Is artificial intelligence use related to self-control, self-esteem and self-efficacy among university students?

Joaquín Rodríguez-Ruiz[1] · Inmaculada Marín-López[2] · Raquel Espejo-Siles[2]

Abstract

The present study aimed to analyse if self-control, self-esteem and self-efficacy are related to the use of artificial intelligence tools. These tools are being incorporated to educational practices, but there is a lack of empirical evidence about the relation between artificial intelligence use by students and their personal and psychological characteristics. Drawing a profile of students concerning their use of artificial intelligence is imperative in order to design effective learning strategies. This was a cross-sectional study including 1 761 undergraduate students enrolled in different degrees related to education and psychology. Data collection was conducted using validated self-reports that showed appropriate psychometric properties. According to linear regression analyses, low levels of self-control were related to a higher frequency of artificial intelligence use. Logistic regression analyses showed that self-control and self-efficacy were associated with using artificial intelligence to solve daily doubts, due to the need of interacting with someone and to do academic tasks instead of the student. Moreover, higher scores in self-esteem decreased the odds of using artificial intelligence due to the need of interacting with someone. Educators should take into account these findings when implementing the use of artificial intelligence in their educational strategies with university students.

Keywords Artificial Intelligence tools · Self-control · Self-esteem · Self-efficacy · University students

✉ Inmaculada Marín-López
inmaculada.marin@uco.es

Joaquín Rodríguez-Ruiz
joaquin.rodriguez-ruiz@fulbrightmail.org

Raquel Espejo-Siles
raquel.espejo@uco.es

1   Department of Psychology and Anthropology, University of Extremadura, Badajoz, Spain

2   Department of Psychology, University of Córdoba, Córdoba, Spain

1 Introduction

The recent accelerating development and widespread of artificial intelligence is expected to revolutionise education (Slimi & Villarejo, 2023). An emerging body of research is deepening into de most effective strategies to integrate artificial intelligence into educational systems (Karan & Angadi, 2023). Indeed, some programmes are being developed in order to implement artificial intelligence education at schools and they measure their outcomes in terms of impact on technology skills (Park & Kwon, 2023). However, the development of such programmes should take into account the characteristics of the individuals who use these emerging technologies. In this sense, there are no studies to date reporting psychological characteristics of the students who use artificial intelligence tools. For these reasons, this study aimed at exploring if the use of artificial intelligence tools is related to self-control, self-esteem and self-efficacy among university students.

Self-control is the capacity to postpone instant reward in the present in order to achieve a greater incentive in the future (Kirby & Herrnstein, 1995). Self-control has been identified as one of the strongest predictors of well-being (Moffitt et al., 2011), while the lack of self-control increases the likelihood of involving in different problematic behaviours (Gillebaart, 2018). In this sense, self-control is lower among individuals reporting excessive social media use (Zahrai et al., 2022) An experimental study with Swiss university students demonstrated that participants with low levels of self-control were more prone to respond immediately to smartphone notifications (Berger et al., 2018). Jiang and Zhao (2016) found that self-control prevented from using mobile phone for interpersonal purposes and entertainment, whereas looking for information on the mobile phone positively correlated with self-control. However, there is a dearth of research exploring associations between self-control and the use of artificial intelligence tools.

Self-esteem is a personal psychological feature that allows people to positively or negatively assess themselves (Rosenberg, 1965). An adequate development of self-esteem is crucial for mental health and quality of life (Boyd et al., 2014). Low scores in self-esteem are related to more time spent online (Kircaburun, 2016). A study including youth adult participants from three different European countries discovered that high self-esteem was not only related to less daily internet use time, but it also was a protective factor against internet addiction (Błachnio et al., 2016). It has been suggested that people with low levels of self-esteem use technology as a mean to avoid offline interactions, in which they feel incompetent (Caplan, 2003; Lee & Cheung, 2014). Specifically, low self-esteem is related to more smartphone use (Kim et al., 2020) and social media use (Colak et al., 2023). Considering the evidence regarding self-esteem and internet use, it would be expected that the use of artificial intelligence tools is higher among individuals with low levels of self-esteem. Nevertheless, empirical research is needed to confirm this.

Closely related to self-esteem, Bandura (1977) introduced the concept of self-efficacy. It refers to the individual´s self-perception as competent to carry out a specific behaviour regardless of difficulties. Given that self-efficacy impacts behaviour both directly and indirectly -via expectations-, this is a key factor to take into account in models seeking to explain a specific behaviour (Williams & Rhodes, 2016). Artificial

intelligence tools offer the possibility of conducting several tasks as a human would do, so the use of this kind of tools could be more prevalent among people with low levels of self-efficacy in an attempt to overcome their perceived incapacity to perform a task. Moreover, self-efficacy is related to more social adaptability (Yin, 2017) and recent findings report that the use of artificial intelligence in education has a negative impact on social adaptability (Lai et al., 2023). Considering these results together, it would be plausible that the use of artificial intelligence tools is associated with low levels of self-efficacy.

2 The current study

In the last few years there has been a notable increase in the use of artificial intelligence tools. Despite these tools are highly accessible to the general population, no studies to date have analysed psychological characteristics of people who usually use them. Self-control, self-esteem and self-efficacy have been previously identified as predictors of higher use of other technology-related elements. Thus, the specific goal of this study was to explore if self-control, self-esteem and self-efficacy are related to the frequency and different types of use of artificial intelligence tools among university students. It was hypothesized that low levels of self-control, self-esteem and self-efficacy would be related to more frequency of use of artificial intelligence tools (H1); low self-control would be linked to the use of artificial intelligence tools to bolster own´s opinions (H2); low self-esteem was expected to be higher among participants using artificial intelligence tools to create images or videos (H3); and low self-efficacy would drive to use artificial intelligence tools to do academic tasks (H4).

3 Method

3.1 Research Design and Procedure

In this study a cross-sectional ex-post facto quantitative research design was employed. Self-reported questionnaires were used as data collection method, in a university students' population. Data collection was carried out through electronic devices under the supervision of a member of the research team.

Firstly, Education and Psychology Degrees were selected due to convenience and accessibility. Secondly, after selecting the university degrees with the potential to participate in this study, university professors of all those college groups were contacted. Thirdly, they were informed about the study, and they were asked to collaborate to collect data during class hours. Fourthly, in those college groups in which the professors accepted, participants were asked for their collaboration; they were informed regarding the study's objectives and the anonymous and confidential nature of their responses. Participation was voluntary and participants could decline or withdraw at any point of data collection. Those accepting to participate were given a QR code to access a Google form to fill in the questionnaires in approximately 10 min during their regular classroom hours. This procedure complies with international and

national laws, ethical standards, and it was approved by the Ethical Committee of the University of Córdoba.

3.2 Participants

The sample was selected by convenience. The study sample involved 1 761 participants. The data from 74 participants were eliminated because they gave no consent to participate (9), they had not an appropriate Spanish language level (6) or they did not correctly answer the control question (59). The final sample was composed by 1 687 individuals from the University of Córdoba (Spain), encompassing students from the Education, Psychology, and English Studies Degrees. Students were distributed among degree programs as follows: Primary Education (41%), Early Childhood Education (32%), Psychology (12.8%), Social Education (10.5%), and a Double Degree program in Primary Education and English Studies (3.6%). The mean age of the participants was 20.30 years ($SD = 2.76$), and the age ranged from 17 to 56 years. Regarding gender, 78.6% of the participants self-identified as female, 21.2% as male, 0.2% did not identify exclusively with either the female or male gender, and 0.1% identified with both the female and male genders. According to recent information provided by the Ministry of Education in Spain, 77.9% of students enrolled in education-related university degrees are female (Ministerio de Educación y Formación Profesional, 2022). Thus, this sample represents the usual distribution in those degrees in terms of gender.

3.3 Instruments

The *Brief version of the Self-control Scale* (Grasmick et al., 1993) is a self-reported instrument to measure the lack of self-control with 10 items (e.g. *I tend to act impulsively without stopping to think*). This brief version has been used in previous studies, showing good psychometric properties (e.g. Rodríguez-Ruiz et al., 2023). Such items were answered on a four-point Likert ranging from 1 (false) to 4 (true). In the current study, it showed good reliability: Cronbach's α of 0.69 and McDonald's Ω of 0.69.

The *Rosenberg Self-esteem Scale* (Rosenberg, 1965) is a unidimensional self-reported instrument to measure self-esteem. It contains 10 items (e.g. *I am convinced that I have good qualities*) among which 5 are negatively worded (e.g. *Sometimes I think I am not a good person*). Participants answered on a four-point scale ranging from 1 (Strongly Disagree) to 4 (Strongly agree). In the current study, psychometric properties were excellent: Cronbach's α of 0.90 and McDonald's Ω of 0.91.

The *General Self-efficacy Scale* (Baessler & Schwarzer, 1996) is a unidimensional self-reported instrument containing 10 items (e.g. *I can solve difficult problems if I try hard enough*) to assess self-efficacy, understood as the stable feeling of personal competence to deal effectively with a variety of effectively in a variety of stressful situations. Participants answered on a four-point scale ranging from 1 (Strongly Disagree) to 4 (Strongly agree). In the current study, reliability analyses showed an excellent Cronbach's α of 0.90 and McDonald's Ω of 0.91.

The use of artificial intelligence was measured by a two-question scale created ad hoc for this study. The item *How often have you used Artificial Intelligence tools*

(ChatGPT, DeepL, Ideogram, etc.) in the last 12 months? assesses the frequency of use of AIT. It is answered on a six-point scale with the following options (1) never, (2) once, (3) more than once, but not as often as once a month, (4) monthly, (5) weekly, and (6) daily. The another item, *What have you used these AI tools for?*, assesses the purpose for which they use such tools. Participants were given eight different options where they could answer as many as necessary. Those options were to solve everyday doubts, to look for information to reinforce my opinions, need for interaction with someone, to do academic work for me, to solve doubts regarding academic work, to create fake images, to create fake audios and to create fake videos. Participants were asked to answer the questionnaire with reference to "the last 12 months".

3.4 Data analysis

Reliability analyses were carried out using FACTOR (Lorenzo-Seva & Ferrando, 2013) to examine the correct performance of the selected instruments. Bivariate Pearson correlations were run including all the study variables: self-control, self-esteem, self-efficacy, the frequency of AIT use, and the 6 different types of AIT use identified. One linear regression was executed to analyse the frequency of AIT use predicted by self-control, self-esteem, and self-efficacy. Finally, six stepwise logistic regressions were carried out to study the prediction of each type of AIT use by four different models including as follows. Model 1 included self-control; model 2 included self-control and self-esteem; model 3 included self-control, self-esteem and self-efficacy; and model 4 added to the previous model both age and gender. Stepwise logistic regression analyses were conducted in comparison to non-AIT users. The gender variable was recoded as female = 1 and male = 2 for regression analyses. For correlation and regression analyses the items assessing the purposes of AIT use to create fake images, to create fake audios and to create fake videos were coded as a single variable measuring the AIT use purpose of creating fake content. Correlation and regression analyses were performed using SPSS v.25.

4 Results

The correlation matrix including *Self-control*, *Self-esteem*, *Self-efficacy*, *Frequency of AIT* and the different types of use of AIT is presented in Table 1. It was found that *Low Self-control* was significantly associated to high *frequency of AIT use* ($r=0.12$), as well as to higher *AIT Use: Need for interaction with someone* ($r=0.07$) and higher *AIT Use: to do academic work for me* ($r=0.13$). High *Self-esteem* was significantly associated to high *Self-efficacy* ($r=0.53$). High *Frequency of AIT use* was significantly associated to all the different types of use of AIT analysed, *AIT Use: To solve everyday doubts ($r=0.16$)*, *AIT Use: To look for information to reinforce my opinions ($r=0.12$)*, *AIT Use: Need for interaction with someone ($r=0.14$)*, *AIT Use: to do academic work for me ($r=0.16$)*, *AIT Use: to solve doubts regarding academic work ($r=0.24$)*, and *AIT Use: to create fake content ($r=0.07$)*. *AIT Use: To solve everyday doubts* was significantly associated to higher *AIT Use: Need for interaction with someone ($r=0.12$)* but lower *AIT Use: to do academic work for me ($r = -0.06$)*. *AIT*

Table 1 Correlations among low Self-control, Self-esteem, Self-efficacy, frequency of AIT use and the different types of use of AIT

	1	2	3	4	5	6	7	8	9
1.Low Self-control									
2.Self-esteem	−0.02								
3.Self-efficacy	0.04	0.53**							
4.Frequency of AIT use	0.12**	0.02	0.03						
5.AIT Use: To solve everyday doubts	−0.05	0.00	0.05	0.16**					
6.AIT Use: To look for information to reinforce my opinions	0.05	−0.04	−0.03	0.12**	0.06				
7.AIT Use: Need for interaction with someone	0.07*	−0.06	0.04	0.14**	0.12**	0.02			
8.AIT Use: to do academic work for me	0.13**	0.01	−0.05	0.16**	−0.06*	−0.07*	0.01		
9.AIT Use: to solve doubts regarding academic work	−0.03	0.01	−0.01	0.24**	0.01	−0.04	−0.07*	−0.02	
10.AIT Use: to create fake content	0.03	−0.02	0.02	0.07*	0.06	0.05	0.10**	0.07*	0.03

Note Pearson r correlations; *$p<0.05$; **$p<0.01$

Table 2 Linear regression of frequency of AIT use predicted by low Self-control, Self-esteem, and self-efficacy

	Frequency of AIT use	
	B (SE)	p
Age	0.02 (0.01)	0.20
Gender	0.30 (0.09)	0.001
Low Self-control	0.35 (0.08)	<0.001
Self-esteem	−0.02 (0.08)	0.79
Self-efficacy	0.02 (0.10)	0.88

Use: To look for information to reinforce my opinions was significantly associated to lower *AIT Use: to do academic work for me* ($r=$ -0.07). *AIT Use: Need for interaction with someone* was significantly associated to lower *AIT Use: to solve doubts regarding academic work* ($r=$ -0.07) but higher *AIT Use: to create fake content* ($r=0.10$). Finally, *AIT Use: to do academic work for me* was significantly associated to higher *AIT Use: to create fake content* ($r=0.07$).

Results of the linear regression analysis of *Frequency of AIT use* predicted by *Low Self-control*, *Self-esteem* and *Self-efficacy* are presented in Table 2. It showed that *Gender* (OR=0.30) and *Self-control* (OR=0.35) predicted higher frequency of use of AIT.

Logistic stepwise regression analyses were performed to find the details of the dynamic relations among the studied variables and the different purposes of use of AIT. Table 3 shows logistic regression coefficients predicting *AIT Use: To solve everyday doubts* with the four analysed models. It was found that high *Self-efficacy* (OR=1.47) predicted higher *AIT Use: To solve everyday doubts* in Model 3; and in Model 4, *Low Self-control* (OR=0.68) predicted lower *AIT Use: To solve everyday*

Table 3 Logistic stepwise regression for AIT Use: to solve everyday doubts with the four analysed models

AIT Use: To solve everyday doubts	Model 1					Model 2					Model 3					Model 4				
	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)
Low Self-control	−0.25	0.14	3.05	0.08	0.78 (0.59-1.03)	−0.25	0.14	3.06	0.08	0.78 (0.592−1.03)	−0.27	0.14	3.50	0.06	0.77 (0.58-1.01)	**−0.38**	**0.15**	**6.66**	**0.01**	**0.68 (0.51-0.91)**
Self-esteem						−0.02	0.13	0.02	0.90	0.98 (0.762−1.27)	−0.19	0.16	1.46	0.23	0.83 (0.61-1.13)	−0.25	0.16	2.37	0.12	0.78 (0.57-1.07)
Self-efficacy											**0.39**	**0.20**	**3.88**	**0.05**	**1.47 (1.00-2.17)**	0.31	0.20	2.44	0.12	1.37 (0.92-2.02)
Age																−0.00	0.03	0.03	0.87	1 (0.946−1.05)
Gender																**0.61**	**0.15**	**16.73**	**0.00**	**1.85 (1.38−2.48)**
R² de Nagelkerke	0.004					0.004					0.009					0.029				
χ²(gl)	3.06 (1)*					3.08 (2)					6.98 (3)*					23.68 (5)***				

*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$

🖄 Springer

doubts and *Male Gender* (OR=1.85) predicted higher *AIT Use: To solve everyday doubts.*

Table 4 shows logistic regression coefficients predicting *AIT Use: To look for information to reinforce my opinions* with the four analysed models. No significant relations were found.

Table 5 shows logistic regression coefficients predicting *AIT Use: Need for interaction with someone* with the four analysed models. It was found that *Low Self-control* predicted higher *AIT Use: Need for interaction with someone* in all four models (OR=2.29; OR=2.26; OR=2.14; OR=2.09, respectively). *Self-esteem* predicted lower *AIT Use: Need for interaction with someone in* Models 3 (OR=0.34) and 4 (OR=0.33). And *Self-efficacy* predicted higher *AIT Use: Need for interaction with someone* in Models 3 (OR=3.69) and 4 (OR=3.63).

Table 6 shows logistic regression coefficients predicting *AIT Use: to do academic work for me* with the four analysed models. It was found that *Low Self-control* predicted higher *AIT Use: to do academic work for me* in all four models (OR=2.01; OR=2.01; OR=2.07; OR=2.63, respectively). *Self-efficacy* predicted lower *AIT Use: to do academic work for me* in Models 3 (OR=0.55) and 4 (OR=0.52). *Male gender* (OR=1.44) predicted higher *AIT Use: to do academic work for me* in Model 4.

Table 7 shows logistic regression coefficients predicting *AIT Use: to solve doubts regarding academic work* with the four analysed models. *Female gender* (OR=0.61) predicted lower *AIT Use: to solve doubts regarding academic work* in Model 4.

Table 8 shows logistic regression coefficients predicting *AIT Use: to create fake content* with the four analysed models. No significant relations were found.

5 Discussion

The recent and rapid widespread of artificial intelligence tools brings a new scenario, given that these tools can be used for several purposes, from answering daily questions to creating and manipulating content. Moreover, educational systems are incorporating artificial intelligence into their practices. However, there is no empirical information to date reporting personal and psychological characteristics of the students who use artificial intelligence tools. Thus, firstly, this study aimed to explore whether the frequency of use of artificial intelligence was related to self-control, self-esteem, and self-efficacy. Then, it was explored if self-control, self-esteem, and self-efficacy were related to different purposes of using artificial intelligence tools.

Regarding the frequency of AIT use, this study hypothesized that it would be associated with lower levels of self-control, self-esteem, and self-efficacy. This hypothesis was partially confirmed since lower level of self-control was the only significant predictor of the frequency of AIT use. Also, male gender was associated with a higher frequency of AIT use. Similarly, previous studies have pointed out that male gender and low self-control were related to more time spent online (Li et al., 2021; Mei et al., 2016). Our results deepen in these previous findings, as they show that both variables are related to more artificial intelligence use.

Table 4 Logistic stepwise regression for AIT Use: to look for information to reinforce my opinions with the four analysed models

AIT Use: To look for information to reinforce my opinions	Model 1					Model 2					Model 3					Model 4				
	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)
Low Self-control	0.24	0.14	3.03	0.08	1.28 (0.97-1.68)	0.23	0.14	2.77	0.09	1.26 (0.96-1.66)	0.24	0.14	2.82	0.09	1.27 (0.96-1.67)	0.25	0.14	2.90	0.09	1.28 (0.96−1.70)
Self-esteem						−0.22	0.13	2.87	0.09	0.80 (0.62-1.04)	−0.20	0.16	1.58	0.21	0.82 (0.61-1.12)	−0.22	0.16	1.95	0.16	0.80 (0.59-1.09)
Self-efficacy											−0.05	0.20	0.07	0.79	0.95 (0.65-1.39)	−0.06	0.20	0.10	0.75	0.94 (0.64-1.38)
Age																0.04	0.03	2.32	0.13	1.04 (0.99-1.09)
Gender																0.10	0.15	0.41	0.52	1.10 (0.82-1.48)
R^2 de Nagelkerke	0.004					0.007					0.007					0.011				
χ^2 (gl)	3.04 (1)					5.91 (2)					5.99 (3)					8.82 (5)				

$*P \leq 0.05$; $**P \leq 0.01$; $***P \leq 0.001$

Table 5 Logistic stepwise regression for AIT Use: need for interaction with someone with the four analysed models

AIT Use: Need for interaction with someone

	Model 1					Model 2					Model 3					Model 4				
	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)
Low Self-control	0.83	0.34	5.81	0.02	2.29 (1.17–4.48)	0.82	0.34	5.59	0.02	2.26 (1.15–4.44)	0.76	0.34	4.89	0.03	2.14 (1.09–4.20)	0.74	0.35	4.44	0.04	2.09 (1.05–4.16)
Self-esteem						−0.51	0.32	2.54	0.11	0.60 (0.32–1.12)	−1.09	0.37	8.47	0.00	0.34 (0.16–0.70)	−1.11	0.38	8.68	0.00	0.33 (0.16–0.69)
Self-efficacy											1.31	0.46	8.03	0.00	3.69 (1.50–9.11)	1.29	0.46	7.76	0.01	3.63 (1.47–9.00)
Age																0.00	0.07	0.00	0.97	1.00 (0.87–1.16)
Gender																0.19	0.35	0.28	0.59	1.21 (0.61–2.40)
R² de Nagelkerke	0.018					0.026					0.051					0.052				
χ²(gl)	5.80 (1)*					8.31 (2)*					16.07 (3)**					16.36 (5)**				

*$P \leq 0.05$; **$P \leq 0.01$; ***$P \leq 0.001$

Table 6 Logistic stepwise regression for AIT Use: to do academic work for me with the four analysed models

AIT Use: to do academic work for me																			
	Model 1					Model 2					Model 3					Model 4				
	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)
Low Self-control	0.70	0.16	19.72	0.00	2.01 (1.48–2.73)	0.70	0.16	19.70	0.00	2.01 (1.48–2.73)	0.73	0.16	21.25	0.00	2.07 (1.52–2.83)	0.65	0.16	16.03	0.00	1.91 (1.39–2.63)
Self-esteem						0.00	0.15	0.00	0.98	1.00 (0.76–1.33)	0.28	0.18	2.46	0.12	1.32 (0.93–1.87)	0.26	0.18	2.17	0.14	1.30 (0.92–1.84)
Self-efficacy											−0.61	0.22	7.57	0.01	0.55 (0.35–0.84)	−0.66	0.22	8.87	0.00	0.52 (0.33–0.80)
Age																−0.05	0.03	2.30	0.13	0.95 (0.89–1.02)
Gender																0.36	0.16	4.95	0.03	1.44 (1.04–1.97)
R² de Nagelkerke	0.027					0.027					0.037					0.046				
χ² (gl)	20.17 (1)***					20.17 (2)***					27.87 (3)***					34.86 (5)***				

*P≤0.05; **P≤0.01; ***P≤0.001

⓪ Springer

Table 7 Logistic stepwise regression for AIT Use: to solve doubts regarding academic work with the four analysed models

| AIT Use: to solve doubts regarding academic work | | | | | | | | | | | | | | | | | | | |
| Model 1 | | | | | Model 2 | | | | | Model 3 | | | | | Model 4 | | | | |
B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)
Low Self-control																			
−0.13	0.14	0.85	0.36	0.88 (0.66-1.16)	−0.13	0.14	0.80	0.37	0.88 (0.66-1.17)	−0.13	0.15	0.80	0.37	0.88 (0.66-1.17)	−0.05	0.15	0.13	0.72	0.95 (0.71-1.27)
Self-esteem																			
					0.07	0.13	0.31	0.58	1.08 (0.83–1.40)	0.07	0.16	0.21	0.65	1.08 (0.78-1.48)	0.12	0.16	0.58	0.45	1.13 (0.82-1.56)
Self-efficacy																			
										<0.01	0.20	0.00	0.99	0.20 (0.68-1.49)	0.07	0.20	0.11	0.74	1.07 (0.72−1.60)
Age															−0.01	0.03	0.29	0.59	0.99 (0.94-1.04)
Gender															**−0.50**	**0.15**	**10.81**	**0.00**	**0.61 (0.45-0.82)**
R² de Nagelkerke	0.001					0.001					0.001					0.016				
χ²(gl)	0.85 (1)					1.15 (2)					1.15 (3)					12.39 (5)*				

*P≤0.05; **P≤0.01; ***P≤0.001

Table 8 Logistic stepwise regression for AIT Use: to create fake content with the four analysed models

| | AIT Use: to create fake content | | | | | | | | | | | | | | | | | | | |
| | Model 1 | | | | | Model 2 | | | | | Model 3 | | | | | Model 4 | | | | |
	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)	B	SE	Wald	p	OR (95%CI)
Low Self-control	0.25	0.32	0.63	0.43	1.29 (0.69-2.41)	0.25	0.32	0.62	0.43	1.29 (0.69-2.41)	0.25	0.32	0.59	0.44	1.28 (0.68–2.40)	0.17	0.33	0.26	0.61	1.18 (0.62-2.27)
Self-esteem						−0.17	0.30	0.30	0.59	0.85 (0.47-1.54)	−0.23	0.35	0.41	0.52	0.80 (0.40-1.59)	−0.27	0.35	0.58	0.45	0.76 (0.38-1.53)
Self-efficacy											0.14	0.43	0.11	0.74	1.15 (0.49–2.70)	0.06	0.44	0.02	0.89	1.06 (0.45-2.52)
Age																0.02	0.05	0.23	0.63	1.02 (0.93-1.13)
Gender																0.54	0.33	2.65	0.10	1.72 (0.90-3.29)
R² de Nagelkerke	0.002					0.002					0.003					0.010				
χ²(gl)	0.63 (1)					0.92 (2)					1.03(3)					3.81 (5)				

*$P \le 0.05$; **$P \le 0.01$; ***$P \le 0.001$

Low self-control was proposed to be related to the use of AIT to bolster own´s opinions. This result was not found in our study. Nevertheless, low self-control predicted a higher use of AIT to do academic tasks in the name of the student and to the need to interact with someone. These purposes have in common that AIT can provide an immediate solution to both elements. In this sense, AIT could provide the response to a self-imposed request, and it could cover the need for socialization quickly. This finding is congruent to the fact that people lacking self-control would prefer immediate rewards (Fujita, 2011). The use of AIT in the previous situations means a faster path to achieve goals or solve problems, which could be seen as an immediate reward for individuals.

In contrast, a lower level of self-control was related to less AIT use to solve daily doubts. Doubts are developed by reflective thinking that leads to questions. Reflective thinking could be less likely in individuals lacking self-control (Grass et al., 2019). Following the dual-system models, individuals lacking self-control may have a weaker activation of the reflective system. This system leads to higher-order mental operations, such as evaluating or inhibiting impulsive responses. In contrast, in individuals lacking self-control may predominate the impulsive system, which leads to an automatic response (Hofmann et al., 2009). This may explain the fact that individuals with low self-control were less likely to use AIT to solve everyday doubts.

It was hypothesized that low self-esteem would be related to the use of AIT to create images or videos. No significant relations were found, and therefore, the results of this study do not support the hypothesis. However, high self-esteem was associated with lower AIT use need to interact with someone. Although high self-esteem has been related to the preference for interacting with others (Harris & Orth, 2020), high self-esteem appears to be related mainly to high-quality face-to-face interactions (Subrahmanyam et al., 2020), and individuals with low self-esteem may develop a preference for online social interactions (Lee & Cheung, 2014).

Lastly, low self-efficacy was proposed to use AIT to do academic tasks. Our findings supported the hypothesis. Therefore, people who perceive themselves as competent to carry out a specific behaviour despite difficulties were less likely to use AIT to do academic activities for them. Moreover, high self-efficacy was related to more use of AIT for the need of interaction with someone. In this sense, a previous study found that students considered that the mobile chatbot helps to promote their self-efficacy and learning engagement (Chang et al., 2022).

6 Conclusion

The current study has some strengths and limitations that should be acknowledged. Probably, the biggest strength is that a never-studied topic was explored, which can open the way to a new body of research. Another important strength is the large sample size, with more almost 1 700 university students being analysed. Also, validated instruments were administered for measuring personal and psychological characteristics. These instruments had shown excellent psychometric properties in previous research, as well as they did in our study. On the other hand, regarding limitations, it should be mentioned that the sample was selected by convenience and the proportion

of female students was much higher in comparison with male students. Moreover, the cross-sectional design prevented us from establishing chronological associations among variables. Finally, the use of self-reports to collect data can lead to different biases, such as the social desirability bias.

Even with some limitations, this investigation has important implications for policy and practice, given that it provides empirical information about the relation between self-control, self-esteem, and self-efficacy with different uses of artificial intelligence tools. Previous research had already demonstrated that self-control, self-esteem and self-efficacy are key elements to achieve a healthy and adaptative use of technological devices (Idrees et al., 2024; Shank & Cotton, 2014; Troll et al., 2021). Notwithstanding, this is the first study linking these personal features with the use of artificial intelligence among university students, which can serves as a basis to promote a responsible use of these tools in educational settings. Educators should consider the personal and psychological characteristics of their students when implementing artificial intelligence into their educational practices. At university, academic work is used to evaluate the acquisition of competencies. Currently, artificial intelligence could compromise this certainty since some tools could escape from plagiarism detectors. In this situation, there is an urgent need to promote ethical practices using artificial intelligence among university students. Promoting self-control and self-efficacy in students may help to increase the ethical use of artificial intelligence tools for academic purposes, such as solving academic doubts, and decrease unethical purposes, such as doing academic work instead of the student. These findings are expected to encourage more research on personal variables associated to the different uses of artificial intelligence, in order to adapt the teaching process to the particularities and necessities of students. Future studies could deepen in this body of research including representative samples, or analysing prospective links among these variables by using a longitudinal design. Moreover, it is recommended to explore other personal variables related to the use of artificial intelligence tools, such as social and emotional competencies, moral factors or personality traits.

Author contributions Conceptualization: Joaquín Rodríguez-Ruiz; Methodology: Inmaculada Marín-López; Formal analysis and investigation: Joaquín Rodríguez-Ruiz, Inmaculada Marín-López and Raquel Espejo-Siles; Writing - original draft preparation: Joaquín Rodríguez-Ruiz, Inmaculada Marín-López and Raquel Espejo-Siles; Writing - review and editing: Joaquín Rodríguez-Ruiz, Inmaculada Marín-López and Raquel Espejo-Siles; Supervision: Joaquín Rodríguez-Ruiz, Inmaculada Marín-López and Raquel Espejo-Siles.

Data availability The data that support the findings of this study are available under request to the corresponding author to avoid compromising the privacy of the participants.

Declarations

Competing interests The authors have no relevant financial or non-financial interests to disclose.

References

Baessler, J., & Schwarzer, R. (1996). Evaluación De La Autoeficacia: Adaptación española de la escala de Autoeficacia General. *Ansiedad Y Estrés*, *2*, 1–8.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215.

Berger, S., Wyss, A. M., & Knoch, D. (2018). Low self-control capacity is associated with immediate responses to smartphone signals. *Computers in Human Behavior*, *86*, 45–51. https://doi.org/10.1016/j.chb.2018.04.031.

Błachnio, A., Przepiórka, A., Senol-Durak, E., Durak, M., & Sherstyuk, L. (2016). The role of self-esteem in internet addiction: A comparison between Turkish, Polish and Ukrainian samples. *The European Journal of Psychiatry*, *30*(2), 149–155.

Boyd, J. E., Otilingam, P. G., & DeForge, B. R. (2014). Brief version of the internalized stigma of Mental Illness (ISMI) scale: Psychometric properties and relationship to depression, self-esteem, recovery orientation, empowerment, and perceived devaluation and discrimination. *Psychiatric Rehabilitation Journal*, *37*(1), 17–23. https://doi.org/10.1037/prj0000035.

Caplan, S. E. (2003). Preference for online social interaction: A theory of problematic internet use and psychosocial well-being. *Communication Research*, *30*(6), 625–648. https://doi.org/10.1177/0093650203257842.

Chang, C. Y., Hwang, G. J., & Gau, M. L. (2022). Promoting students' learning achievement and self-efficacy: A mobile chatbot approach for nursing training. *British Journal of Educational Technology*, *53*(1), 171–188. https://doi.org/10.1111/bjet.13158.

Colak, M., Bingol, O. S., & Dayi, A. (2023). Self-esteem and social media addiction level in adolescents: The mediating role of body image. *Indian Journal of Psychiatry*, *65*(5), 595–600. https://doi.org/10.4103/indianjpsychiatry.indianjpsychiatry_306_22.

Fujita, K. (2011). On conceptualizing self-control as more than the Effortful Inhibition of impulses. *Personality and Social Psychology Review*, *15*(4), 352–366. https://doi.org/10.1177/1088868311411165.

Gillebaart, M. (2018). The operational definition of self-control. *Frontiers in Psychology*, *9*, 1231. https://doi.org/10.3389/fpsyg.2018.01231.

Grasmick, H. G., Tittle, C. R., Bursik, R. J., & Arneklev, B. J. (1993). Testing the core empirical implications of Gottfredson and Hirschi's general theory of crime. *Journal of Research in Crime and Delinquency*, *30*, 5–29. https://doi.org/10.1177/0022427893030001002.

Grass, J., Krieger, F., Paulus, P., Greiff, S., Strobel, A., & Strobel, A. (2019). Thinking in action: Need for cognition predicts self-control together with action orientation. *PLoS One*, *14*(8), e0220282. https://doi.org/10.1371/journal.pone.0220282.

Harris, M. A., & Orth, U. (2020). The link between self-esteem and social relationships: A meta-analysis of longitudinal studies. *Journal of Personality and Social Psychology*, *119*(6), 1459–1477. https://doi.org/10.1037/pspp0000265.

Hofmann, W., Friese, M., & Strack, F. (2009). Impulse and self-control from a dual-systems Perspective. *Perspectives on Psychological Science*, *4*(2), 162–176. https://doi.org/10.1111/j.1745-6924.2009.01116.x.

Idrees, B., Sampasa-Kanyinga, H., Hamilton, H. A., & Chaput, J. P. (2024). Associations between problem technology use, life stress, and self-esteem among high school students. *Bmc Public Health*, *24*(1), 492. https://doi.org/10.1186/s12889-024-17963-7.

Jiang, Z., & Zhao, X. (2016). Self-control and problematic mobile phone use in Chinese college students: The mediating role of mobile phone use patterns. *Bmc Psychiatry*, *16*, 416. https://doi.org/10.1186/s12888-016-1131-z.

Karan, B., & Angadi, G. R. (2023). Artificial Intelligence Integration into School Education: A review of Indian and foreign perspectives. *Millennial Asia*, *0*(0). https://doi.org/10.1177/09763996231158229.

Kim, H., Choi, I. Y., & Kim, D. J. (2020). Excessive smartphone use and self-esteem among adults with internet gaming disorder: Quantitative survey study. *JMIR mHealth and uHealth*, *8*(9), e18505. https://doi.org/10.2196/18505.

Kirby, K. N., & Herrnstein, R. J. (1995). Preference reversals due to myopic discounting of delayed reward. *Psychological Science*, *6*(2), 83–89. https://doi.org/10.1111/j.1467-9280.1995.tb00311.x.

Kircaburun, K. (2016). Self-Esteem, Daily Internet Use and Social Media Addiction as predictors of Depression among Turkish adolescents. *Journal of Education and Practice*, *7*(24), 64–72.

Lai, T., Xie, C., Ruan, M., Wang, Z., Lu, H., & Fu, S. (2023). Influence of artificial intelligence in education on adolescents' social adaptability: The mediatory role of social support. *PLoS One*, *18*(3). https://doi.org/10.1371/journal.pone.0283170.

Lee, Z. W. Y., & Cheung, C. M. K. (2014). Problematic use of Social networking sites: The role of self-esteem. *International Journal of Business and Information*, *9*(2), 143–159. https://doi.org/10.6702/ijbi.2014.9.2.1.

Li, S., Ren, P., Chiu, M. M., Wang, C., & Lei, H. (2021). The relationship between self-control and internet addiction among students: A Meta-analysis. *Frontiers in Psychology*, *12*, 735–755. https://doi.org/10.3389/fpsyg.2021.735755.

Lorenzo-Seva, U., & Ferrando, P. J. (2013). FACTOR 9.2: A comprehensive program for fitting exploratory and semi confirmatory factor analysis and IRT models. *Applied Psychological Measurement*, *37*(6), 497–498. https://doi.org/10.1177/0146621613487794.

Mei, S., Yau, Y. H., Chai, J., Guo, J., & Potenza, M. N. (2016). Problematic internet use, well-being, self-esteem and self-control: Data from a high-school survey in China. *Addictive Behaviors*, *61*, 74–79. https://doi.org/10.1016/j.addbeh.2016.05.009.

Ministerio de Educación y Formación Profesional (2022). *Igualdad en cifras MEFP 2022* Secretaría General Técnica.

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., Houts, R., Poulton, R., Roberts, B. W., Ross, S., Sears, M. R., Thomson, M., & Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences U S A*, *108*, 2693–2698. https://doi.org/10.1073/pnas.1010076108.

Park, W., & Kwon, H. (2023). Implementing artificial intelligence education for middle school technology education in Republic of Korea. *International Journal of Technology and Design Education*. https://doi.org/10.1007/s10798-023-09812-2.

Rodríguez-Ruiz, J., Zych, I., Ribeaud, D., Steinhoff, A., Eisner, M., Quednow, B. B., & Shanahan, L. (2023). The influence of different dimensions of the parent–child relationship in Childhood as Longitudinal predictors of Substance Use in Late Adolescence. The Mediating Role of Self-Control. *International Journal of Mental Health and Addiction*. https://doi.org/10.1007/s11469-023-01036-8.

Rosenberg, M. (1965). *Society and adolescent self-image*. Princeton University Press.

Shank, D. B., & Cotton, S. R. (2014). Does technology empower urban youth? The relationship of technology use to self-efficacy. *Computers & Education*, *70*, 184–193. https://doi.org/10.1016/j.compedu.2013.08.018.

Slimi, Z., & Villarejo, B. (2023). Navigating the Ethical Challenges of Artificial Intelligence in Higher Education: An analysis of seven global AI Ethics policies. *TEM Journal*, *12*(2), 590–602. https://doi.org/10.18421/TEM122-02.

Subrahmanyam, K., Frison, E., & Michikyan, M. (2020). The relation between face-to-face and digital interactions and self-esteem: a daily diary study. *Human Behavior and Emerging Technologies*, *2*(2), 116–127. https://doi.org/10.1002/hbe2.187.

Troll, E. S., Friese, M., & Loschelder, D. D. (2021). How students' self-control and smartphone-use explain their academic performance. *Computers in Human Behavior*, *117*, 106624. https://doi.org/10.1016/j.chb.2020.106624.

Williams, D. M., & Rhodes, R. E. (2016). The confounded self-efficacy construct: Conceptual analysis and recommendations for future research. *Health Psychology Review*, *10*(2), 113–128. https://doi.org/10.1080/17437199.2014.941998.

Yin, H. (2017). The relationship between Self Efficacy and Social Adaptation of College Students with left-behind experience: Mediating Effect of Psychological Resilience. *Advances in Psychology*, *7*(8), 1058–1067. https://doi.org/10.12677/ap.2017.78133.

Zahrai, K., Veer, E., Ballantine, P. W., De Vries, H. P., & Prayag, G. (2022). Either you control social media or social media controls you: Understanding the impact of self-control on excessive social media use from the dual-system perspective. *The Journal of Consumer Affairs*, *56*(2), 806–848. https://doi.org/10.1111/joca.12449.