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The role of personality traits in predicting educational use of generative AI in higher education

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Generative Artificial Intelligence (Gen-AI) systems offer significant opportunities for personalized learning in higher education. Studying the effects of personality traits on the use of Gen-AI is crucial for understanding the role of individual differences in integrating this innovative technology into education. Therefore, this study investigated how the Big Five personality traits, age, and gender predict the educational use of Gen-AI in higher education. In this study, data were obtained from 1016 university students through an online survey. The data obtained using the Five Factor Personality and educational use scales were analyzed using linear regression. Artificial neural networks (ANNs) were employed to investigate more complex and non-linear relationships. Additionally, multiple linear regression and multigroup analysis were employed to investigate age and gender differences. Significant and positive relationships were found between openness to experience, conscientiousness, extraversion, and the educational use of Gen-AI. However, neuroticism showed a negative association, while agreeableness did not demonstrate a significant association. The ANN model showed that openness was the strongest predictor. The results indicated that the effect of certain personality traits on Gen-AI use differed significantly between men and women. These findings significantly advance our understanding of the relationship between personality traits and the use of Gen-AI in higher education.

Keywords Artificial intelligence, Big five, Generative AI, Personality traits

Gen-AI systems are designed to engage in interactive chats with users[1]. Gen-AI employs "natural language processing" (NLP) and machine learning to interpret user prompts, generate new and unique content, and simulate human-like conversational experiences[2]. Gen-AI systems can transform higher education environments by facilitating knowledge discovery and enabling a paradigm shift in teaching and learning applications[3]. For instance, students can interact with these systems, delving deeper into complex subjects. They can also utilize these systems to discover resources, foundational research papers, and literature suggestions related to a specific field[4].

AI development progresses through five stages, with chatbots classified at the initial level as basic conversational AI[2]. These stages represent the evolution of AI technologies, starting with basic conversational AI and progressing to more advanced capabilities, including creativity, problem-solving, and automation. While chatbots are a subset of Gen-AI, they extend beyond them, encompassing levels 2–5 with advanced capabilities such as creativity, problem-solving, and automation[5]. Although modern chatbots rely on Gen-AI, the technology also powers AI agents, innovators, and autonomous systems, making it far more than just chat-based interactions.

GAI systems can support students by providing academic assistance[6]. For example, Gen-AI systems can create personalized learning resources tailored to students' learning styles, generate interactive questions that provide instant feedback, and guide students based on their answers[7]. They assist with tasks such as editing, summarizing, providing explanations, checking language and grammar, and translating text for assignments and projects[8]. Consequently, they alleviate students' workloads by offering a smoother learning experience through accurate and timely assistance[9]. Facilitating the easy organization of assignments and providing instant access to a vast pool of information spanning various fields, Gen-AI technologies enable researchers to produce summaries and explanations from different perspectives, allowing students to explore complex topics[10].

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These benefits underscore the potential of Gen-AI to foster collaboration, refine research methodologies, and expand the scope of knowledge across diverse academic disciplines. Additionally, Gen-AI technologies have the potential to serve as research aids, generating text, narratives, diverse perspectives, and innovative concepts for students, thereby enhancing their understanding of research topics and methodologies.

Another advantage of Gen-AI technologies is their support for lifelong and personalized student learning[11]. These systems can adapt to students' preferences and learning styles[12]. Students can receive personalized recommendations, customized study materials, and adaptable learning experiences, making them feel valued and catered to. This adaptability can significantly improve the learning experience and foster a sense of individualized attention[13]. Through interactive and immediate learning experiences that promote active student participation and improve problem-solving skills[14]. Students can experience lifelong and personalized learning[15]. Moreover, by promoting inclusivity and accessibility, Gen-AI technologies expand educational opportunities for different learners, ensuring equal access to academic and research resources. This expansion of educational opportunities can make the audience feel that Gen-AI is contributing to a more inclusive and accessible educational landscape[16].

Several factors can significantly influence user behavior, including economic considerations such as cost and resource availability, psychological elements like user preferences and cognitive load, and social dimensions like cultural norms and peer influence[17]. These interconnected factors shape how individuals interact with products and services, ultimately influencing their decision-making and engagement[18]. Specifically, personality traits have been identified as a crucial determinant affecting human behavior in digital services[19,20]. Based on the literature, a noticeable gap exists regarding research dedicated to exploring the role of personality traits in predicting students' use of Gen-AI for educational purposes.

Unlike traditional educational technologies, Gen-AI can generate content and support creativity; therefore, individuals' personality traits, particularly openness to innovation and conscientiousness, may play a decisive role in the use of Gen-AI. Therefore, it is crucial to understand the key role that personality traits play in integrating this innovative technology into education. Learning methods tailored to individual personality traits can increase student motivation and academic achievement[21]. In this regard, designing Gen-AI systems that take personality factors into account can lead to more effective educational outcomes. This study aims to explore the role of the "Big Five Personality Traits," also known as the "Five Factor Model" (FFM), in predicting students' use of Gen-AI for educational purposes.

Theoretical background and hypotheses

The literature review on the educational use of Gen-AI presents a comprehensive understanding of its impact across various academic levels and contexts. For instance, a recent study explored undergraduate students' perceptions of Gen-AI, exemplified by ChatGPT, within higher education settings[22]. Their research, which recruited 399 postgraduate and undergraduate students in Hong Kong, reveals favorable attitudes toward incorporating Gen-AI into educational practices. While recognizing its great potential for personalized assistance, research capabilities, and writing support, concerns regarding accuracy, privacy, and ethical considerations were also voiced[2]. A study revealed that students utilize Gen-AI for tailored academic support, recommendations, and direction[23]. Leveraging advanced data models, these chatbots can evaluate assignments, rectify errors, and furnish feedback that is finely tuned to address individual mistakes. Moreover, they can scrutinize students' historical academic performances, writing patterns, and preferences from prior courses.

A recent study extended the discourse to the influence of Gen-AI technologies on academic research in the higher education landscape of Saudi Arabia[24]. An online survey involving 505 participants showed overwhelmingly positive attitudes toward Gen-AI in research, highlighting its potential to revolutionize academic research processes and enhance efficiency. Another study shifts the focus to primary school education, demonstrating the applicability of Gen-AI, particularly ChatGPT, in tailoring learning materials to suit the diverse knowledge levels of pupils aged 8–14[25]. The study, encompassing 110 pupils across different grades, illustrates a favorable reception among students toward AI-modified learning materials.

A recent study adopted a proactive stance toward embracing Gen-AI in education, particularly management education[26]. The study highlighted the transformative potential of Gen-AI technologies in reshaping educational paradigms, providing valuable insights for educational reform. A systematic review focusing on technological affordances and challenges associated with Gen-AI elucidated key affordances such as automation, accessibility, interactivity, and personalization, alongside challenges including integrity, bias, overdependence, the digital divide, and security risks[27]. The studies highlight the multifaceted implications of integrating Gen-AI into educational frameworks, underscoring its transformative potential and the need to address associated challenges for effective implementation.

Based on the comprehensive literature review conducted, it becomes evident that substantial research exists examining various aspects of Gen-AI implementation in educational settings. However, a notable gap remains regarding the influence of personality traits on students' use of such technologies for educational purposes. Specifically, the existing literature lacks dedicated research on how personality traits may influence students' adoption of Gen-AI for educational purposes. Thus, this study aims to address this gap by investigating the significance of these personality traits in predicting students' use of Gen-AI within academic contexts. This study aimed to provide insights into enhancing the effectiveness and acceptance of AI in education by examining the relationship between "Big Five personality traits" and the adoption of technology.

Personality refers to "the more or less stable and enduring organization of a person's character, temperament, intellect, and physique, which determines his unique adjustment to the environment"[28] (p. 2). An individual's generally stable attitude towards various events is often defined as their personality, encompassing relationships, experiences, and motivations[29]. The "Big Five personality" traits, specifically identified as "agreeableness, conscientiousness, openness to experience, extraversion, and neuroticism," represent a widely acknowledged framework for defining the fundamental structure of personality[30]. Each type has its own set of distinctive

behaviors. For instance, open individuals tend to be curious and embrace diversity, while conscientious individuals pay attention to details and are dependable. Meanwhile, agreeable individuals are cooperative, extroverts are highly social, and neurotic individuals are characterized by high levels of anxiety and shyness[31].

Personality is a fundamental psychological mechanism guiding an individual's emotional, cognitive, and behavioral responses[21]. These inherent qualities, known as personality traits, differentiate individuals and play a pivotal role in shaping their behaviors[32]. They encompass thought patterns, emotions, and decision-making tendencies, providing insights into the distinctiveness of an individual's behavioral intentions[33]. Consequently, personality traits are valuable indicators that can forecast individual behavior.

Recent attention has been directed toward investigating correlations between individual personality traits and attitudes toward using AI-based technologies[34,35]. Nevertheless, existing studies have not explicitly explored how personality traits may impact students' use of Gen-AI in educational settings. This study thus posits that the "Big Five personality" traits could significantly influence the educational use of AI among students in higher education. Figure 1 illustrates the theoretical framework and associated hypotheses.

Extraversion

When discussing extraversion, it is crucial to employ adjectives such as assertive, talkative, energetic, and spontaneous[36]. Individuals displaying strong extraversion are more likely to ascend to leadership roles due to their active social engagement and propensity to express themselves assertively[37]. Past studies indicated a significant relationship between technology usage and extraversion[38]. Furthermore, extroverts are notably

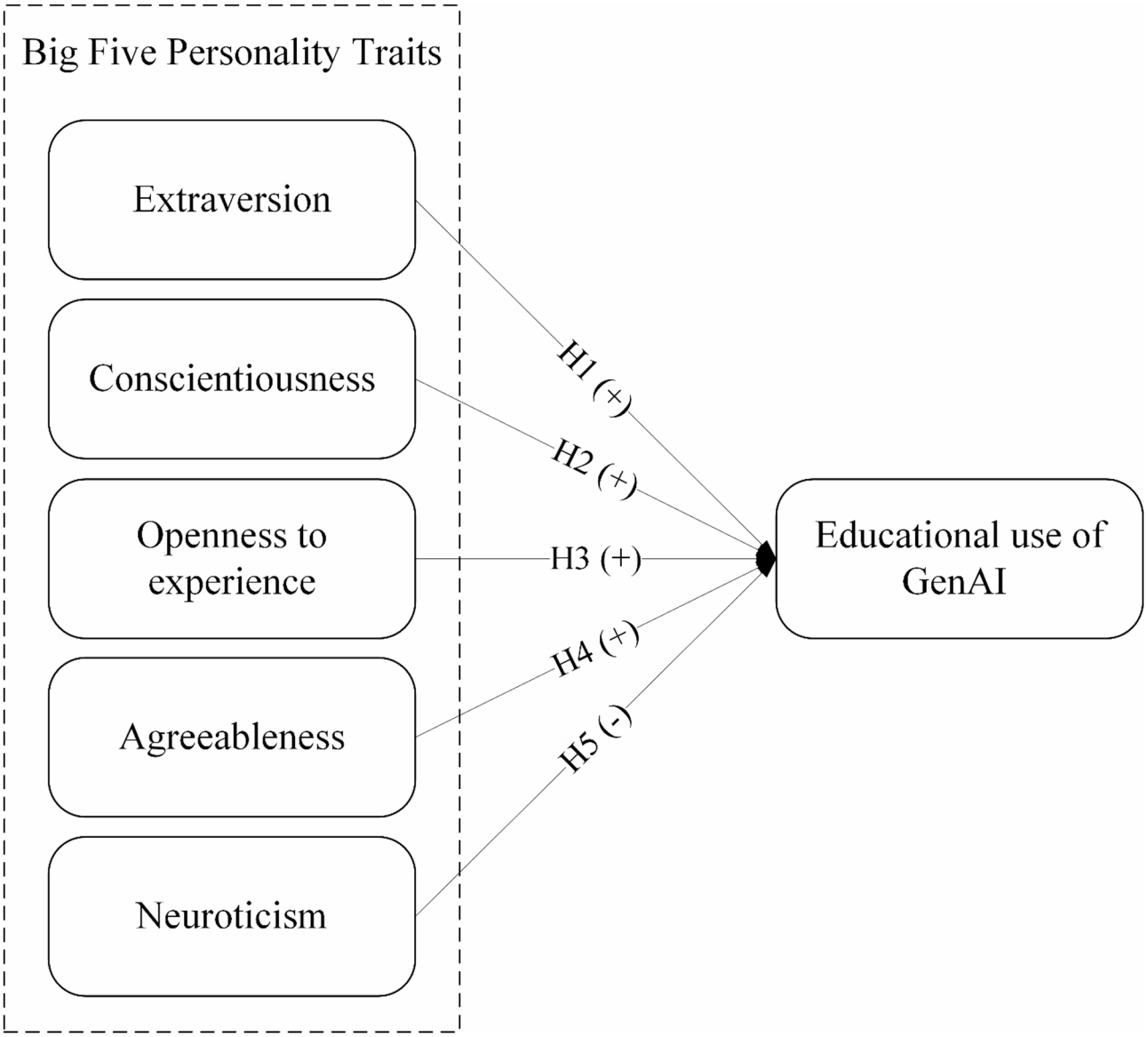


Fig. 1. Theoretical framework.

engaged in smartphone ownership and its excessive use[39]. Their increased sociability leads individuals to score higher on the extraversion trait and utilize social media apps more frequently[40].

Moreover, studies revealed that extroverted individuals are more inclined to experiment with emerging technologies and exhibit creative thinking. This finding has significant implications for the field of educational technology, as it suggests that extroverted students may be more open to using innovative tools like Gen-AI in their learning process[41]. Similarly, they display elevated levels of innovation and proactivity in utilizing new technology[19]. Consequently, students with greater extroversion are more inclined to view Gen-AI as an opportunity to enhance their creative learning performance. Drawing from the above insights, we hypothesize the following:

H1. Students with higher extraversion are more likely to use Gen-AI for educational purposes.

Conscientiousness

Individuals who exhibit conscientiousness display traits such as being hardworking, self-regulated, diligent, careful, responsible, achievement-oriented, and possessing self-control[42]. This correlates with a keen drive for learning, as conscientious people tend to establish clear objectives and engage in actions that foster their achievement[43]. Furthermore, it exhibits a positive correlation with a learning goal orientation, indicating that individuals prioritize acquiring new knowledge and skills[42]. Individuals with conscientious traits tend to thoroughly assess whether technology can enhance their workplace performance and subsequently act upon this evaluation. This implies that conscientiousness may play a crucial role in promoting the use of Gen-AI for educational purposes, offering a reassuring perspective on its potential.

H2. Students with higher conscientiousness are more likely to use Gen-AI for educational purposes.

Openness to experience

Openness to experience encompasses characteristics such as originality, curiosity, artistic sensitivity, and inquisitiveness[29]. Like conscientiousness, openness to experience is also related to a strong drive to learn[43] and a focus on learning goals[44]. This correlation might stem from individuals with high openness displaying a sincere and innate desire for learning. Previous research indicates that individuals scoring higher in openness tend to use social networks more frequently[40]. Substantiating this, a literature review on understanding how personality influences technology acceptance suggests that openness has a positive influence on behavioral intentions to use new technologies[45]. Students with a high level of openness are expected to show a strong inclination toward using Gen-AI. This suggests a promising avenue for educational technology, as openness could be a key factor in its successful implementation.

H3. Students with higher openness to experience are more likely to use Gen-AI for educational purposes.

Agreeableness

Agreeableness is defined by qualities such as kindness, helpfulness, cooperativeness, good-naturedness, trust, tolerance, and compassion[46]. Prior studies have indicated that agreeableness has a significantly positive impact on technology acceptance and usage[37]. Additionally, previous research has shown that agreeableness significantly predicts the acceptance of emerging technology[47]. Students exhibiting greater agreeableness are more likely to utilize Gen-AI, as this technology promotes cooperation, collaboration, and task completion. Therefore,

H4. Students with higher agreeableness are more likely to use Gen-AI for educational purposes.

Neuroticism

Neuroticism is a personality trait marked by emotions such as irritability, depression, anxiety, emotional instability, self-consciousness, and frustration[32]. Individuals with greater neuroticism often experience higher rates of depression, anxiety, and concern[48]. Individuals with neurotic tendencies tend to perceive new technology as stressful, resulting in a negative evaluation[49]. Research by[38] indicated that neuroticism is significantly but negatively correlated with the use of technology. Moreover[50], revealed a significant but negative association between neuroticism and personal innovativeness in technology. Supporting these findings, a recent study showed that individuals exhibiting neurotic personalities tend to view technological progress in their work environment as stressful and threatening, often displaying predominantly negative thought patterns when considering it[37]. Therefore, students with a high level of neuroticism are less likely to adopt Gen-AI for educational purposes, as they tend to perceive technological advancements as stressful and often maintain negative attitudes toward technology.

H5. Students with higher neuroticism are less likely to use Gen-AI for educational purposes.

Methodology

Study design

This study followed a "cross-sectional research design" by using a "convenience sampling" approach. Data were collected through an online survey conducted via Google Forms between September and October 2024. Prior to participation, students were informed about the objectives of the study and assured that their data would be used solely for research purposes and kept confidential and anonymous. Participation was entirely voluntary, and informed consents were obtained from all participants prior to participation. Additionally, participants were reminded that they had the right to withdraw from the study at any time. Secure digital storage methods were used to ensure data confidentiality, and identifiable information was removed. The research protocol was approved by the Institutional Review Board (IRB No. 2023-7).

Participants

The study sample consisted of 1,800 university students from Türkiye enrolled in various departments, including Engineering, Education, Computer Science, Social Sciences, and Medicine. The inclusion criteria required participants to have prior experience using at least one Gen-AI tool for educational purposes. 784 participants were therefore excluded from the primary analysis because they reported not using any Gen-AI tool. The remaining 1,016 participants (56.4%) reported having prior experience with Gen-AI tools, such as ChatGPT, Bing AI, Jasper, or ChatSonic, and had used them for educational purposes. The majority of participants were undergraduate students ($n = 980$, 96.5%), followed by master's students ($n = 30$, 3%) and doctoral students ($n = 6$, 0.6%). Their ages ranged between 17 and 28 years (M = 20.82, SD = 1.92).

The adequacy of the sample size was assessed by considering the number of parameters estimated in the framework[51]. Following common guidance requiring a sample size of at least 10 participants per estimated parameter, the final sample of 1,016 participants exceeded the minimum threshold and provided sufficient statistical power[52].

Instruments

"Big five inventory scale" (BFI)

The 44-item BFI was initially developed in 1998[53]. It was subsequently adapted for use in Turkish culture[54]. Participants rate it on a "five-point Likert" scale, with higher scores demonstrating a higher level of the specific personality trait. It is reported that the internal reliability of the dimensions ranged between 0.64 and 0.77, indicating acceptable to good reliability[54]. The BFI is specifically designed to evaluate five core personality traits. "Agreeableness" comprises nine questions. An example question is, "I see myself as someone who tends to find fault with others." "Conscientiousness" contains nine questions; for example, "I see myself as someone who does a thorough job." "Neuroticism" comprises eight questions; an example is "I see myself as someone who worries a lot." "Extraversion" comprises eight questions; for example, the question "I see myself as someone talkative." "Openness" comprises ten questions, including "I see myself as someone original who comes up with new ideas and prefers work that is routine."

Educational use of Gen-AI

Five items, adapted from a recent study, were designed to assess educational use[55]. Sample items include: "I use Gen-AI for educational purposes," "I often utilize Gen-AI to learn new concepts," and "I frequently employ Gen-AI in my academic endeavors." These items have been confirmed for reliability and validity in a previous study examining the intention to use cloud services for academic purposes[55]. The study reported Cronbach's α of 0.91 for this dimension. Responses were measured using "five-point Likert" scales ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). The scores obtained were treated as continuous variables and used to evaluate the study hypotheses. Higher scores indicate greater use of AI for educational purposes.

Data analysis

The research employed a multi-technique approach, utilizing SPSS and SPSS AMOS 25 to combine standard regression analysis and "Artificial Neural Networks" (ANN). The integration of classical regression analysis with ANN aimed to capture both linear and non-linear data relationships. While regression analysis proficiently addresses linear associations between endogenous and exogenous variables in a structured model[2]. In contrast, the ANN model accurately represents relationships where variables have non-linear connections[56]. Furthermore, the sensitivity analysis enabled us to determine the contributions of each predictor to the educational use of Gen-AI. A multigroup analysis using "Covariance-based Structural Equation Modeling" (CB-SEM) is conducted to assess the role of gender in the relationships between Big Five personality traits and educational use. Finally, multiple linear regression was performed to predict the educational use of Gen-AI based on the personality traits and age.

Common method bias

Given this research's heavy reliance on self-reported data, the potential for encountering social desirability and "common-method bias" (CMB) has been thoroughly investigated. Consequently, we conducted an analysis employing "Harman's one-factor test" on the constructs within our theoretical model, following the guidance recommended by[57]. The results revealed that the initial factor explained only 15.105% of the total variance. This outcome instills a degree of confidence that CMB did not impact our study, thus mitigating potential risks associated with bias.

Reliability and validity

The normality test results indicated skewness ranging from −0.259 to 0.442 (SE = 0.077) and kurtosis ranging from −0.501 to 1.80 (SE = 0.153), suggesting that the data followed a normal distribution. Measurement reliability was evaluated by calculating Cronbach's alpha coefficient. The outcomes of the reliability tests demonstrated that each construct displayed satisfactory internal reliability.

"Confirmatory Factor Analysis" (CFA) was performed to investigate the measurement model. Various model-fit indices were employed to assess the overall goodness of fit for the model. The results revealed a good fit for the data, with the following values: CMIN/DF = 4.264, GFI = 0.902, CFI = 0.854, SRMR = 0.088, and RMSEA = 0.057. Additionally, to assess discriminant validity, the "Heterotrait-Monotrait Ratio" (HTMT) was employed, following the guidelines outlined by a prior study, which recommends an HTMT below 0.90 as evidence of discriminant validity[58]. The results presented in Table 1 confirm that all variables have discriminant validity.

Pearson correlation analyses were conducted to investigate relationships between educational use (EU) and Big Five personality traits in a sample of 1016 participants. The results revealed that Openness ($r = 0.464$) and

Construct	α	E	A	C	N	O
Extraversion (E)	0.767					
Agreeableness (A)	0.745	0.637				
Conscientiousness (C)	0.728	0.674	0.878			
Neuroticism (N)	0.765	0.541	0.663	0.635		
Openness (O)	0.793	0.759	0.674	0.791	0.268	
Educational Use (EU)	0.826	0.397	0.349	0.384	0.075	0.536

Table 1. HTMT results.

		S.E.	β	t	Sig.	Results
H1	Extraversion → Educational use	0.027	0.117	2.641	0.008	Supported
H2	Conscientiousness → Educational use	0.023	0.267	6.325	< 0.001	Supported
H3	Openness → Educational use	0.019	0.250	5.984	< 0.001	Supported
H4	Agreeableness → Educational use	0.024	0.033	0.779	0.436	Rejected
H5	Neuroticism → Educational use	0.024	− 0.127	-3.218	0.001	Supported

Table 2. Hypothesis testing.

Conscientiousness ($r = 0.451$) exhibited the strongest positive correlations with the EU. Extraversion ($r = 0.423$) and Agreeableness ($r = 0.345$) exhibited moderate positive correlations, while Neuroticism (r = -0.262) showed the weakest negative correlation.

Results

Participant characteristics

The respondents ranged in age between 17 and 28, with an average age of 20.82 and a "standard deviation" (S.D.) of 1.912. "One-way ANOVA" results indicated a statistically significant effect of age group on educational use, $F(2, 989) = 1.65$, $p = 0.022$, partial $\eta^2 = 0.042$, indicating that at least one age group differed from the others. Post hoc comparisons using the Games-Howell test (selected due to unequal group sizes and heterogeneity of variance) showed that 22-year-olds ($M = 11.37$, $SD = 2.99$) reported marginally higher educational use than 20-year-olds ($M = 10.44$, $SD = 2.84$), $MD = 0.93$, 95% CI [0.01, 1.86], $p = 0.057$. No other pairwise differences were statistically significant ($p > 0.05$).

Regarding Gen-AI usage, 72.6% of respondents reported using it for less than two hours per day, 16.7% for 3–4 h, 5.9% for 4–5 h, 2.8% for 5–6 h, and 2% for more than 6 h daily. Regarding gender distribution, 48.6% of the participants were female (494 females and 522 males). An independent samples test revealed no significant gender differences for educational use, $t(1014) = -1.72$, $p = 0.086$, 95% CI [-0.67, 0.04].

Respondents generally perceive Gen-AI positively, with high scores in terms of enriching learning ($M = 3.58$, $SD = 1.11$), providing valuable resources ($M = 3.55$, $SD = 1.10$), and adapting content to educational needs ($M = 3.60$, $SD = 1.10$). Gen-AI is also perceived as helpful for complex tasks ($M = 3.51$, $SD = 1.125$), although it is slightly less effective in stimulating creativity and critical thinking ($M = 3.38$, $SD = 1.161$).

Hypothesis testing

The results of the linear regression analysis, presented in Table 2, indicated that Conscientiousness ($\beta = 0.267$, $p < 0.001$) and Openness ($\beta = 0.250$, $p < 0.001$) are the strongest positive predictors of educational use, suggesting that individuals who are organized, disciplined, and curious are more likely to engage in educational use. Extraversion ($\beta = 0.117$, $p = 0.008$) also has a small but significant positive impact, indicating that more extroverted individuals may be slightly more inclined towards educational use. In contrast, Neuroticism (β = -0.127, $p = 0.001$) is a significant negative predictor, meaning that individuals prone to anxiety and emotional instability are less likely to engage in educational use. Agreeableness ($\beta = 0.033$, $p = 0.436$) does not significantly predict educational use, suggesting that being cooperative and kind does not independently contribute to educational use. Overall, the findings highlight the importance of personality traits ($R^2 = 0.264$), particularly conscientiousness and openness, in shaping educational use.

	Female				Male			
	β	S.E.	C.*R.*	*P*	β	S.E.	C.*R.*	*P*
H1	0.035	0.026	3.317	***	0.116	0.021	2.908	0.004
H2	0.285	0.023	7.035	***	0.273	0.019	6.869	***
H3	0.250	0.018	6.180	***	0.276	0.016	6.922	***
H4	0.134	0.025	0.867	0.386	0.032	0.020	0.809	0.419
H5	−0.174	0.025	-4.303	***	−0.096	0.022	-2.405	0.016

Table 3. Multi-group analysis. $^{***}p < 0.001$.

Network	*N* (Training)	*N* (Testing)	RMSE (Training)	RMSE (Testing)
1	913	103	0.482	0.480
2	899	117	0.484	0.479
3	898	118	0.482	0.486
4	910	106	0.479	0.502
5	909	107	0.486	0.459
6	918	98	0.481	0.496
7	913	103	0.482	0.474
8	910	106	0.481	0.506
9	909	107	0.485	0.464
10	917	99	0.482	0.491
Mean	909.6	106.4	0.482	0.484
SD	6.636	6.636	0.002	0.015

Table 4. RMSE of the ANN models.

Gender differences

Multigroup analysis using CB-SEM is conducted to determine the role of gender in the relationship between the personality traits and educational use. The results, shown in Table 3, reveal notable differences in how Big Five personality traits predict educational use between men and women. For both genders, openness and conscientiousness are the strongest positive predictors of educational use. Still, conscientiousness has a slightly stronger effect for women (β = 0.285) than for men (β = 0.273), while openness has a stronger impact for men (β = 0.276) than for women (β = 0.250). This suggests that being organized and disciplined is slightly more important for academic engagement in females, while curiosity and creativity have a more significant impact on males.

Extraversion is a significant predictor for both genders but has a larger effect for females (β = 0.134) than for males (β = 0.116), implying that extroverted females may engage more in educational use than their male counterparts. Neuroticism has a negative impact on educational use in both males and females. Still, its effect is much stronger in women (β = −0.174) than in men (β = −0.096), suggesting that emotional instability is a greater barrier to educational use for women. Agreeableness was not a significant predictor for either gender ($p > 0.05$), suggesting that being cooperative and kind does not strongly influence educational use. Overall, these findings indicate that conscientiousness and openness are not significant predictors of educational use for either gender.

Age differences

"Multiple linear regression" was performed to predict the educational use of Gen-AI based on the Big Five personality traits and age. The overall model was statistically significant, $F(6, 1009) = 60.69$, $p < 0.001$, indicating that it accounted for a significant amount of variance in Gen-AI use. The model explained approximately 26.5% of the variance ($R^2 = 0.265$), demonstrating a moderate effect. Among the predictors, Conscientiousness ($\beta = 0.267$, $p < 0.001$), Openness ($\beta = 0.250$, $p < 0.001$), Neuroticism ($\beta = -0.128$, $p = 0.001$), and Extraversion ($\beta = 0.119$, $p = 0.008$) were statistically significant. In contrast, Agreeableness ($\beta = 0.031$, $p = 0.458$) and age ($\beta = 0.029$, $p = 0.280$) did not significantly predict the educational use of Gen-AI.

ANN model

"Artificial Neural Network" (ANN) models, employing a multi-layer perceptron classifier, underwent training utilizing a 10-fold cross-validation method. The constructed ANN model incorporated five exogenous factors—namely, "agreeableness," "neuroticism," "conscientiousness," "extraversion," and "openness"—all given as continuous variables, serving as input layers. The performance of the ANN model across ten iterations is presented in Table 4, with the "Root Mean Square Error" (RMSE) used as a measure of accuracy.

		Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism
1	RI	0.244	0.215	0.269	0.192	0.079
	NI	90.8%	80.0%	100.0%	71.4%	29.3%
2	RI	0.310	0.223	0.230	0.209	0.028
	NI	100.0%	71.80%	74.3%	67.4%	9.0%
3	RI	0.331	0.184	0.223	0.138	0.124
	NI	100.0%	55.70%	67.2%	41.7%	37.5%
4	RI	0.338	0.237	0.194	0.121	0.111
	NI	100.0%	70.1%	57%	35.7%	32.7%
5	RI	0.285	0.257	0.181	0.160	0.118
	NI	100.0%	90.4%	64%	56.2%	41.4%
6	RI	0.274	0.213	0.250	0.137	0.127
	NI	100.0%	78.0%	91%	50.0%	46.3%
7	RI	0.310	0.237	0.212	0.148	0.093
	NI	100.0%	76.6%	69%	47.7%	30.1%
8	RI	0.334	0.272	0.191	0.136	0.066
	NI	100.0%	81.4%	57%	40.7%	19.8%
9	RI	0.363	0.257	0.171	0.150	0.059
	NI	100.0%	70.9%	47%	41.4%	16.2%
10	RI	0.365	0.265	0.191	0.146	0.032
	NI	100.0%	72.6%	52%	40.1%	8.7%
Avg. RI		0.315	0.236	0.211	0.154	0.084
Avg. NI		99.1%	74.8%	67.9%	49.2%	27.1%
Ranking		1	2	3	4	5

Table 5. Sensitivity analysis.

Sensitivity analysis of ANN models

The sensitivity analysis aimed to investigate how variations in exogenous factors contribute to variations in the endogenous factor. Specifically, in this study, we evaluated the impact of each predictor on the endogenous factor, defined here as "educational use," through sensitivity analysis. This analysis produced two pivotal metrics: "Relative Importance" (RI) and "Normalized Importance" (NI), expressed as percentages. The results, presented in Table 5, underscored that "openness" stood out as the strongest predictor of "educational use." Following this, in decreasing order of significance, were "conscientiousness," "extraversion," "agreeableness," and "neuroticism." These outcomes offer valuable insights into the relative contributions of each personality trait to predicting actual usage.

Discussion

AI has the exciting potential to revolutionize education by delivering personalized learning to millions of students simultaneously[59]. This breakthrough can significantly enhance equality of opportunity in education and democratize access to high-quality learning. By automating routine tasks, Gen-AI can empower teachers to concentrate more on their mentoring and guiding roles[60], fostering students' social-emotional development and critical thinking skills. Moreover, Gen-AI can support individuals' lifelong learning processes[61]. These potential impacts can reshape the future of education systems and transform the learning experience. However, it is critical to address challenges such as AI-generated misinformation, ethical use of these technologies, and bridging the digital divide to ensure a balanced and equitable educational landscape[62,63].

This study rigorously investigated the role of the "Big Five personality traits" in predicting the educational use of Gen-AI. The findings indicated that openness, extraversion, and conscientiousness had a significant and positive impact on the educational use of Gen-AI. Conversely, neuroticism demonstrated a negative yet statistically significant association with the educational use of Gen-AI, while agreeableness indicated no significant relationship. The findings shed light on the considerable connections between four personality traits and the educational use of Gen-AI, aligning with prior literature that emphasizes the substantial impact of the "Big Five personality traits" on the adoption of emerging technologies[21]. Understanding these influences is crucial for the effective integration of AI in higher education.

Personality traits significantly influence individuals' thoughts, feelings, and behaviors, providing a reliable framework for understanding how they perceive and react in various situations[64]. Moreover, these traits have a significant impact on educational processes[65]. In the academic landscape, students' traits become increasingly crucial, especially with the integration of technology. Gen-AI technologies are becoming increasingly prevalent in education, providing students with new learning opportunities, practice, and feedback[66]. The outcomes established a significant relationship between certain personality traits and the educational use of Gen-AI among undergraduate students. Students exhibiting extroverted traits were more inclined to engage with Gen-AI for educational purposes. Similar studies have also reported connections between extraversion and the use

of innovative technology[50]. The perception of Gen-AI as new conversation partners and learning companions leads extroverted individuals to engage more with this technology. Additionally, prior research findings have consistently supported this link[67].

Openness is a trait associated with being receptive to innovative ideas and experiences[32], was positively correlated with the educational use of Gen-AI. Furthermore, the sensitivity analysis indicated that openness emerged as the strongest predictor of the educational use of Gen-AI. Corroborating this, earlier research suggested that students displaying openness were more inclined to adopt innovative technologies due to their favorable attitudes toward information technology advancements[21]. For students with a higher openness to experience, Gen-AI may provide access to information and expertise, leading to more frequent interactions with this technology. Similar outcomes from other studies support this finding[68] underscoring openness as a driving factor in utilizing innovative platforms[69].

Conscientiousness, which typifies individuals inclined toward responsibility, planning, and organization[32], was also found to exhibit a positive and significant relation with the educational use of Gen-AI. This connection suggests that conscientious individuals tend to prefer and utilize Gen-AI more for educational purposes. Similar studies have drawn parallels between conscientiousness and the adoption of innovative technologies[50]. Conscientious individuals perceive Gen-AI as a practical tool that supports structured work, explaining their preference for this technology. This inclination towards more systematic support aligns with previous research findings[68].

The significant and negative relationship identified between neuroticism and educational use reveals that students with higher neuroticism exhibit reluctance to engage with Gen-AI. Prior research also indicates a negative association between neurotic individuals and recent technology use[50,70]. Additionally, previous research findings have revealed that neuroticism is positively and significantly linked to problematic technology usage[19]. Neuroticism is associated with anxiety and emotional variability, leading individuals to resist new stimuli and be less open to change[38]. Therefore, individuals with higher neuroticism levels tend to avoid using Gen-AI technologies due to their aversion to new stimuli and apprehension about interacting with non-human entities, as supported by consistent research findings.

The personality trait of agreeableness did not indicate a significant relationship with the educational use of Gen-AI. This finding implies that students with agreeableness traits did not exhibit a particular inclination to utilize Gen-AI for educational purposes. Agreeable individuals value collaboration and exhibit cooperative behaviors, favoring human interactions and potentially perceiving non-human interactions as threatening[71]. Supporting this finding, previous research suggests that agreeable individuals tend to prioritize social support, empathy, and interpersonal trust[72]. Therefore, they value human interactions more due to their need for social connectedness and empathy[73]. In the context of "human-computer interaction" (HCI), studies have shown that agreeable people may prefer human-like interactions over fully automated systems as they value warmth and social engagement[74,75]. Given that generative AI lacks the human-like cues of empathy, emotion, and social context that agreeable individuals may seek[76], the findings align with prior literature, suggesting that agreeable users may prefer human interactions over online interactions[77].

Finally, the findings of the multi-group analysis reveal gender differences in how personality traits predict educational use of Gen-AI. Conscientiousness and Openness are the strongest predictors for both men and women. Conscientiousness has a slightly more substantial effect on women than on men, and Openness has a more significant impact on men than on women. This suggests that being organized and disciplined is more important for academic engagement in females, while curiosity and creativity play a more significant role in males. Extraversion significantly predicts educational use for both genders, but its effect is more important for females than for males. Neuroticism has a negative impact on educational use for both genders, with a more substantial negative effect for females compared to males, suggesting that emotional instability poses a greater barrier for females. Agreeableness is not a significant predictor for either gender. These gender differences in the strength of the effects of Conscientiousness and Openness highlight nuances in how personality traits impact the educational use of AI, and they could inform the development of gender-specific educational strategies and policies.

Conclusion

Theoretical contributions

The research makes significant contributions to the existing literature by identifying the relationship between the "Big Five personality" traits and the use of AI in education. This investigation stands as a pioneering inquiry, demonstrating the pivotal role of personality traits in shaping the use of Gen-AI. The established connection between Big Five personality traits and technology usage introduces a fresh perspective to the existing literature on individual technology adoption and utilization. The findings serve as a crucial foundation for more effective and comprehensive future applications of Gen-AI in education. Notably, studies examining how users perceive Gen-AI as human-like emphasize the growing importance of understanding how individuals' personality traits impact the use of Gen-AI.

Recent advancements in NLP have empowered Gen-AI to produce responses that more closely resemble human interactions. This progress underscores the need for Gen-AI to comprehend emotions and assume more complex roles, such as offering emotional support and providing tailored responses. In executing these multifaceted roles, a growing need exists to design Gen-AI tailored to users' personality traits. The findings of this study are poised to significantly influence the developmental trajectory of Gen-AI.

Conclusively, this study makes unique theoretical contributions by integrating the "Big Five personality traits" into the domain of Gen-AI. While the Big Five theory has been extensively applied to understand user behavior in various technological contexts, its application to Gen-AI is a novel contribution. The study employs a multi-technique approach that combines regression and ANN methods. The ANN-based sensitivity analysis

provided more profound insights into the relative importance of personality traits in predicting the educational use of Gen-AI. While SEM results show significant positive relationships for openness, conscientiousness, and extraversion, and a negative relationship for neuroticism, the ANN model captures complex, non-linear relationships between these variables. The sensitivity analysis confirms openness to experience as the most influential predictor, reinforcing its essential role in shaping users' engagement with Gen-AI.

Practical implications

Personalized, personality-based education is considered more effective due to the unique strengths, weaknesses, and distinct learning preferences of individuals[78]. The potential of Gen-AI, customized to specific personality traits, to design and implement personalized educational programs tailored to individual students is a promising prospect. The adaptability of Gen-AI to individual users serves to meet students' particular needs[79], highlighting the potential of personalized Gen-AI in significantly enhancing student learning. Moreover, by sensitizing Gen-AI to various personality traits, students can establish a relationship built on trust, fostering an emotional connection and enriching their interaction. Hence, the findings provide valuable insights that can significantly enhance the efficacy and inclusivity of AI chatbot utilization in educational settings.

Educational institutions embracing a personalized approach can develop AI chatbot-supported learning and guidance services tailored to students' unique personality traits. For example, extroverted students might benefit from interactive and socially engaging learning experiences customized through AI chatbot technologies. Extroverted learners can maximize the benefits of collaborative and interactive learning environments powered by AI. By fostering such interactive learning environments, educational institutions can stimulate social and extroverted tendencies, thereby enhancing academic achievement.

The results show that personality traits, such as openness and a sense of responsibility, are strong determinants of the educational use of Gen-AI technologies. This can be explained by the fact that individuals who are open to innovation are more willing to try innovative technologies, while those with a high sense of responsibility use these technologies in a more systematic and goal-oriented manner[80]. This finding provides important insights for the development of adaptive interface designs that can be customized according to users' personality profiles.

It is essential to incorporate Gen-AI tools that consider individual personality traits into lesson plans and teaching methods. This will enable the needs of students with diverse learning styles to be met more effectively, thereby increasing their motivation to learn. Software designers should focus on developing flexible and customizable adaptive interfaces that can be dynamically adapted to users' personality profiles. Higher education policymakers should establish policies and guidance mechanisms that support the ethical, responsible, and inclusive use of Gen-AI technologies and provide awareness-raising training programs for faculty and students to ensure the widespread and efficient adoption of the technology.

Educational materials can be adjusted to accommodate the preferences and requirements of individuals with diverse personality traits. For students characterized by openness, academic institutions can strengthen AI-driven learning by promoting innovative technologies. These technologies, such as AI-powered brainstorming tools, have the potential to enhance students' creative thinking and curiosity significantly. By offering opportunities such as exploratory projects and research-based assignments, institutions can foster a culture of innovation and optimism about the future of education.

Limitations and future work

This research investigated the relationships between "Big Five personality" traits and the educational use of AI. The findings revealed the key role of certain personality traits in predicting educational use of Gen-AI. However, this study is subject to specific limitations. This research was conducted in a Turkish cultural context characterized by collectivist values. Given that personality traits and technology adoption may differ across cultures, the findings should be interpreted with this cultural background in mind. Future research could examine cross-cultural comparisons to increase the generalizability of the findings.

Future research should also consider the potential of longitudinal or intervention-based studies to track the development of the relationship between the big five personality traits and Gen-AI use over time. Furthermore, as Gen-AI technologies evolve and include more human-mimicking features such as voice recognition and avatar-like personalization, studies on the impact of these forms of communication and features on the acceptance of Generative AI by individuals with compatible personalities should be explored. Additionally, with the shift from digital literacy to data literacy and now to AI literacy, the role of personal traits in AI literacy and how they can enhance interaction with these emerging tools should also be examined[81,82].

One of the main weaknesses of the study is the absence of a well-established theoretical framework. As the focus is on users who have already adopted and are actively using Gen-AI technology, theoretical models related to technology acceptance were not included in the research model. Future studies should prioritize the integration of such theories to provide a stronger theoretical foundation and relate the findings better to established perspectives. Furthermore, this study did not control external variables such as digital literacy, motivation, and prior digital skills, which were considered limitations and should be addressed in future research.

The integration of AI technology into education presents numerous advantages for both students and teachers. Hence, this study highlights the benefits Gen-AI offers to students. However, to mitigate the potential misuse of AI that could compromise academic integrity, future work should prioritize the exploration of measures to ensure responsible and ethical use of this technology in educational contexts. Furthermore, in future studies, the issue of academic integrity in the use of Gen-AI can be addressed in a more comprehensive and detailed manner, with ethical issues and proposed solutions being examined in depth.

Ultimately, future studies should thoroughly examine the ethical issues that may arise from the irresponsible use of Gen-AI[83]. These issues include potential addiction, inhibition of creative thinking, the digital divide, disparity, inequity, privacy concerns, accuracy issues, and bias[84]. Addressing these ethical considerations is

required to promote the responsible and equitable integration of this destructive technology into educational settings. Finally, a potential future direction for this study is to investigate how personality traits affect teachers' willingness to integrate and utilize Gen-AI tools in pedagogical practice.

Data availability

Data are available from the corresponding author upon request.

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Declarations

Competing interests
The authors declare no competing interests.

Institutional review board
The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (Approval # 2023-7).

Informed consent
Informed consent was obtained from all subjects involved in the study.

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