



RESEARCH PAPER

Examining the Impact of AI based Chatbots on Academic Self-Efficacy and Self-Regulation among University Students

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ABSTRACT

The present study aimed to investigate the impact of Artificial Intelligence (AI) Chatbots on academic self-efficacy and self-regulation among university students. To test the moderating effect of self-regulation on the association between AI Chatbots and academic self-efficacy. In addition, the research aligns with highlighted social debates surrounding ethical quandaries surrounding AI adoption in education. Using purposive sampling technique data was collected from universities students ($N = 350$) based in Rawalpindi and Islamabad. Along with demographic information, data was collected on the measures of the Human-Computer Trust Scale, Academic Self-Efficacy Scale, and Short-Form Self-Regulation Questionnaire to assess study variables. Results showed that AI Chatbots and Self-Regulation positively predict academic self-efficacy. AI Chatbots help in growing educational technologies and provide the education sector and policymakers for enhancing the level of education by adding tools for performance.

KEYWORDS Artificial Intelligence, Chatbots, Academic Self-Efficacy, Self-Regulation

Introduction

Artificial intelligence (AI) technologies have advanced rapidly in recent years, and this has had a significant impact on all aspects of society, including science, education, politics, the business, and science and technology (Mhlanga, 2021). AI technologies, which are becoming increasingly prevalent in education, have the potential to improve teachers' teaching methods as well as students' learning outcomes and experiences (Yetisensoy & Karaduman, 2024). Further, teachers at all education levels extensively utilize these tools (Haleem et al., 2022). Estimates suggest that the impact of AI on education will be increased in the near future (Kuleto et al., 2021; Willcocks, 2020). According to Munde (2023), the monetary value of AI in the education market is predicted to increase at a rate of 38% each year between 2023 and 2030, from US\$ 3.45 billion to US\$ 23.82 billion. This expansion is anticipated to drastically alter current educational practices and bring about new dynamics for all stakeholders involved in education (Pettersson, 2021).

With Chatbots powered by AI, the educational technology industry has opened a new frontier in which learning experiences can be scaled up to support student success (Hanna & Liu, 2023). AI Chatbots employ natural language processing and machine learning algorithms to engage in interactive conversations with learners (Lee et al., 2022). These Chatbots can provide learners with on-demand assistance, answer academic questions, self-paced learning tools or relevant resources. AI Chatbots can be especially powerful when it comes down to the promotion of active engagement and development of a culture of continuous learning (Abbas et al., 2022).

While these advancements continue, empirical studies began to explore the aversive effects of this overindulgence of artificial intelligence in human lives as well into the field of

education (Ahmad et al., 2021; George et al., 2023; Luan et al., 2020). AI in education could lead to a one-size-fits-all strategy where customized learning becomes automated and loses the depth of knowledge that comes from face-to-face instruction. This may result in students' educational experiences becoming less enriching and more transactional (Aldosemani & Al Khateeb, 2022; Zamiri & Esmaeili, 2024). Moreover, while offering personalized help and feedback, artificial intelligence (AI) has the ability to increase students' academic-confidence in their capacity to learn, it can also restrict their abilities by making them overly dependent on the technology (Rodway & Schepman, 2023).

The reliance on AI Chatbots in the educational context has arisen as a significant source of concern among university students (Gill et al., 2024). The extensive use of AI Chatbots to provide academic support and information raises concerns regarding their impact on student's academic self-efficacy (Ait Baha et al., 2023). It is critical to examine academic self-efficacy, defined as students' confidence in their ability to attain academic goals, is closely related to overall educational performance (Bouih et al., 2021). Furthermore, self-regulation, or students' ability to govern their own learning processes (Russell et al., 2022), can have a substantial impact on how AI Chatbots affect academic self-efficacy. Understanding the intricate interplay between these variables is critical for informing pedagogical methods and optimizing student learning outcomes as AI chatbots become more integrated into education. The current research will provide an insight into the effects of AI Chatbots on students' academic-efficacy and how self-regulation can help students maintain their self-efficacy while still using AI to enrich their learning.

Literature Review

This section presents extensive literature review of previous studies that have investigated the association between AI Chatbots, academic self-efficacy and self-regulation. In an important investigation, Parsakia (2023) attempted to examine the multifaceted impact of AI Chatbots in academic sector. They conducted an extensive review to explore how the incorporation of AI Chatbots influence the psychological aspects and cognitive skills among students. Findings revealed that AI Chatbots enhance self-efficacy and academic engagement among students through frequent and satisfying interactions. Similarly, Pedro et al. (2019) insisted that AI technologies provide personalized learning pathways that considers individualized needs, learning preferences, learning styles, and learning activity objectives through adaptive learning materials and content, etc. Besides, the personalization greatly improves students' motivation and strategic implications e.g. engagement, self-efficacy, regression or progress monitoring. Furthermore, the personalized approach to learning through AI technologies can enhance both learning experience and personal academic efficacy.

A study by Lee et al. (2022) investigated the association between AI usage and academic self-efficacy of children. The study aimed to understand the impact the usage of AI Chatbot holds on academic self-efficacy of students. A quasi-experiment was held across university students of Taiwan. The sample collected was 38 students divided into a control group ($N = 20$) and an experimental group ($N = 18$). The study results obtained that usage of AI Chatbots was positively associated with academic efficacy with students having better results, higher assignment content and better performance. The students further exhibited higher motivation, learning attitude and self-efficacy.

Another study conducted by Essel et al. (2022) attempted to investigate the effects of AI Chatbots that automatically respond to the questions of students in Ghana. Using a pre-test-post-test approach, participants including undergraduate students ($N = 68$) were randomly assigned to scenarios representing a 2×2 design. Findings revealed that students who interacted with AI Chatbots had higher academic self-efficacy and academic performance compared to the students engaging with the course instructor. Findings imply that assistance provided by AI Chatbots potentially enhance self-efficacy and learning

engagement among students. Contrasting to these findings, Lee and Hwang (2022) provided that over-reliance on artificial intelligence can have aversive impacts on students learning and their motivation. The study aimed to investigate the effects of AI Chatbots in the field of education. A systematic review was conducted utilizing 58 research studies. Findings indicated aversive effects of usage of Chatbots on student's mental health and their academic efficacy.

Chen and colleagues (2020) argued that AI-empowered educational tools make collaboration learning possible. Students can work together on projects, share resource with other students, peer's feedback and support. By enabling collaboration and communication skills, AI technologies enhance students' experience of academic efficacy, as they collaborate and interact with others to solving problem, discuss about their learning process and thinking. Through working with peers toward a common goal, students develop the ability to successfully navigate working with others when they get into future academic and professional.

Material and Methods

The sample included university students enrolled in public and private sector universities based in Rawalpindi, and Islamabad ($N = 350$). Purposive sampling technique was used for the purpose of data collection. The sample included both male ($n = 183$) and female students ($n = 167$), and the age range was 18-44 years ($M = 25.67$ years; $SD = 5.62$). Only the students who admitted that they use AI chatbots for academic purpose were included in the study.

Data Analysis

The data was analysed quantitative with the help of SPSS Software. The IBM SPSS software platform offers advanced statistical analysis, a vast library of machine learning algorithms, text analysis, open-source extensibility, integration with big data and seamless deployment into applications. In the first. Data collected was entered on the Data file. Second step, statistical analysis was applied and table were generated. The analysis includes was Cronbach's Alpha Reliability, correlation, Multiple linear regression, T-Test, Moderation. Hence significance of results was established.

Results and Discussion

A comprehensive demographic sheet was formulated to collect data on gender, age, family income, program and discipline of the study. In addition, some other variables that were particularly relevant to AI Chatbots were identified on the base of literature and included in the demographic sheet of the present study.

Table 1
Demographic Characteristics of the Sample (N = 350)

<i>Demographics</i>	<i>f (%)</i>	<i>Demographics</i>	<i>f (%)</i>
Gender		Do AI chatbots provide reliable answers?	
Male	183 (52.29)	Yes	283 (80.9)
Female	167 (47.71)	No	67 (19.1)
Program Enrolled in		Have your study habits changed after you started using AI chatbots?	
Bachelors	203 (58)	Yes	249 (71.1)
MS/MPhil	136 (38.9)	No	98 (28.0)

PhD	11 (3.1)	Missing System	3 (.9)
Discipline	Mean (SD)		
Natural Sciences	183 (52.3)	Age	25.67 (5.62)
Social Sciences	117 (33.4)	Monthly Family Income	123.67 (109.18)
Arts and Humanities	50 (14.3)	Grade Point Average	3.37 (.66)

Table 1 shows a comprehensive demographic description of the study sample. Results show that the percentage of female participants is the highest. Most of the participants are enrolled in MS/MPhil program and natural sciences discipline. Moreover, a vast majority of participants believed that their study habits have changed after they started using AI chatbots, and that these chatbots provide reliable answers.

The average age of the participants was 25.67 years. Additionally, the average grade point of the participants was 3.37. Finally, the average monthly family income (measured in thousands) was 123.67.

The current study aimed to examine the impact of AI Chatbots on academic self-efficacy and self-regulation of university students. The chapter will concentrate on the findings related to the respective hypotheses, as informed by the literature review and research questions. Detailed results are outlined in the subsequent section.

Table 2
Cronbach's Alpha and Descriptive Statistics of the Study Variables (N = 350)

Variables	k	α	M	SD	Range		Skew	Kurt
					Actual	Potential		
Trust in AI-Based Chatbots	12	.78	40.62	6.19	12-53	12-60	-.73	2.03
Academic Self-Efficacy	20	.88	73.26	10.23	20-93	20-100	-1.71	2.19
Self-Regulation	31	.76	105.90	10.08	78-129	31-155	.21	-.43

Table 2 shows detailed descriptive characteristics of the study variables including the mean, standard deviation, and normality scores. Results illustrate that all the scales demonstrate satisfactory reliability. According to Field (2009), the normal distribution of data is affirmed by the values of skewness and kurtosis that fall within the range of -2.69 to +2.69. Thus, the values of skewness and kurtosis show that the data is normally distributed.

Table 3
Correlation Among Study Variables (N = 350)

Variables	1	2	3	4	5	6
1 Age	-	-.05	-.20**	.12*	-.04	-.01
2 Family Income		-	-.02	-.06	-.10	-.08
3 Grade Point Average			-	.02	-.20	-.08
4 Trust in AI-Based Chatbots				-	.25**	.46**
5 Academic Self-Efficacy					-	.37**
6 Self-Regulation						-

* $p < .05$. ** $p < .01$.

Table 3 presents the coefficients of correlation among study variables. Results indicate that age is significantly negatively associated with grade point average but significantly positively associated with trust in AI Chatbots. Trust in AI-based Chatbots is found to be significantly positively associated with academic self-efficacy and self-regulation. Findings further illustrate that academic self-efficacy is significantly positively associated with self-regulation.

Table 4

Multiple Linear Regression Analysis Testing Predictors of Academic Self-Efficacy among University Students (N = 350)

Variables	Academic Self-Efficacy			
	B	SE	95 % CI	
			LL	UL
Constant	78.20**	4.32	69.88	86.53
Trust in AI-Based Chatbots	.23**	.05	.18	.29
Self-Regulation	.13**	.03	.06	.18
R^2	.36			
F	19.87**			

* $p < .05$. ** $p < .01$

Table 4 shows results of regression analysis testing the variance explained by predictor variables in academic self-efficacy. Results show that trust in AI chatbots and self-regulation significantly positively predict academic self-efficacy. The explained variance shows that together the predictor variables explain 36% variance in academic self-efficacy.

Table 5
Moderating Effect of Self-Regulation on the Association between Trust in AI-Based Chatbots and Academic Self-Efficacy among University Students (N = 350)

Predictors	Academic Self-Efficacy		
	B	95% CI	
		LL	UL
Constant	73.05**	71.78	74.32
Trust in AI-Based Chatbots	.15*	.01	.29
Self-Regulation	.20*	.04	.36
Trust in AI-Based Chatbots * Self-regulation	.02*	.01	.04
R^2	.04		
F	4.81**		

* $p < .05$. ** $p < .01$

The moderating effect of self-regulation on the relationship between trust in AI Chatbots and academic self-efficacy is presented in Table 5. Results show a significant interaction effect (B interaction = .02, $p < .05$) of trust in AI Chatbots and self-regulation explaining 4% variance in academic self-efficacy. The strength of association between trust in AI Chatbots and academic self-efficacy is strengthened by self-regulation. The moderating effect at different levels of self-regulation (i.e., low, medium, and high) is further elaborated through mod graph in Figure 2. Figure illustrates that the strength of positive association between trust in AI Chatbots and academic self-efficacy increases with the increase in levels of self-regulation.

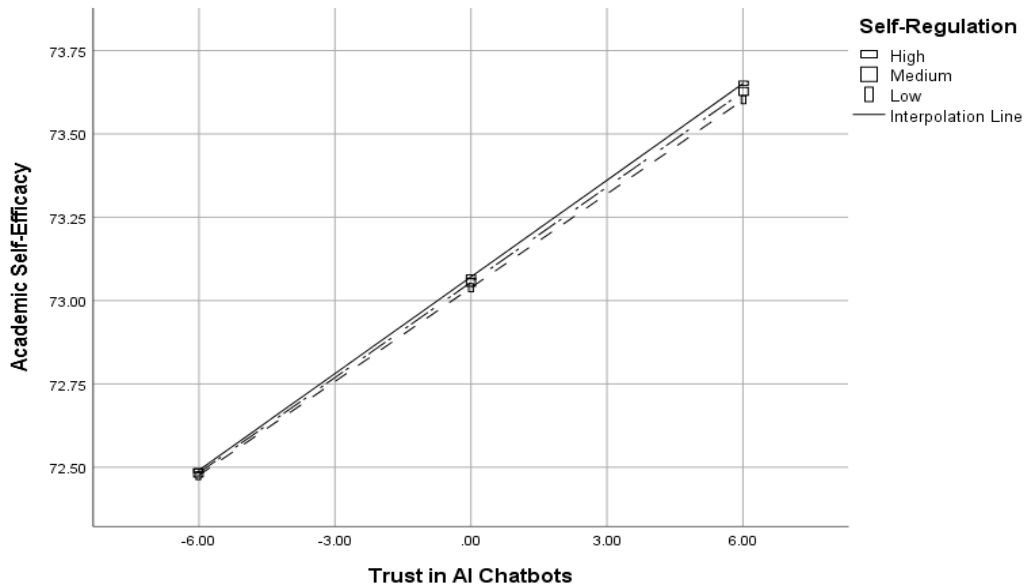


Figure 2. Moderating Effect of Self-Regulation on the Association Between Trust in AI-Based Chatbots and Academic Self-Efficacy

Table 6
Mean Differences across Gender along Study Variables (N = 350)

Variables	Males (n = 183)		Females (n = 167)		t	p	95% CI		Cohen's d
	M	SD	M	SD			LL	UL	
TAIC	73.69	5.66	70.21	6.72	2.18	.02	-.53	2.11	.56
ASE	76.00	11.16	70.54	9.14	2.49	.04	1.61	2.70	.54
SR	107.61	9.47	104.17	10.43	2.99	.00	1.17	5.69	.35

Note. TAIC = Trust in AI-Based Chatbots; ASE = Academic Self-Efficacy; SR = Self-Regulation.

Table 6 presents gender differences across study variables. Results indicate that academic self-efficacy and self-regulation are significantly higher among male students. On the other hand, gender does not play a significant role in trust in AI Chatbots.

Discussion

In today’s technology driven world, the usage of artificial intelligence measures is integrated in nearly all aspects of life including education sector. With all its positive and negative sides, the usage of AI Chatbots is rising exponentially particularly among university students (Ahmad, 2021). Therefore, the present study aimed to investigate the impact of AI Chatbots on self-regulation and academic self-efficacy of university students. In addition, the role of demographic variables (e.g., gender) was also tested in relationship to the study variables.

The current study used a correlational and cross-sectional research approach. Using purposive sampling technique, data was collected from university students (N = 350, Age range = 18-44; M = 25.67 years; SD = 5.62). Only the students who admitted to using AI for academic purposes were included in the study. Data was collected on the Academic Self-Efficacy Scale (Sachitra & Bandra, 2017), Short Form Self-Regulation Questionnaire (Carey et al., 2004), and Human-Computer Trust Scale (Gulati et al., 2019). All the participants were briefed about the purpose of research and their right to quit anytime. Additionally, all ethical obligations were strictly observed. The collected data was later analysed using SPSS.

Initially, the psychometric properties of all the scales were examined using descriptive statistics. Internal consistencies were established using Cronbach's alpha coefficient values for all the study variables (see Table 2). According to the generally acknowledged standards, a Cronbach's alpha coefficient of .60-.70 represents an acceptable degree of reliability, while 0.80 or higher suggests a very good level (Hulin et al., 2001). Therefore, all the scales used in the study demonstrate acceptable reliability ranging from .76-.88. All measures of descriptive statistics including mean, standard deviation, skewness and kurtosis were also computed. According to the values of skewness and kurtosis, the data was normally distributed. Since parametric tests required that the data follow a normal distribution, they were used for additional analysis (Altman & Bland, 2009).

Conclusion

The present study attempted to examine the influence of AI on the academic self-efficacy of university students. Moreover, the moderating effect of self-regulation was also tested. Findings revealed that trust in AI-based Chatbots increases academic self-efficacy and self-regulation. The positive impact of AI-based Chatbots on academic self-efficacy increases with increase in self-regulation. Finally, gender was also found to play a significant role in study variables.

Recommendations

The practical and theoretical implications of the study are discussed below.

- The present study will serve to enhance the understanding of relationship among study variables and contribute to the existing body of knowledge.
- Results could assist institutions and educators understand the possible advantages of incorporating AI-based Chatbots into classroom settings. The development of techniques to improve the educational experiences of students may be guided by an understanding of the ways in which AI Chatbots affect self-efficacy and self-regulation.
- Findings of the study may be used by university students to enhance student support services. AI Chatbots could be used as an additional academic support tool to give students individualized help, which could enhance their entire experience and academic performance.

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