the learning process affective, where frustration, confusion, and anxiety hinder motivations and performance (Ilieva et al., 2023; Jebara et al., 2025; Qiu et al., 2025).

This paper asserts that emotion-sensing chatbots are an important step forward in the field of education technology. This is because there is the possibility of going beyond the transitional engagement that has existed via AI chatbots so far by applying affective computing. This research aims to develop, deploy, and analyze the impact of an Artificial Intelligence-enabled and emotion-aware Virtual Teaching Assistant for college students. Also, this research examines the effect of emotion awareness on engagement, perception, and learning.

## **LITERATURE REVIEW AND RELATED WORK**

### **AI Chatbots in Higher Education**

Educational chatbots were researched extensively due to their potential role in providing automated learning support, which may involve responding to frequently asked questions, course orientation, and basic tutoring. Existing research work has established that chatbots can help decrease the instructor's workload, increase response time, and boost student perceptions of learning resource accessibility (Ilieva et al., 2023; Schei et al., 2024; van den Berg, 2025). However, most of the applications currently available emphasize functionality rather than the user experience. Student interactions might be rule-based, info-focused, but less equipped to react effectively to the emotions of the students when faced with learning difficulties (Alsaiari et al., 2024a; Kim et al., 2025; Yin et al., 2024).

### **Emotional Factors in Learning**

A major concern of educational psychology studies involves the role of emotions in learning. Frustration, anxiety, or confusion may negatively affect cognitive processing, while support, encouragement, or reassurance can positively contribute to persistence and self-efficacy beliefs (Alsaiari et al., 2024b; Di Leo et al., 2019; Tulis & Fulmer, 2013). In online or mixed-mode settings, where there are no social cues, emotional support becomes a greater concern. Despite this, emotional awareness is not entrenched in learning support systems. It is therefore crucial to develop intelligent systems capable of interpreting and responding to emotions (Di Leo et al., 2019; Hegde & Jayalath, 2025; Stolba et al., 2024).

### **Emotion-Aware and Affective Computing Systems**

Affective computing is particularly concerned with systems that can detect and interpret human emotions, as well as reacting to these. Common

methodologies include sentiment analysis, linguistic patterns, and analysis of interaction behavior (Cao et al., 2023; Hegde & Jayalath, 2025; Yin et al., 2024). Within the realm of education, affective systems have been found to have great potential for increasing involvement and, importantly, fighting dropout, but relevant systems are less often utilized (Hegde & Jayalath, 2025; Yuvaraj et al., n.d., 2025). Surveying the recent body of literature, we found that most of the existing work in this area was done using agents that rely heavily on Large Language Modules such as ChatGPT, Gemini, LLaMA, and others (Li, 2025; Paul et al., 2024; Zhang et al., 2025). Our proposed framework is different than generic AI agents that may not be curriculum oriented. Our proposed VTA will provide interactions with students within the course context. This is an important gap that our proposed framework is trying to address. The AI hallucination is a common problem that stems from using generic LLMs (Tonmoy et al., 2024a, 2024b; Xu et al., 2024). If students realized that the VTA is hallucinating, they will stop trusting it as source of information and may abandon it or simply switch to online LLMs module.

### **Research Objectives and Questions**

The objectives of our studies are to first develop an AI-based chatbot as a Virtual Teaching Assistant (VTA) that can recognize the emotional state of students participating in academic interactions. Second, assess the effect of emotion-aware responses on student engagement and satisfaction. Third, to evaluate how students perceive support and availability offered by VTA. Based on these objectives, the following research questions are proposed:

- **RQ1:** How do students perceive the usefulness and accessibility of an emotion-aware virtual teaching assistant?
- **RQ2:** Does emotion-aware interaction reduce student frustration during academic problem-solving?
- **RQ3:** How does emotional responsiveness influence student engagement and overall learning experience?

## **SYSTEM DESIGN**

### **Chatbot Architecture**

The proposed VTA would have four main parts. The first would be the User Interaction Interface. This is the conversational interface that will be embedded inside the learning management system (LMS). The interface will be platform independent and will be compatible with different types of LMS systems. The second part is the Natural Language Understanding (NLU) Module. This part would handle the input queries raised by the students and try to understand the intents to match them with pre-defined answers about the course and the covered topics. The third part will be the emotion detection module. This module would employ the use of natural language processing and sentiment analysis to determine the emotion displayed by the students while interacting with the VTA. The final component of the VTA

will be the adaptive response module. The module is responsible for adapting the conversation based on the emotional status of the student.

### **Emotion Detection Mechanism**

The proposed VTA recognizes textual cues like negative sentiment, repetition of questioning, and confusion (for example, “I don’t understand,” “this makes no sense”). Interaction patterns, such as rapid repetition of messages and a prolonged interaction time, can also convey emotion. Emotional states that are recognized are classified into general categories such as confusion, frustration, neutrality, and positivity.

### **Adaptive Response Strategy**

Depending on the emotional state recognized, the chatbot responds as follows:

- Clarifying explanations when there is a recognition of confusion.
- Providing encouragement and assurance when there is a recognition of frustration.
- Recommending escalation of distress signals to an instructor when there are recurring signals of distress.

## **RESEARCH METHODOLOGY**

### **Study Context**

The VTA was utilized in a STEM undergraduate course as a pilot within the college of business and administration for a Management Information Systems curriculum. Students interacted with the VTA via an interface that was deployed in the institution’s LMS. The interactions were voluntary and could be via text or voice.

### **Data Collection**

A mixed-methods approach was adopted for data collection. First interaction logs that captured frequency, duration, and emotional classifications of chatbot interactions. Second, student Survey that Measures perceived usefulness, emotional support, engagement, and satisfaction using Likert-scale items. Third, open ended feedback that allowed students to reflect on their experience with the chatbot.

### **Data Analysis**

We analyzed the survey data using PLS-SEM as shown in Table 1. The preliminary results are listed below including standardized path coefficients and p values.

**Table 1:** Preliminary structural model results.

Path	$\beta$	p-value
Emotion recognition → Emotional support	0.50	< .001
Emotional support → Frustration Reduction	0.41	< .001
Emotional Support → Student Engagement	0.34	< .001
Perceived Ease of Use → Continued Use Intention	0.44	< .001
Perceived Usefulness → Continued Use Intention	0.26	< .001
Student Engagement → Continued Use Intention	0.46	< .001
Trust in the VTA → Continued Use Intention	0.17	0.005

## RESULTS AND FINDINGS

Our preliminary results show that emotion recognition plays an important part in shaping the user's perceptions of the VTA. The results reveal that emotional support significantly reduces student frustration and enhances engagement. Also, we found that both emotional and cognitive factors contribute to user's intention to continue using the system. Specifically, perceived ease of use and perceived usefulness showed significant positive effects on the intention to keep using the VTA. In addition, user's engagement and trust in the VTA are strong predictors of the usage of the VTA.

## DISCUSSION

Emotional awareness is an important aspect for improving the pedagogical benefit of AI chatbots in higher education (Alsaiani et al., 2024; Cao et al., 2023; Tulis & Fulmer, 2013). The proposed VTA helps in enhancing the human aspect of educational experience by recognizing the emotional experiences and the status of the users while interacting with it. Emotion-aware smart systems could complement teacher's effort as they could act as a first line of support and highlight situations that require the teacher's attention especially in situations with limited resources (Huang et al., 2025; Konadu & Kusi, 2025; Qiu et al., 2025).

## CONCLUSION

The current research reveals how AI-based chatbots with emotion recognition abilities can play a role as a VTA in higher education courses. Also, combining conversational abilities with emotion detecting and AI the proposed VTA can make the learning experience more engaging. Also, that VTA experience can lower frustrating experiences and interactions. AI capable VTAs have great advantages if incorporated with LMS to benefit both learners and educators.

## IMPLICATIONS

### Theoretical Implications

This study contributes to educational technology literature by integrating affective AI-driven VTAs as support systems for students. This work highlighting the role of emotions in human and AI interaction.

### Practical Implications

For educators and teaching institutions, VTA that are emotion-aware offer a scalable solution for student support. That can benefit teachers particularly in large or online classes. The proposed systems will provide quick support for students while maintaining empathy and adaptive responsiveness.

## LIMITATIONS AND FUTURE RESEARCH

The current research was done as a pilot to measure the effectiveness of VTA in higher education classes. Future work will include more data and bigger sample to enhance the generality of this research.

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