Research article

Examining the association between emotional intelligence and chatbot utilization in education: A cross-sectional examination of undergraduate students in the UAE

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ABSTRACT

Background: While Emotional Intelligence (EI) demonstrably affects academic success, literature lacks exploration of how implementing chatbot in education might influence both academic performance and students' emotional intelligence, despite the evident potential of such technology.
Aim: To investigate the associations between Emotional Intelligence (EI), chatbot utilization among undergraduate students.
Methods: A cross-sectional approach was employed, utilizing a convenience sample of 529 undergraduate students recruited through online questionnaires. The participants completed the Trait Emotional Intelligence Questionnaire and modified and a modified versions of the unified theory of acceptance and use of technology (UTAUT) model.
Results: of the 529 participants, 83.6 % (n = 440) of participants regularly used chatbot for learning. Students demonstrated a moderate average EI score (129.60 $\pm$ 50.15) and an exceptionally high score (89.61 $\pm$ 20.70) for chatbot acceptance and usage. A statistically significant (p < 0.001) positive correlation was found between chatbot usage frequency and EI total score. Gender and major emerged as significant factors, with female students (p < 0.05) and health science students (p < 0.05) utilizing chatbot less compared to male and other major students, respectively. A negative correlation (r = −0.111, p = 0.011) was observed between study hours and chatbot usage, suggesting students with higher study hours relied less on chatbot.
Conclusions: The positive correlation between chatbot use and EI in this study sparks promising avenues for enhancing the learning experience. By investing in further research to understand this link and integrate AI tools thoughtfully, policymakers and educators can cultivate a learning environment that prioritizes both academic excellence and student well-being, reflecting the values and perspectives of UAE culture.

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1. Background

Emotional Intelligence (EI) is a concept that has received critical acknowledgment from psychologists and researchers over the last two decades [1]. Emotional Intelligence (EI) is defined as "skills help us recognize, contain, and effectively communicate our emotions, as well as recognize the emotions of people" [2]. It has a high impact on many aspects of a learner's life and academic performance level [3]. Academic achievement is "the knowledge-attaining ability or degree of competence in students' tasks usually measured by standardized tests and expressed in grades or units based on a people's performance" [4]. Emotional Intelligence (EI) integrates crucial elements of effective interpersonal interactions to bolster self-management abilities such as adaptability, emotional regulation, and stress reduction. As a result, the significance of EI in fostering successful academic achievement, career advancement, and its application in clinical contexts has gained broader acknowledgment [5] and college students were happier, more self-assured, self-confident, and had more professional achievements than those with EI score [6,7]. EI also has been found to be connected with key skills and important students' competencies that can help to better control emotions and connect with other [8].

Students with high emotional intelligence (EI) can manage their own and others' emotions, as well as recognize, understand, and use their own emotions[7]. They also tend to have higher GPAs and be more successful in life. On the other hand, students with low to moderate EI levels may struggle to manage their emotions, which can lead to academic barriers and difficulties in relationships [9]. The four main components of EI are self-awareness, self-management, social awareness, and relationship management. Recent study revealed that students who focused on attain and enhance EI principle components had significant improvement in their GPAs suggesting that EI is a key factor for academic success [9]. Numerous studies have investigated the relationship between emotional intelligence (EI), library use, and academic achievement. A study conducted by Jan and Anwar (2019) among undergraduate university students in Pakistan revealed a significant positive correlation between EI and academic achievement as measured by GPA [10]. Similarly, a study by Musa et al. [11] involving 200 undergraduate students in Malaysia demonstrated that students with higher EI scores attained higher GPAs [11]. These findings suggest that EI plays a crucial role in academic success by equipping students with the necessary skills to manage emotions, maintain motivation, and foster positive relationships. Emotionally Intelligent students (EI) can manage their stress effectively and avoid its negative effects on their attitude, work performance, grade level, and academic success [12]. The relationship between EI and academic achievement is likely to be complex and influenced by a variety of factors, such as the individual's age, gender, and cultural background. More research is needed to fully understand the relationship between EI and academic achievement particularly among UAE contexts. The study's results could be used to help students understand the value of emotional regulation and the necessity of incorporating and putting into practice the EI components in the curriculum.

Artificial intelligence (AI) is rapidly revolutionizing the education sector, introducing innovative tools and applications to enhance the learning experience. The AI, defined as "the ability of a computer program or machine to think and learn similar to the way that humans do naturally," is primarily driven by artificial neural networks (ANN) that mimic the human brain's cognitive processes [13]. Among the plethora of AI-powered educational tools, chatbot stand out as a groundbreaking communication technology that facilitates more practical and engaging learning interactions compared to traditional methods [13].

2. Significance of the study

In recent years, the integration of chatbot into the educational landscape has garnered significant interest, with researchers and educators exploring the multifaceted roles these AI-driven conversational agents can play in transforming traditional teaching methods and enhancing student engagement. Chatbot also serves as invaluable resources for answering students' questions promptly, minimizing the time spent searching for information and ensuring that students receive timely clarifications. This real-time support can be particularly beneficial in enhancing students' comprehension and engagement with the learning material. Moreover, chatbots possess the capability to provide constructive feedback, fostering a continuous cycle of improvement for students [14]. Emotionally intelligent (EI) individuals possess the ability to effectively manage stress, mitigate its negative effects on their attitude, work performance, and academic success [12]. However, the relationship between EI, chatbot utilization, and academic achievement is likely complex and influenced by various factors, such as individual age, gender, and cultural background. Further research is warranted to fully elucidate the intricate relationship between EI, chatbot utilization, and academic achievement, particularly within the context of the United Arab Emirates (UAE). The findings of this study could inform strategies to help students understand the value of emotional regulation and the importance of incorporating EI components into the curriculum. Additionally, the integration of chatbot into education holds immense promise in enhancing accessibility and personalization of learning for students across diverse backgrounds and abilities [15]. Comprehensive studies examining the precise effects of chatbot utilization on these outcomes are currently lacking. Therefore, a thorough investigation of the potential implications of chatbot integration within educational contexts is essential. Such research endeavors could provide valuable insights into the effectiveness of these AI-driven tools in not only enhancing academic outcomes but also nurturing EI in students. By addressing this research gap, we can gain a deeper understanding of the true potential of chatbot in shaping the future of education, ensuring that it remains adaptable, inclusive, and optimized for the diverse needs of learners. Therefore, this study sought to assess the relationship between EI, academic performance, chatbot utilization. This study will examine students' perception toward Chatbot benefits.

This research holds particular significance within the context of UAE culture and among Higher Colleges of Technology (HCT) students, given the unique amalgamation of factors present in this setting. The UAE's steadfast commitment to education as a catalyst for personal and national advancement has made the integration of AI into educational environments an inevitable and transformative process. Furthermore, as the UAE actively embraces AI across various sectors, including education, this study assumes a timely and pivotal role in providing insights into the effects of AI on students' well-being and academic outcomes. These insights can directly

inform policy decisions and curriculum design, ensuring that students are adequately prepared for a world increasingly driven by AI while safeguarding their emotional and psychological welfare.

3. Theoretical context and literature review

This study integrated the Unified Theory of Acceptance and Use of Technology (UTAUT) model to examine the association between students' perception of chatbot utilization and their level of emotional intelligence. The UTAUT model has for main constructs explains factor toward accepting and adopting a new learning technology, which includes performance expectancy, effort expectancy, social influence, and facilitating conditions [16]. Performance Expectancy: This is about how much students expect chatbot will improve their learning skills. In our scale, the item "Chatbot are useful to me and satisfy my university needs" captures this concept. Effort Expectancy is related to ease of using Chatbot tool. If technology is user-friendly and effortless to use, users are more likely to be interested in chatbot. In our scale, the item "It is easy for me to become skillful at using chatbots" represents effort expectancy. Social Influence refers to the impact of social context in term of students, instructor and institution level of acceptance of a technology. In our scale, the item "People around me encourage me to use chatbot reflects social influence. Facilitating conditions construct refers to the degree to which students perceive that they can gain the knowledge and skills from organizational and technical infrastructure to support the sustain use of chatbot technology. In our scale, the item "I can get guidance and help regarding how to use Chatbot from the system and user's guide." represents facilitating conditions.

Within the Unified Theory of Acceptance and Use of Technology (UTAUT) model, factors such as performance expectancy, effort expectancy, social influence, and facilitating conditions influence users' adoption and continued use of technology. Regarding performance expectancy, students who perceive chatbot as capable of enhancing their academic performance by providing quick, accurate, and personalized support are more likely to embrace their use. The perceived ease of use and minimal effort required to interact with chatbot contribute to a favorable attitude towards their adoption. Additionally, positive recommendations from peers and instructors can act as catalysts for social influence, encouraging students to explore and utilize chatbot.

Beyond academic performance, chatbot can also positively impact students' emotional intelligence (EI). By fostering a supportive and empathetic environment, chatbot can help students develop self-awareness, self-regulation, social awareness, and relationship management skills. Chatbot can provide a safe space for students to express their concerns, seek advice, and practice emotional regulation techniques.

Incorporating the Unified Theory of Acceptance and Use of Technology (UTAUT) model into this study provides a comprehensive framework for understanding how factors such as performance expectancy, effort expectancy, social influence, and facilitating conditions influence students' adoption and continued use of chatbots [16]. By addressing these factors and their relationship with emotional intelligence, educators can effectively implement chatbots to enhance the overall learning experience and foster emotional intelligence development among students [17].

Recent studies have recognized the relevance of the UTAUT model in understanding technology adoption in educational settings [17,18]. By integrating this theoretical framework, this study aims to provide valuable insights into the effects of chatbot utilization on students' emotional intelligence and academic achievement, particularly within the UAE context. Comprehensive research examining the precise effects of chatbot integration on these outcomes is essential for informing educational practices and ensuring the effective use of AI-driven tools in enhancing learning experiences and fostering emotional intelligence development among students. Foroughi et al. [19] employed the UTAUT model to investigate the factors influencing the intention to use ChatGPT. Their study revealed that performance expectancy, effort expectancy, hedonic motivation, and learning value had significant effects on the intention to use ChatGPT. Additionally, Strzelecki [20] identified habit as the primary predictor of behavioral intention, followed by performance expectancy and hedonic motivation. Moreover, Strzelecki [20] found that for actual usage behavior, behavioral intention was the principal determinant, followed by personal innovativeness. Moreover, the performance expectancy, social influence, and facilitating conditions of the UTAUT model were significantly enhance preschool teachers' willingness to utilize Generative Artificial Intelligence [18].

A recent Jordanian study focused on Moodle adoption among undergraduates, finding the influence of performance and effort expectancy [21]. Meanwhile [22], explored mobile learning, introducing variables like perceived enjoyment and trust, and discovered factors affecting behavioral intention [22]. These studies collectively contribute insights for educators and policymakers facing technological integration challenges in different contexts. The study conducted in the Philippines highlights the importance of several factors, such as enjoyment, interactivity, flexibility, and the quality of the online learning system, in influencing the acceptance of technology, behavioral intentions, and actual usage of the system among college students. This remains true even in developing countries with connectivity challenges [23].

There is no recent literature on the influence of chatbot technology on students EI. while the recent literature explores various learning outcome benefits from integration of chatbot on student academic performance. A recent study investigated how students in higher education accept and use ChatGPT, a large language model developed by Open AI [20]. Utilizing structural equation modeling and data gathered from 534 students at a Polish state university, the researchers examined the factors influencing students' intentions to use ChatGPT and their actual usage behavior. The findings revealed that habit, performance expectancy, and hedonic motivation were significant predictors of students' intention to adopt ChatGPT. Additionally, students' intention and personal innovativeness were found to influence their actual use behavior, with intention being a crucial determinant. Students with a greater openness to new technologies exhibited a higher likelihood of using ChatGPT. The study identified ChatGPT as an AI tool capable of assisting with writing, learning, and solving assessments in a conversational manner. The researchers concluded that AI tools like ChatGPT possess potential benefits in the educational realm, warranting further exploration to determine effective implementation strategies. Similarly,

a systematic review investigated the potential utility of ChatGPT in healthcare education, research, and practice [24]. The review identified several benefits, such as its use in scientific writing and healthcare research, but also emphasized the associated risks, including ethical issues, potential bias, and incorrect responses. An addition recent study examined the use of ChatGPT as an educational tool in communication, business writing, and composition courses. While ChatGPT demonstrated the ability to provide accurate and reliable information, concerns were raised about its potential for unethical use and the challenges of assessing student understanding [25].

4. The study aims to achieve two main objectives

1. Determine the levels of chatbot utilization and emotional intelligence among undergraduate students.
2. Examine the association between emotional intelligence (EI), academic performance, and chatbot utilization.

To address these objectives, the following questions were posed.

1. To what extent do students' individual characteristics influence both their emotional intelligence (EI) and chatbot utilization?
2. Is there a significant association between students' emotional intelligence (EI) and chatbot utilization?

We hypothesize that higher emotional intelligence will be positively correlated with higher academic achievements. Additionally, we anticipate that more frequent utilization of chatbots tends to be associated with higher academic achievement and higher levels of emotional intelligence.

5. Methodology

5.1. Design

A cross-sectional study design was used to examine the relationship between students' EI level and chatbot utilization.

5.2. Sampling procedure and size

The target participants of this study were undergraduate students at the Higher College of Technology (HCT) in the UAE with a calculated GPA. Using a convenient sampling technique, 524 undergraduate students from five majors (Health Science, Applied Media, Computer Information Science, Education, and Engineering Technology and Science) across the nine campuses located throughout all Emirates were recruited to participate in the study. All students were considered potential participants without any predetermined exclusion criteria.

The sample size was determined based on a correlational test to measure the association between Emotional Intelligence (EI), the dependent variable, and students' perception of chatbot utilization, the independent variable. A hypothesis of a medium correlation (r = 0.3) between the dependent and independent variables was assumed, with a significance level of alpha 0.05 and a power of 0.95. Based on these parameters, a minimum sample size of 154 participants was required. However, the study exceeded this minimum requirement by recruiting 524 participants, ensuring sufficient statistical power to detect meaningful relationships between the variables of interest.

5.3. Outcome measure

An online survey was conducted to collect data for this study. The survey was designed to take approximately 10 min to complete and consisted of four sections addressing various aspects of the study's research questions.

5.4. Demographic data questionnaire

The first section includes seven items related to sociodemographic information such as gender, age, marital status, which campus, current semester, major, and GPA. Four items asked participants regarding the use of chatbot usage such as do you use chatbots, which chatbots sites, and how often do you use them.

5.5. Emotional intelligence questionnaire

The second section of the survey was "The Trait Emotional Intelligence Questionnaire - Short Form" (TEIQue-SF). The questionnaire has a 30-item developed by Petrides in 2009 to measure trait EI [26]. Respondents rate each item on a 7-point Likert scale from completely disagree to completely agree. The items were categorized under subscales as follows: Well-being (6 items), Self-control (6 items), Emotionality (8 items), and Sociability (6 items). The remaining four items contribute directly to the global trait EI score. A low total score indicates lower trait EI, suggesting challenges in understanding and managing emotions, while a high score suggests a higher level of EI, indicating proficiency in emotional awareness, regulation, and interpersonal skills. The TEIQue-SF scale has been found to be valid and reliable in previous literature. The values of Cronbach's alpha for all subscales ranged from 0.60 to 0.89.

5.6. Chatbot utilization questionnaire

To achieve the purpose of this study, Chatbot Utilization, was adopted and designed based on insights from existing literature and the UTAUT model (C. [27]). The UTAUT model is an established framework for examining the factors influencing technology acceptance and utilization. The items were modified to specifically assess students' perceptions of chatbot utilization. Five faculty members from the education and health science departments initially reviewed the modified scale. After incorporating their feedback, the revised questionnaire was distributed to six additional instructors in computer science and health science. Upon considering these latest comments, the final scale was established. A pilot study involving 20 students was conducted to evaluate the clarity of the scale. The pilot study's findings were used to make further refinements to the scale before its final administration. The final scale comprised of 20 items, with responses measured on a five-point Likert scale, ranging from "strongly disagree" to "strongly agree". For this study, the total score has been adapted to indicate the participant's perception of usefulness, ease of use, social influence, and behavioral intentions specifically related to chatbot utilization technology. In the current study, the values of Cronbach's alpha for all subscales ranged from 0.83 to 0.92, which indicates a good level of reliability.

5.7. Data collection procedure

The data collection procedure started immediately after submitting the proposal for Institutional Review Board (IRB) approval from the Research Ethics Integrity Committee (REIC) at the Higher College of Technology (HCT) and gained approval. The study

Table 1
Sociodemographic of participants (n = 529).

Variables	Mean (SD)
Average Age (SD)	21.37 (1.85)
Average study hour s	3.78 (2.171)
Variables	Frequency (Percentage)
Gender	
Female	338 (63.9 %
Male	191 (36.1 %)
Marital Status	
Single	453 (85.6 %)
Married	74 (14.0 %)
Divorced	2 (0.4 %)
Major	
Health Science	166 (31.4 %)
Applied media	28 (5.3 %)
Computer information science	100 (18.9 %)
Education	26 (4.9 %)
Engineering technology and science	137 (25. %)
Business	72 (13.6 %)
Semester	
Semester 1	31 (5.9 %)
Semester 2	66 (12.5 %)
Semester 3	77 (14.6 %)
Semester 4	79 (14.9 %)
Semester5	62 (11.7 %)
Semester 6	65 (12.3 %)
Semester 7	72 (13.6 %)
Semester 8	77 (14.6 %)
GPA	
0–1.0	6(1.1 %)
1.1–2.0	31 (5.9 %)
2.1–3.0	352 (66.5 %)
3.1–4.0	140 (26.5 %)
Chatbot use in studying	
Yes	440(83.6 %)
No	89 (16.8 %)
Frequency of chatbot use	
Several times a day	121 (27.5 %)
A few times a week	160 (36.3 %)
Once a month	19 (4.3 %)
Only when necessary	140 (31.8 %)
Chatbot effectiveness	
Very effective	196 (44.5 %)
Effective	166 (37.7 %)
Somewhat effective	57 (129 %)
Not very ineffective	16 (3.6 %)
Ineffective	3 (0.68 %)

electronic survey was sent to all potential participants using their HCT email. Finally, those who agreed to participate were electronically provided with informed consent, which includes the study aim, data collection procedure, data collection tool, risks and benefits, and any other considerations. The survey contains a digital consent form, as a statement of acceptance and agreement to the declaration of commitment to participate in the study. Data collection was continued for two weeks despite achieving the target sample size.

5.8. Ethical considerations

The study received ethical approval from the HCT Research Ethics and Integrity Committee (5-234SM). Participation was voluntary, and participants remained anonymous as no personal identifying information (such as names, emails, or phone numbers) was requested. Informed consent was obtained from all participants. There were no anticipated physical, emotional, or psychological risks or benefits associated with participation. All participants were treated equally, irrespective of age, gender, academic level, or GPA. The collected data is strictly confidential and will be used solely for research purposes. It will be securely stored in a password-protected device accessible only to the study researcher.

5.9. Data analysis

Data management and analysis were conducted using IBM SPSS Statistics, Version 29, in the year 2023. The analysis process was divided into several steps to comprehensively explore the dataset and investigate relationships between various variables. Initially, descriptive statistics were employed to provide an overview of the students' characteristics, as well as the total scores for emotional intelligence (EI) and chatbot utilization. The data were presented in a manner that aligns with the level of measurement: counts and percentages for categorical variables and means and standard deviation (SD) for continuous variables. Additionally, the subscales of EI and chatbot utilization were computed to examine their relationship by performing Pearson correlation tests. Subsequently, a series of univariate analyses were conducted to delve deeper into the relationships between the study variables, including EI scores, AI utilization scores, and students' GPA. The primary objective here is to ascertain whether there are statistically significant associations between these variables. A p-value of less than 0.05 served as the threshold for determining statistical significance across all the tests conducted.

6. Results

The online survey was available for over two weeks and 529 undergraduate students participated. The average age was 21.37 years (SD ± 1.857), with a range from 17 to 28. The average studying hours for participants was 3.78 (SD ± 2.171) hours, with a range from 0 to 12 h per day. Most participants were from health science majors 166 (31.4 %) and then from engineering technology and science137 (25.0 %) (Table 1). Of the 526 participants, 440 (83.6 %) were using chatbot. Participants used chatbot tools daily were 121 (27.5 %), while 36.3 % used them several times a week. Most students perceived chatbot as very effective (44.5 %) or effective (37.7 %) in completing the learning tasks (Table 1).

6.1. Emotional intelligence

On average, participants had a moderate level of emotional intelligence (EI), with an average EI score of 129.60 (SD ± 50.15). Participants scored highest on the "Emotion ability" with an average score of 32.99 (SD ± 13.12), which measures their ability to identify, understand, and express their own emotions. On the other hand, "Sociability" displayed the lowest mean score at 25.89 (SD ± 10.44), suggesting a comparatively lower level of sociability (Table 2).

6.2. Chatbot utilization

On average, participants had a high perception toward accepting and utilizing chatbot with an average total score of 89.61 (SD ± 20.70). Participants scored the highest on Performance Expectancy at 4.58 (SD ± 1.82), Social Influence at 4.58 (SD ± 1.91), and Facilitating Conditions at 4.48 (SD ± 1.79), which indicate a high level of perception of effectiveness of chatbot in completing learning tasks and a high level of support for both social members and the institution. The Effort Expectancy score of 3.86 (SD ± 1.79) indicates that participants perceived a moderate level of effort and self-control required for using chatbot effectively. Finally, the Use Intention

Table 2
Emotional intelligence.

	Mean (SD)
EI total score	129.59 (50.15)
Well being	26.91 (10.49)
Self-control	26.63 (10.62)
Emotion ability	32.99 (13.12)
Sociability	25.89 (10.44)

score was the lowest at 2.13 (SD ± 0.90), suggesting a relatively low level of willingness and intention to continue using chatbot technology (Table 3).

6.3. The association between participants' characteristics, EI, and chatbot utilization

This section will answer the first study question "To what extent do students' individual characteristics influence both their EI and their chatbot utilization?" A series of univariate analyses was conducted to determine this association. First Pearson correlation was conducted between continuous variables such as participants' age and average study hours with a total score of EI and chatbot utilization. There are negative relationships between the number of study hours and the chatbot utilization (r = −0.111, P = 0.011). The results also revealed a positive correlation between age and EI (r = 0.124, P = 0.004). Finally, the result showed a strong positive association between EI and Chatbot utilization subscales (Table 4).

An independent *t*-test was conducted to investigate the gender-based differences in perceived total score of EI and chatbot utilization. The results revealed that male participants exhibited a higher EI score (161.88, SD ± 37.10) compared to female participants (111.34, SD ± 47.31) (Table 5). In contrast, female participants displayed a lower chatbot utilization score (85.12, SD ± 22.07) compared to males (97.56, SD ± 15.10). An ANOVA test was conducted to examine chatbot utilization among various majors and showed that Engineering technology and science students significantly exhibited the highest chatbot utilization levels compared to other majors. Additionally, health science students had the lowest chatbot utilization levels, with a mean of 82.5 (SD ± 23.518). Additionally, an ANOVA test was conducted to analyze EI among different majors. Once again, engineering technology and science students have significantly the highest EI level, with a mean of 155.87 (SD ± 42.67). In contrast, health science students had significantly the lowest EI levels with a mean of 109.68 (SD ± 44.35) (Table 5). Overall, these findings indicate that, while there are significant variations in chatbot utilization among majors with engineering technology and science students tend to utilize chatbot more frequently than other majors and consequently report higher EI levels. Finally, there were no significant differences in students' GPA based on the total score of EI and Chatbot utilization.

Table 5 also presents the association between AI and EI among chatbot users and non-users. It is evident that chatbot users have significantly higher mean scores for both AI total of 91.82 (SD ± 18.61) and EI total of 134.17 (SD ± 49.76) compared to non-users. The results also revealed that students who used chatbot more frequently reported significantly higher EI total scores (P < 0.001)

7. Discussion

This study ventures into uncharted territory by examining the connection between emotional intelligence (EI) and chatbot use in students. Drawing upon the UTAUT model, we also investigated how participant characteristics influence EI and chatbot utilization. The findings, discussed in the following section, hold significant implications for future research and educational practices.

Our study uncovers a positive association between students' perceptions of chatbot value, their utilization of chatbots, and their levels of emotional intelligence (EI). This finding shed light on the potential mechanisms underlying the relationship between frequent chatbot use and higher emotional intelligence scores among students. Specifically, our results suggest that regular interactions with chatbots could play a role in fostering the development of emotional intelligence skills among students. Through these interactions, students have opportunities for meaningful self-reflection, practice in emotion regulation techniques, heightened social awareness, and personalized feedback, all of which are integral components of emotional intelligence growth.

While several recent studies highlight the potential benefits of chatbot for student well-being, none has directly explored the link with EI. However, existing research offers promising evidence: chatbot have shown effectiveness in reducing stress and improving mental health outcomes [24], while fostering engagement and satisfaction in academic settings [6]. Further strengthening this concept, a recent study demonstrated that chatbot use led to increased life satisfaction, positive affect, and decreased negative affect in students [28]. These preliminary findings pave the way for further investigation into the intricate relationship between chatbot utilization and student EI. Future research should delve deeper into the long-term impacts of chatbot use on emotions and well-being. Additionally, exploring the role of chatbot design and functionality in influencing student emotional states can yield valuable insights for optimizing their effectiveness in education.

This study found no statistically significant association between students' current GPA and chatbot use, suggesting that chatbot use might not have a direct impact on their academic performance. Additionally, students with GPAs between 2 and 3 reported a higher positive attitude toward chatbot use. This group of students might be working harder than others to avoid being at risk. While no

Table 3
Perceived Chatbot utilization.

	Mean (SD)
AI total score	89.61 (20.70)
Performance Expectancy	4.58 (1.82)
Social Influence	3.86 (1.79)
Effort Expectancy	4.58 (1.91)
Facilitating Conditions	4.48 (1.70)
Individual Innovation	4.19 (1.73)
Perceived Cost	3.85 (1.54)
Use Intention	2.13 (0.90)

Table 4

Correlation coefficient of the association between EI and Chatbot utilization.

	Well being	Self-control	Emotion ability	Sociability	EI Total
Performance Expectancy	0.895	0.903	0.918	0.887	0.926
Effort Expectancy	0.767	0.783	0.862	0.779	0.823
Social Influence	0.922	0.934	0.867	0.916	0.926
Facilitating Conditions	0.925	0.904	0.903	0.890	0.925
Individual Innovation	0.899	0.893	0.910	0.923	0.927
Perceived Cost	0.737	0.774	0.889	0.800	0.831
Use Intention	0.0.881	0.912	0.922	0.887	0.925
Performance Expectancy	0.959	0.949	0.911	0.923	0.954

$P < 0.001$.

Table 5

The association between participant characteristics, emotional, and chatbot utilization.

Variables	Chatbot		EI	
	Mean (SD)	*P* vale	Means (SD)	*P* value
Gender		0.0001[a]		0.0001[a]
Female	85.12 (22.07)		111.34 (47.31)	
Male	97.56 (15.10)		161.88 (37.10)	
Marital Status		0.286[b]		0.671[b]
Single	89.68 (20.32)		129.00 (50.34)	
Married	89.82 (22.98)		132.48 (49.66)	
Divorced	66.50 (7.77)		154.50 (14.84)	
Major		0.0001[b]		0.0001[b]
Health Science	82.50 (23.51)		109.68 (44.35)	
Applied media	85.00 (21.90)		119.96 (44.29)	
Computer information science	91.36 (17.70)		131.51 (50.33)	
Education	89.92 (16.61)		114.34 (57.01)	
Engineering technology and science	97.57 (16.97)		155.87 (42.67)	
Business	90.13 (19.53)		132.05 (53.15)	
GPA		0.131[b]		0.212[b]
0–1.0	77.50 (31.60)		119.33 (59.20)	
1.1–2.0	88.51 (19.86)		112.00 (49.39)	
2.1–3.0	90.92 (20.10)		131.35 (51.41)	
3.1–4.0	87.09 (21.67)		129.49 (46.29)	
Do you Use chatbot in your studying?				
Yes	91.82 (18.61)	0.001[a]	134.17 (49.76)	0.001[a]
No	78.68 (26.43)		106.94 (45.92)	
How often do you use chatbot?		0.001[b]		0.001[b]
Several times a day	97.4 (13.25)		145.48 (52.30)	
A few times a week	92.25 (21.31)		135.92 (49.32)	
Once a month	84.93 (18.66)		96.34 (47.24)	
Only when necessary	84.93 (18.66)		121.58 (44.46)	
I'm not sure	76.78 (29.32)		117.67 (50.89)	
How effective do you find chatbots in helping your academic tasks?		0.001[b]		0.001[b]
Very effective	94.30 (18.07)		140.57 (50.09)	
Effective	90.36 (20.95)		130.27 (50.18)	
Somewhat effective	78.30 (19.60)		105.57 (39.83)	
Not very ineffective	79.09 (29.32)		114.22 (50.65)	
Ineffective	88.40 (11.26)		88.40 (44.23)	

[a] *P*-Value of Independent *t*-test.
[b] *P*- value of ANOVA.

previous studies have directly correlated GPA with chatbot use, literature has explored other learning outcomes impacted by AI, such as critical thinking and problem-solving skills. Chatbot have also shown positive outcomes in educational settings among university students, enhancing research knowledge, providing personalized learning experiences, and improving student motivation, engagement, and self-efficacy [29,30].

While chatbot offer quick information and improved writing skills, crucial for undergraduate assignments, this study surprisingly found a negative association between chatbot use and total study hours per day. This suggests that students relying heavily on chatbot may be spending less time studying overall. Interestingly, existing research highlights the potential of AI tools like chatbot to personalize learning and enhance student experiences. In the age of mobile AI, accessible and interactive learning opportunities are expected to further revolutionize education [31,32].

This study suggests a potential gender gap in chatbot utilization, with male participants scoring higher than females. This aligns with some research, which suggests female students may be less motivated to learn about AI (P.-Y. [33]). However other literature

found no significant gender difference in factors influencing AI-related intentions. Further research is crucial to understand the complex factors at play and develop effective strategies to promote positive AI attitudes for all students [34].

Our research reveals no significant link between age and AI utilization. This echoes findings from a similar Egyptian study, suggesting demographic factors like age may not directly impact AI use [34]. Notably, engineering and science students exhibited the highest AI levels compared to other disciplines, indicating specific academic fields likely influence utilization more than age. This underscores the need for further research exploring factors beyond demographics that shape chatbot engagement and adoption. A recent study revealed that the performance expectancy, social influence, and facilitating conditions outlined in the UTAUT model contribute to increased student and teacher engagement in learning technologies such as chatbots [18,35,36]. A study showed that students who perceived greater AI use in nursing practice were more likely to adopt it themselves [37]. This indicates that introducing students to practical AI applications within their respective fields may be crucial for increasing overall utilization, regardless of their age or academic background. This notion is supported by a recent study that utilized the UTAUT model to explore the factors impacting the intention to use ChatGPT [19]. The research demonstrated that performance expectancy, effort expectancy, hedonic motivation, and learning value significantly influenced the intention to utilize ChatGPT.

7.1. Emotional intelligence

Exploring the relationship between age and Emotional Intelligence (EI), our study joins a growing research area with intriguing outcomes. We observed a positive correlation between age and EI, mirroring findings of previous studies [38,39]. These connections hint at the possibility that life experiences serve as training grounds for EI development. Similarly, a study identified a link between age and empathy among medical postgraduates, potentially indicating that navigating life's complexities enhances our ability to connect with others' emotions[40]. While further research is needed to unravel the specific mechanisms involved, these findings suggest that age may be more than just a chronological marker; it could represent a rich tapestry of experiences that weave the fabric of our emotional intelligence.

Our research found male students scoring higher on Emotional Intelligence (EI) compared to females, aligning with some previous studies but contradicting others. Notably, a study by Nöthling et al. [49] also found higher EI in males within the radiography cohort, particularly in Global EI and Self-control. However, some studies [38,41] reported higher EI in female medical students, attributing it to factors like socialization and nurturing nature. This inconsistency highlights the need for further research into cultural and social contexts influencing EI expression and gender differences.

Compared to students in other majors, those in Engineering Technology and Science exhibited significantly higher levels of emotional intelligence (EI). This finding aligns with a study among engineering students in Turkey, where those with design-related hobbies and those with engineers in their family scored higher on EI assessments [42]. However, contrasting results have emerged from other studies. A cross-sectional study with nursing and engineering students in Slovenia showed significantly higher EI in nursing students compared to engineering students, regardless of gender or prior caring experience [43]. These mixed findings highlight the complexity of EI and its relationship with academic discipline. Further research is needed to delve deeper into the specific factors influencing EI development and expression across diverse contexts.

Our study found a fascinating relationship between EI and academic progress. Semester 1 students exhibited the lowest EI levels, while those in semester 2 had the highest. This aligns with a recent research among health science students, who found higher EI in first and third years compared to second and fourth [44]. However, another study among medical students at King Saud University found the opposite trend [45]. Interestingly, our data also revealed a positive association between high average study hours and improved EI. This resonates with a study on nursing students, which showed significant EI improvement after increased clinical working hours [46]. Similarly, it was suggested that integrating skill training into nursing education and hospital in-service programs enhances EI and interpersonal relationships among nurses [47]. These findings suggest a potential link between academic engagement and EI development [48]. Further research is needed to explore the mechanisms behind this relationship and determine whether targeted interventions could boost EI through academic activities.

8. Study strength and limitation

While our study acknowledges the limitations inherent in its convenient sampling method, the large sample size and diverse representation of majors and campuses provide some degree of generalizability to the broader HCT undergraduate population. However, it's important to recognize some key limitations. Firstly, focusing solely on emotional intelligence and GPA as outcome variables may not fully capture the multifaceted nature of student abilities and learning experiences. Secondly, we also acknowledge that our study did not explore the impact of the chatbot on critical thinking, problem-solving, or the interplay between the learning environment, emotions, and AI perceptions. Thirdly, while we utilized a modified UTAUT-based tool to evaluate chatbot utilization, demonstrating high reliability, further research is needed to establish its validity. Lastly, our study was confined to undergraduate students from the Emirates, limiting the generalizability of our findings. We recommend conducting future studies with a more diverse student population that represents UAE culture more broadly. This would not only enhance the generalizability of the results but also deepen our understanding of the association between emotional intelligence and the adoption of various pedagogical methods such as chatbots.

9. Implication and conclusion

The study results revealed that students who used chatbot more frequently reported significantly higher EI. This emphasizes the importance of assessing students' emotional status in relation to AI acceptance. It suggests prioritizing emotional well-being to establish a supportive learning environment that leverages AI's advantages while mitigating potential drawbacks.

The study emphasizes the importance of investigating the relationship between AI integration, particularly through tools like chatbots, and the improvement of undergraduate students' learning experiences. This research indicates the importance of raising student awareness and providing training on the use of chatbot tools to enhance their learning capabilities. However, to regulate how students utilize chatbots for content generation, higher education institutions must incorporate technological transparency into their academic integrity policies [20].

This integration necessitates a multifaceted approach to education, which includes adopting best practices, developing policies, raising individual awareness, and conducting ongoing research. By taking this comprehensive approach, educators aim to enhance the overall educational experience and better equip students for success in a technology-driven world. Achieving this goal involves implementing various learning pedagogies to maximize student engagement and attainment in the learning process.

The research found that those who use chatbots tend to have higher emotional intelligence. However, it also revealed that males, on average, have higher levels of emotional intelligence and self-control compared to females. Based on these findings, it is crucial to employ AI in teaching methods thoughtfully to enhance students' emotional intelligence while ensuring equitable access and avoiding the exacerbation of existing inequalities. Furthermore, it suggests tailoring technology adoption strategies to cultural context, while emphasizing benefits, user-friendliness, and social support. It also emphasizes the need to consider emotional dimensions in technology and integrating emotional-related modules into curricula.

This study holds significant implications for understanding the relationship between AI, EI, and academic achievement within the context of UAE culture and HCT. The findings can inform policy decisions, curriculum design, and pedagogical approaches to enhance the learning experience for students while fostering their emotional well-being.

The ethical approval statement

- The study was approved by the Institutional Review Board (IRB) at the Higher Colleges of Technology (HCT) on 5 October 2023. ref: 5-234SM
- The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments.
- Informed consent was obtained from all individual participants included in the study.

CRediT authorship contribution statement

Sultan M. Mosleh: Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Fton Ali Alsaadi:** Writing – original draft, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Fatima Khamis Alnaqbi:** Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Meirah Abdullrahman Alkhzaimi:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Shamma Waleed Alnaqbi:** Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Waad Mohammed Alsereidi:** Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at doi:mmcdoino

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