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Rethinking human excellence in the AI age: The relationship between intellectual humility and attitudes toward ChatGPT

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ABSTRACT

Previous research has shown that the AI (artificial intelligence) sensation often provokes mixed feelings in people who gain exposure to it. We theorize that intellectual humility, which is the awareness of the fallibility of one's beliefs, opinions, and knowledge, can increase participants' openness to experiences, and consequently promote acceptance of ChatGPT. In four studies involving a total of 943 participants from various populations (students and general adults), different measurement methods (self-report and behavioral outcome variables), and diverse research designs (correlational and experimental approaches), we found consistent evidence that intellectual humility were associated with more favorable attitudes toward ChatGPT. In Study 1, we observed that Chinese university students with higher levels of intellectual humility were more accepting of ChatGPT. Study 2 used a behavioral measure and found that participants with higher levels of intellectual humility were more likely to select texts generated by ChatGPT. Employing a more diverse population and an experimental design, Study 3 demonstrate a causal link between intellectual humility and acceptance of AI. Study 4 further revealed that the effect was mediated by openness to experiences. These findings provided the first experimental observation that intellectual humility plays a critical role in embracing emerging technologies in the AI age.

1. Introduction

In the science fiction movie "M3GAN", an artificially intelligent doll develops a destructive sense of over-protection and engages in aggressive behavior aiming at anyone who comes between her and her human owner. In contemporary real-life settings, AI technology is sweeping our world and leads to groundbreaking changes in our daily lives (van Dis et al., 2023). For example, ChatGPT, an AI-powered chatbot from OpenAI, reached a milestone monthly active user count of 100 million within just two months of its existence (ChatGPT sets record for fastest-growing user base - analyst note, 2023). Despite sparking a frenzy in the tech community and revolutionizing how people work, live, and play, ChatGPT is facing mounting criticism. Many jobs are at risk of being replaced by AI, the use of intelligence application in essay writing raises concerns of cheating and ethics, and journals are prohibiting authorship credit for such AI tools in published literature (Liebrenz et al., 2023; Tlili et al., 2023).

Indeed, historical records have shown that people tend to have mixed feelings about the emergence of technological advances (Gessl et al., 2019). Maladjustment of the emerging technologies, a lack of trust, and feelings of anxiety may hinder people from rational choice in interactions with these important innovations (Bochniarz et al., 2022; Broadbent, 2017; Suen & Hung, 2023). According to the technology acceptance model, when users are presented with a new technology, a complex range of factors, such as perceived ease-of-use of a technology, usefulness, perceived risk on system use, and social influence, jointly impact their acceptance and usage behavior (Davis, 1985, 1989).

One important extension of the technology acceptance model is the examination of individual differences in attitudes toward different AI services (Venkatesh, 2000; Venkatesh & Davis, 2000). For example, previous studies have shown that people who displayed higher levels of performance expectancy of new technologies, personality agreeableness, and hedonic motivations showed stronger behavioral intention toward AI across multiple industries and sectors (Choung et al., 2023; Gursoy et al., 2019; Kelly et al., 2022; Sindermann et al., 2022). Despite previous research yielding insights into rational and non-rational factors influencing participants' intentions to use AI systems, the role of intellectual humility, an emerging individual-differences variable, in the willingness to use AI, particularly ChatGPT, has received limited attention.

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Our study offer theoretical, practice, and policy contributions. Theoretically, by examining the role of intellectual humility in the acceptance of ChatGPT, the present research aims to provide a more comprehensive understanding of the factors contributing to user acceptance of AI. Investigating the antecedents of AI acceptance can also lead to the development and empirical testing of various theoretical model for AI device use acceptance frameworks. Practically, the increasing integration of ChatGPT into numerous applications makes people' lives safer, easier, and healthier in various ways. Understanding the specific factors that contribute to user acceptance of ChatGPT is important for facilitating the acceptance and adoption of this AI system. In addition, this research can provide stakeholders with recommendations to ensure that their time and money will be appropriately invested in line with the ever-changing digital society.

In positive psychology literature, intellectual humility is defined as a mindset that involves a meta-cognitive ability to recognize the intellectual fallibility of one's beliefs, opinions, and knowledge (Davis et al., 2016; Hoyle et al., 2016; Leary et al., 2017). Despite lively debates around the definition, this psychological construct has several critical elements that may encourage people to embrace the transformative potential of AI. We theorize that individuals who score highly on intellectual humility may have more favorable attitudes toward ChatGPT.

First, when dealing with contentious topics like the threat of AI on humanity, people who frequently show intellectually humble thoughts and behavior are less likely to feel threatened by the evolution of computer science (Gorichanaz, 2022). This is because intellectual humility encourages individuals to acknowledge that no single source of information can provide all the answers. Therefore, those who recognize their own intellectual limitations may view AI as a tool to overcome challenges in life, strengthen public safety, create intellectual property, among other benefits.

Second, intellectually humble individuals approach the world with an open mind, putting aside their own feelings or opinions to consider new perspectives (Porter et al., 2022). They actively seek out a range of opinions and feedback when evaluating new technologies like GPT, helping them to make more informed judgments. For example, Leary et al. (2017) found that people who exhibited superior intellectual humility were less likely to endorse religio-centrism and were more tolerant of opposing religious viewpoints.

Third, understanding of one's own limitations can directly contribute to improving their self-awareness and reducing their intellectual arrogance (Gregg et al., 2017; Leman et al., 2023). An example of this trait is that people high in intellectual humility may be quicker to admit that they know little about the evolution of AI. It is premature for an average person to reject the emergence of complex and innovative technologies in the market. Thus, a person with intellectual humility may be more open to revise their initial attitudes toward and consider alternative perspectives on AI.

Some evidence supports the positive role of intellectual humility in the acceptance of new technologies. For example, Bernabé-Valero et al. (2018) explored how intellectual humility moderated the relationship between aging and the adoption of information and communications technology (ICT). They found a moderating effect of intellectual humility that enhanced technology adoption. However, there are conceptual and methodological issues that warrant closer examination. First, Bernabé-Valero et al. (2018) study was based only on data from a sample of Spaniards. It remains unclear whether the conclusions from these WEIRD (Western, educated, industrialized, rich, and democratic) samples in cyberpsychology can be applied to other populations.

Second, Bernabé-Valero et al. (2018) study treated intellectual humility only as a moderator, a third variable that influences the strength or direction of the relationship between a dependent and independent variable in correlation. Since there is no manipulation of intellectual humility, it is difficult to assess its direct causal effects on the adoption of technologies. Lastly, Bernabé-Valero et al. (2018) study focused primarily on computer and digital devices, not accounting for the unique features of ChatGPT that is designed for conversational interaction and provides an engaging conversation experience. To address these issues, we conducted a set of studies on the role of intellectual humility in the adoption of ChapGPT in China, a country with a significant population. Building on previous research, we hypothesize that individuals with high levels of intellectual humility will hold more favorable attitudes toward this new AI chatbot.

A key aspect that has garnered significant scholarly attention in intellectual humility research is openness to new experiences. McElroy et al. (2014) theorized that while general humility is a broader concept encompassing humility in all areas of life, intellectual humility specifically relates to people's humility in intellectual and cognitive contexts. This involves placing great value on the willingness to negotiated different ideas, evaluate conflict evidence, and temper offensive reactions to critique. Consistent with this theoretical perspective, numerous studies have provided evidence supporting the notion that compared to general humility, intellectual humility accounts for a significant variance in attitudes and behaviors associated with openness to experience across diverse contexts (Davis et al., 2016; Zmigrod et al., 2019). For example, Cao and Li (2023) found that intellectual humility increased participants' openness to experience, consequently reducing an unfair preference for natural drugs.

In addition, a corpus of empirical studies has demonstrated a significant relationship between the Big Five Personality trait of Openness and acceptance of AI. For example, Sisk et al. (2020) found a positive association between parental openness and favorable attitudes toward AI-driven precision medicine technologies in pediatric healthcare. Moving beyond the medical domain, researchers have also investigated the correlation between openness personality and trust toward robots and AI in a general context. In a study involving 1077 American participants, Oksanen et al. (2020) found that openness to experience was a highly significant predictor of trust in robotization and AI. More recently, Sindermann et al. (2022) replicated this finding in a Chinese sample, revealing a positive associations between acceptance of AI and the openness trait. Based on these findings, it is expected that openness to experience may play a mediating role in the effect of intellectual humility on acceptance of ChatGPT.

We conducted four studies to test our focal and mediation hypotheses that intellectual humility promotes positive attitudes toward ChatGPT via increased state of openness. In Study 1, we examined the correlation between intellectual humility, acceptance, and fear of ChatGPT among Chinese university students. Moving beyond self-report data, Study 2 aimed to replicate the findings in a real-life context by observing the actual behavior. Adopting an experimental perspective and involving a general adult population, Study 3 examined the causal influence of intellectual humility on promoting the use of ChatGPT in advertisements. Study 4 explored the psychological mechanism mediating the association between intellectual humility and acceptance of ChatGPT.

2. Study 1

If intellectual humility leads to more positive attitudes toward new technologies, those who score higher on intellectual humility may show more acceptance of and less fear of ChatGPT. Study 1 involved a survey exploring whether intellectual humility emerged as a significant predictor of people's attitudes toward ChatGPT.

2.1. Method

2.1.1. Participants

The adequate sample size was determined based on the medium effect size ($r = 0.40$) for a correlation test. G*Power indicates that 59 participants was required to reach 80 % statistical power. However, we recruited as many participants as we could if the availability of resources shaped by our budget permitted to obtain a more desired level of statistical power. A total of 309 undergraduate and graduate students (167

females; $Mean_{age} = 23.1$, SD = 2.4) from southwest China took part in the study. The survey was purported to examine individual differences in technology use. They completed the survey for a small monetary reward.

2.1.2. Materials and procedure

We measured intellectual humility by using Krumrei-Mancuso and Rouse (2016) 22-item Comprehensive Intellectual Humility Scale. Previous construct validation studies have demonstrated that the Chinese version of this scale has satisfactory reliability and validity (Cao & Li, 2023; Wong & Wong, 2021). The scale is divided into four sub-scales: Independence of Intellect and Ego; Openness to Revising One's Viewpoint; Respect for Others' Viewpoints; and Lack of Intellectual Overconfidence. The construct validity of the total index and the sub-scales show satisfactory internal consistency reliability. Participants were asked how much they agreed with each statement using a 5-point Likert scale ranging from "*Strongly Disagree*(1)" on one end to "*Strongly Agree* (5)" on the other end.

General attitudes toward ChatGPT were measured using a five-item measure adapted from the Chinese version of the Attitude Toward Artificial Intelligence (ATAI) scale (Sindermann et al., 2021, 2022). The two subscales - acceptance (2 items) and fear (3 items) of artificial intelligence - in the scale were examined independently. Sample statements include "*I trust ChatGPT.*" (Acceptance) and "*ChatGPT will cause many job losses.*"(Fear). Participants responded to the instrument on an 11-point Likert-Scale from 0 = "*strongly disagree*" to 10 = "*strongly agree*".

2.2. Results and discussion

Mean scores, standard deviations, and correlations between the measures in this study are reported in Table 1. In line with our prediction, intellectual humility was positively associated with acceptance of ChatGPT, $r(309) = 0.23$, $p < .01$, 95%CI = [0.1163, 0.3283], but negatively linked to fear of ChatGPT, $r(309) = -0.19$, $p < .01$, 95%CI = [−0.2915, −0.0760]. These relationships remained significant when we controlled for the individual-level control variables such as age and gender (all $ps < 0.05$).

It is worth noting that there was no significant relationship between fear and acceptance of ChatGPT ($r = -0.07$), which is consistent with previous findings (Sindermann et al., 2022). Additionally, no significant correlations between fear of ChatGPT and two of the subscales of intellectual (Independence of intellect: $r = -0.10$; Ego and Lack of intellectual overconfidence: $r = -0.07$) were observed in the current study. This is possibly because the item "*Artificial intelligence will cause many job losses*" weakly loaded (0.20) on the Fear factor, which suggests that potential job loss from advances in AI does not necessarily lead to a negative attitude or fear of AI (Granulo et al., 2019).

In a cross-cultural validation study on the ATAI scale, Sindermann et al. (2021) also found that the loading of the same item was not particularly high in Chinese samples. The researchers speculated that their participants were primarily based on students from a technology-oriented university and thus were taught to work with AI products. As participants in our study represented different majors, these findings suggest that Chinese university students may not see job loss as a serious reason to fear AI. After we removed this item, fear of ChatGPT were significantly correlated with all of the subscales of IH (Independence of intellect: $r = -0.13$, $p < .05$; Ego and Lack of intellectual overconfidence: $r = -0.12$, $p < .05$) and with acceptance of GPT ($r = -0.14$, $p < .01$).

Despite these data presenting preliminary evidence for the relationship between intellectual humility and positive evaluations of ChatGPT, Study 1 relied on individuals' self-report of their attitudes toward AI usage. However, there might be a striking discrepancy between explicit measures of attitudes and actual behavior in the real-life context. To overcome the potential issue regarding measurement techniques, Study 2 employed an objective index of ChatGPT-related support behavior. In addition, one might argue that the obtained results are unique to the specific questionnaire and conceptualization of intellectual humility (e.g., unidimensional vs. multidimensional). To help dispel this concern, we employed a different measure of intellectual humility in Study 2.

3. Study 2

Study 2 expanded upon Study 1 in two important ways: (a) To increase the generalizability of our findings, we used a different sample of participants from another location in China; (b) We were interested in whether the relationship between intellectual humility and positive attitudes toward ChatGPT can hold within a behavioral context.

3.1. Method

3.1.1. Participants

We used a medium effect size (Cramer V = 0.3) in a Chi-square test for sample size calculations. G*Power analysis suggested that a total of 143 participants were required to attain a statistical power of 80 %. A total of 144 undergraduate and graduate students (77 females, $Mean_{age} = 22.7$, SD = 2.5) from central China took part in the study that was purported to be a personality assessment in daily life. They completed the study for a small monetary reward.

3.1.2. Materials and procedure

Participants were assured that the research was completely anonymous and confidential. To obscure the real purpose of the study, participants were first given a time management survey. Afterwards, participants complete a 5-item measure of intellectual humility from Leary et al. (2017). This measure demonstrated strong internal consistency and was successfully used in Chinese populations according to previous studies (Cao & Li, 2023). The present study demonstrated the sufficient internal reliability for the scale, α = 0.88. Participants viewed the items as personality descriptions and responded to each statement quantitatively using a 5-likert scale ranging from 1 (*not at all like me*) to 5 (*very much like me*). Sample items included "*In the face of conflicting*

Table 1
Summary of means, standard deviations, cronbach's alphas, and correlations between study variables.

Variable	M	SD	α	1	2	3	4	5	6
1. Intellectual humility overall	3.78	0.50	0.89						
2. Openness to revising one's viewpoint	3.29	0.71	0.73	0.65**					
3. Independence of intellect and ego	3.68	0.67	0.76	0.78**	0.35**				
4. Respect for other's viewpoints	4.14	0.64	0.87	0.79**	0.33**	0.47**			
5. Lack of intellectual overconfidence	3.90	0.63	0.78	0.82**	0.31**	0.60**	0.55*		
6. Fear of ChatGPT	4.24	1.82	0.70	−0.19**	−0.22**	−0.10	−0.18**	−0.07	
7. Acceptance of ChatGPT	5.66	1.66	0.75	0.23**	0.19**	0.20**	0.12*	0.19**	−0.07

Note: $N = 309$.
* Correlations are significant with $p < .05$.
** Correlations are significant with $p < .01$.

evidence, I am open to changing my opinions" and "*I reconsider my opinions when presented with new evidence*". Upon completing the survey, the research assistant said:

> Thank you for completing the survey! Ahh, actually I'd like to let you know that The Annual University Celebration is approaching. To attract more alumni, partners, and special guests for attending the event either in person on campus or online from around the world, we have prepared invitation letters for our guests of honor. We have two versions, and we'd like to ask you to choose one for the formal invitation. One is written by ChatGPT, which can produce human-like text responses to user-generated prompts. The other is written by a professional writer in a public relations corporation (the mentioning order of these two types of letter was counterbalanced across participants). Both of them can write engaging and high-quality content according to customers' requests in terms of tone and formality. A pilot survey indicates that the two versions did not differ in terms of many key criteria of promotion/marketing, such as credibility, effectiveness, readability, and valence. Due to time limits, we will not ask you to read the two versions. You just need to indicate your preference. We are very interested in your initial reaction.

Because it is common to ask student participants about university-related issues in campus surveys, this paradigm provides an opportunity for observing AI use behavior with high fidelity. After participants indicated their choices, the research assistant debriefed them by informing them the true purpose of the research. All participants understood the deception methods used in the study and agreed that their response can be used for scientific research.

3.2. Results and discussion

Respondent debriefing data show that that none of them attained any insight into the study's hypotheses regarding the relationship between intellectual humility and invitation letter preference/attitudes toward AI technology. Of the 144 participants, 119 participants, or 82.64 %, preferred the invitation letter they thought was written by a human, in comparison to 25, or 17.36 %, of participants chose the version they believed was generated by ChatGPT. A post-hoc analysis reveals a statistically significant difference in selection preference across the two groups: χ^2 (1, 144) = 61.36, $p < .001$; Cramer's φ = 0.65, 95 % CI = [0.5262, 0.7510].

To examine whether intellectual humility can predict participants selection choice, we conducted a binary logistic regression with letter preference (1 = human-written letter, 2 = ChatGPT-generated letter) as the dependent variable and intellectual humility scores ($M = 3.67$, $SD = 0.74$) as the independent variable. Confirming our prediction, we found that intellectual humility was a positive and significant predictor of letter preference, Nagelkerke $R^2 = 0.93$, B = −0.93, SE = 0.36, Wald (df = 1) = 6.50, $p = .01$, odds ratio = 2.52 (95 % CI = 1.238, 5.132).

Collectively, Studies 1 and 2 provide consistent evidence that people who show higher levels of intellectual humility are more supportive of ChatGPT than their less intellectually humble peers. However, these studies are purely correlational in nature and there is no clue indicating the causality between the two variables. Study 3 takes a step toward managing this potential issue by testing the causal role of intellectual humility in influencing attitudes toward ChatGPT. In addition, one important limitation of Study 2 is that some participants may not believe the cover story of the invitation letter for the university celebration. Put differently, participants may not have believed that the research assistant had two versions of invitation letters. To shed further light on this possibility, in Study 3 we presented participants with two texts to boost the veracity of the cover story.

4. Study 3

The primary goal of Study 3 is to examine how intellectual humility causally influences attitudes toward ChatGPT. In both Studies 1 and 2, the studied population was predominantly university students. However, they may be more accustomed to AI technology and, therefore, may have different evaluations of ChatGPT. To overcome this sampling bias, Study 3 sought to include diverse populations. We predicted that those in the intellectual humility (vs. intellectual certainty) condition would be more likely to support efforts to integrate ChatGPT generated texts into advertisement for a scenic location. Consistent with previous findings, we expect that there might be temporary increases in the state of intellectual humility due to the short-term manipulation (Cao & Li, 2023; Porter et al., 2020). However, it is unlikely that the trait level of this construct would be rapidly and permanently changed by this manipulation treatment.

4.1. Method

4.1.1. Participants

We used a medium effect size (Cramer V = 0.3) in a Chi-square test for sample size calculations. G*Power analysis suggested that a total of 143 participants were required to attain a statistical power of 80 %. As time and research funding permitted, we recruited 172 Chinese non-student adults (90 females; M_{age} = 30.7 years, SD_{age} = 10.5) from Wenjuanxing (wjx), a reliable Chinese commercial online survey service provider similar to Amazon Mechanical Turk (MTurk) and widely used in many published studies (Buchtel et al., 2015; Lu et al., 2020). According to the report by China Internet Network Information Center (2019), the sociodemographic profiles of wjx user pools are comparable to those of the 695 million Chinese internet users. Eight participants failed an attention check (i.e., Please select "3" for this question) and were eliminated from the main analyses. The analytic sample comprised 164 participants (86 females; M_{age} = 30.6 years, SD_{age} = 10.4).

4.1.2. Materials and procedure

Following a priming paradigm used successfully in prior work (Hong et al., 1999; Nussbaum & Dweck, 2008), we randomly assigned participants to various conditions. In the experimental condition ($N = 80$), participants read an article on the topic of intellectual humility and the benefits of admitting one's own limitations. It described, "*Acknowledging self-knowledge failure can have great advantages*". In the control condition ($N = 84$), participants read an article on the topic of intellectual certainty and the benefits of showing what you know is advantageous. It described: "*Stop being bashful in showing how much you know can have great advantages*". The two articles are comparable in terms of length and content, which were ostensibly written for Xinhua News, the mainstream new portal in China.

To measure the impact of the treatment, we incorporated a manipulation check in which participants responded to the same five-item measure of intellectual humility as in Study 2 (α = 0.78). Following Cao and Li (2023), we made some minor changes in the wording of the original scale to ensure that the questionnaire was applicable for capturing the state level of intellectual humility.

Subsequently, participants were presented with a photo of a beautiful mountain lake scene. They read that the government was now planning to promote local tourism and that there were two versions of advertisements for this scenic spot. One was produced by ChatGPT, which can generate human-like text responses and has already been used in ad campaigns. The other was produced by a professional writer in an advertising and marketing company. Actually, the two texts were written by the same person. The order of presentation of the two texts was counterbalanced, as were their pairings with "human-written" and "ChatGPT-generated".

In a separate pilot test, 120 online participants (M_{Age} = 33.4, SD = 9.7) were randomly assigned to evaluate the two letters on many key

criteria of promotion/marketing, such as credibility (1 = very uncreditable, 7 = very creaditable), effectiveness (1 = very ineffective, 7 = very effective), readability (1 = very unreadable, 7 = very readable), and valence (1 = very negative, 7 = very positive). Results from the pretest indicated that the two letters did not differ from each other in terms of credibility ($M_{experimental} = 4.80$, SD = 0.73; $M_{control} = 4.81$, SD = 0.68; t (118) = 0.08, $p = .93$), effectiveness ($M_{experimental} = 4.92$, SD = 0.81; $M_{control}$, = 4.83, SD = 0.85; t (118) = 0.59, $p = .55$), readability ($M_{experimental} = 5.01$, SD = 0.87; $M_{control} = 4.93$, SD = 0.82; t (118) = 0.52, $p = .61$), and valence ($M_{experimental} = 5.08$, SD = 0.74; $M_{control}$ = 5.28, SD = 0.80; t (118) = 1.41, $p = .16$).

4.2. Results and discussion

Respondent debriefing data indicated that none of them attained any insight into the study's hypotheses regarding the relationship between intellectual humility and text preference. The results showed that participants in the intellectual humility condition scored higher on self-reported level of intellectual humility ($M = 3.91$, $SD = 0.59$) than those in the intellectual certainty condition ($M = 3.66$, $SD = 0.70$), t (162) = 2.53, $p = .01$, $d = 0.40$, 95 % CI = [0.0556, 0.4529]. This finding provided evidence for the effectiveness and success of the manipulation treatment.

72, or 85.7 %, of 84 participants in the intellectual certainty condition selected the text they believed was written by a human. Meanwhile, 55, or 68.9 %, of 80 participants in the intellectual humility condition selected the text they believed was written by a human. Critically, participants in the two experimental conditions showed a significant difference in their selection preference, χ^2 (1, $N = 164$) = 6.75. $p = .009$, Cramer's $\varphi = 0.20$, 95 % CI = [0.0505, 0.3460]. These findings provided further support for our theoretical perspective that encouraging intellectual humility can promote more favorable attitudes toward ChatGPT, at least temporarily.

Study 3 provided experimental evidence for our theoretical perspective that enhancing intellectual humility could at least have a short-lived effect on promoting the acceptance of ChatGPT. Since there is no true control condition in this study, some critics may argue that intellectual certainty is not generally viewed as the opposite of intellectual humility. In other words, the manipulation in the intellectual humility condition may not increase the testing variable, but the process of intentional change in the intellectual certainty condition decreased intellectual humility. Note, however, that by using the same experimental manipulation, Cao and Li (2023) found that encouraging intellectual humility can reduce people's preference for natural drugs. Because there is no evidence that intellectual certainty increases naturalness bias, the results are more likely to attributable to increased intellectual humility in the experimental condition. In Study 4, we included a control condition that lacks any treatment or manipulation of intellectual humility or certainty.

5. Study 4

Up to this point, the psychological mechanism that contributes to effects of intellectual humility on people's attitudes toward ChatGPT is unclear. To answer this question, Study 4 investigated the mediating processes underlying the association between intellectual humility and acceptance of ChatGPT. In the introduction part of this paper, we have discussed that a critical difference between intellectual humility and other forms of humility is openness to experience. Empirically, the findings of Study 1 showed that openness to revising one's viewpoint emerged as a significant predictor of people's acceptance of ChatGPT (Acceptance: $r(309) = 0.19$, $p < .01$, 95%CI = [0.0770, 0.2925]; Fear: r (309) = −0.22, $p < .01$, 95%CI = [−0.3218, −0.1091]). Based on these theoretical and empirical observations, we examined whether intellectual humility triggered changes in openness to experience, which in turn led people to adopt more favorable attitudes toward ChatGPT.

5.1. Method

5.1.1. Participants

Based on the effect size in Study 3 (Cramer's $\varphi = 0.20$) in a Chi-square test for sample size calculations. G*Power analysis suggested that a total of 321 participants were required to attain a statistical power of 80 %. We recruited 326 undergraduate and graduate students (173 females, $Mean_{age} = 21.6$, SD = 1.7) in central China for the study. They completed the study for a small monetary reward. We randomly assigned participants into the experimental ($N = 166$) and control condition ($N = 160$).

5.1.2. Materials and procedure

The materials and procedures were identical to Study 3. However, in the control condition, participants read an article on the topic of general terms in sports events. It described: "*Participating teams must pay a contribution fee to the Organizing Committee in order to cover the cost of the international referees*". Afterwards, participants responded to the Chinese version of the NEO Five-Factor Inventory-3 (Fan et al., 2018; McCrae & Costa Jr., 2007; Xu et al., 2021), which was used to measure their openness to experience. The Openness subscale ($\alpha = 0.75$) consists of 12 items. Sample items include "*I believe variety is the spice of life*" and "*I have a lot of intellectual curiosity*" ($\alpha = 0.75$). Participants were required to indicated their agreement with each statement on a 5-point Likert scales ranging from 1 = *totally disagree* to 5 = *totally agree*. Because the original scale is used to assess openness as a stable individual trait, we made some minor changes in the wording so that all statements were sufficient to assess variability in state openness, as previous research did (Cao & Li, 2023).

Upon completing the survey, participants were asked to select an invitation letter as in Study 2. The only exception is that the experimenter presented participants with two versions of invitation letter. One was purported to be generated by ChatGPT, and the other was purported to be produced by a professional writer. Actually, the two texts were written by the same person. The order of presentation of the two texts was counterbalanced, as were their pairings with "human-written" and "ChatGPT-generated".

In a separate pilot test, 96 student participants ($M_{Age} = 19.8$, SD = 1.5) were randomly assigned to evaluate the two letters on many key criteria, such as credibility (1 = very uncreditable, 7 = very creditable), effectiveness (1 = very ineffective, 7 = very effective), readability (1 = very unreadable, 7 = very readable), and valence (1 = very negative, 7 = very positive). Results from the pretest indicated that the two letters did not differ from each other in terms of credibility ($M_{experimental} = 5.38$, SD = 1.01; $M_{control} = 5.20$, SD = 1.02; t (94) = 0.87, $p = .39$), effectiveness ($M_{experimental} = 5.36$, SD = 1.05; $M_{control} = 5.57$, SD = 0.98; t (94) = 1.01, $p = .31$), readability ($M_{experimental} = 5.44$, SD = 1.01; $M_{control} = 5.39$, SD = 1.06; t (94) = 0.24, $p = .81$), and valence ($M_{experimental} = 5.18$, SD = 0.96; $M_{control} = 5.24$, SD = 0.92; t (94) = 0.31, $p = .76$).

5.2. Results and discussion

Respondent debriefing data showed that none of them attained any insight into the study's hypotheses regarding the relationship between intellectual humility and invitation letter preference/attitudes toward AI technology. The results showed that participants in the intellectual humility condition scored higher on the self-reported level of intellectual humility ($M = 3.83$, $SD = 0.66$) than those in the intellectual certainty condition ($M = 3.61$, $SD = 0.61$), t (324) = 3.13, $p = .001$, $d = 0.35$, 95 % CI = [0.0816, 0.3584]. By including a true control condition, this finding provided converging evidence for the effectiveness and success of the manipulation treatment.

As for the invitation letter preference, 102 or 63.75 % of the 160 participants in the intellectual humility condition selected the letter they believed was written by a human. Meanwhile, 128 or 77.11 % of the 166

participants in the control condition selected the letter they thought was written by a human. As expected, there was a significant difference in invitation letter preference between participants in the two conditions, χ^2 (1, $N = 96$) = 6.99, $p = .008$, Cramer's $\varphi = 0.15$, 95 % CI = [0.0382, 0.2514].

In line with our prediction, participants in the intellectual humility condition exhibited more openness ($M = 3.30$, $SD = 0.56$) than participants in the control condition ($M = 3.05$, $SD = 0.52$), t (94) = 2.74, $p < .001$, $d = 0.46$, 95 % CI = [0.1323, 0.3677]. We ran a 5000 sample bootstrapped mediation model (PROCESS model 4) testing the effect of intellectual humility on acceptance of ChatGPT, including openness as a mediator. Bootstrapping analyses revealed that the openness level played a mediating role in accounting for the relationship between intellectual humility and selection choice, yielding a point estimate for the indirect effect of 0.21 and a 95 % confidence interval of 0.0705 to 0.4043 (see Fig. 1).

6. General discussion

The rise of the human-like ChatGPT has facilitated a meaningful interchange of varied viewpoints on its bright future and dark sides. One the one hand, this generative AI has a plethora of possibilities, such as side-stepping human errors, taking risks instead of humans, as well as helping in monotonous and repetitive jobs (van Dis et al., 2023). On the other hand, scientists have sounded the alarm about the drawbacks or disadvantages of chatbots, such as the high costs of creation, lack of empathy, and heavily biased responses (Tlili et al., 2023). Considering that people may have mixed, non-static attitudes toward this emerging technology, the current research investigated, for the first time in the literature, the potential relevance of intellectual humility to people's acceptance of ChatGPT.

Study 1 was a survey-research correlation study that involved Chinese university students. It was found that intellectual humility was associated with higher acceptance of ChatGPT. Study 2 replicated the results of Study 1 in a behavioral decision by utilizing a sample of participants from a different geographic location and a different measure of intellectual humility. The results showed that participants higher in intellectual humility were more likely to choose the invitation letter they believed was generated by ChatGPT. Study 3 further tested the causal role of intellectual humility in influencing people's attitudes toward ChatGPT by employing general adults. We found that participants who were exposed to an intellectual humility prime were more prone to select the advertisements for scenic spots written by ChatGPT compared to those in the intellectual certainty condition. Study 4 replicated the findings of Study 3, including a true control condition. Additionally, the results revealed that openness to experiences mediated the influence of intellectual humility on the acceptance of ChatGPT. Taken together, these four studies offer consistent support for our theoretical perspective that intellectual humility can boost openness to experiences, which in turn leads to more favorable attitudes toward ChatGPT.

6.1. Theoretical and practical implications

As the first systematic investigation of how intellectual humility influences the intention to adopt ChatGPT, our study advances the literature in several important ways. First, the current work yields important insights about the role intellectual humility can play in influencing evaluations of new technologies. Previous research has shown that intellectual humility can be helpful when people engage in the discussion of highly controversial topics, such as religious beliefs, sociopolitical life, and public health (Cao & Li, 2023; Hoyle et al., 2016; Leary et al., 2017). There is, however, no direct evidence regarding how intellectual humility shapes public opinions on emerging technologies.

In this study, we present the first experimental observation that intellectually humble individuals are more likely to embrace the new large language model. It is possible that intellectual humility, a cornerstone moral virtue, encourages people to explore the unknown and to become more receptive to new ideas. This finding enriches the growing body of research on the impact of intellectual humility on polarized issues. For instance, intellectual humility has found to be associated with a higher acceptance rate of opposing political perspectives (Porter & Schumann, 2018), facilitating attitude change and relationship intimacy in disagreement-motivated religious skepticism (Rodriguez et al., 2019), and increasing COVID-19 vaccination uptake (Huynh & Senger, 2021). Our study highlights the relevance of intellectual humility in the attitudes of Chinese individuals toward the acceptance of ChatGPT. This insight adds to the existing research on the role of individual differences in the adoption of emerging technologies in the AI age (Venkatesh, 2000; Venkatesh & Davis, 2000).

Furthermore, we propose that openness to experiences mediates the relationship between intellectual humility and acceptance of ChatGPT. This psychological process is supported by previous research on the significant relationship between certain dimensions of The Big Five personality traits and attitudes toward AI (Noah & Sethumadhavan, 2019; Szalma & Taylor, 2011). It has been demonstrated that openness to experiences, a dimension of cognitive style, is not a fixed personality trait and can vary dramatically depending on the context (Gallimore, 2020). For example, Mortensen et al. (2010) found that participants who were exposed to a disease prime rated themselves as less open to experiences than those in the control condition. Bearing the malleable nature of openness to experiences in mind, researchers and practitioners can utilize these techniques to alleviate common fears surrounding AI

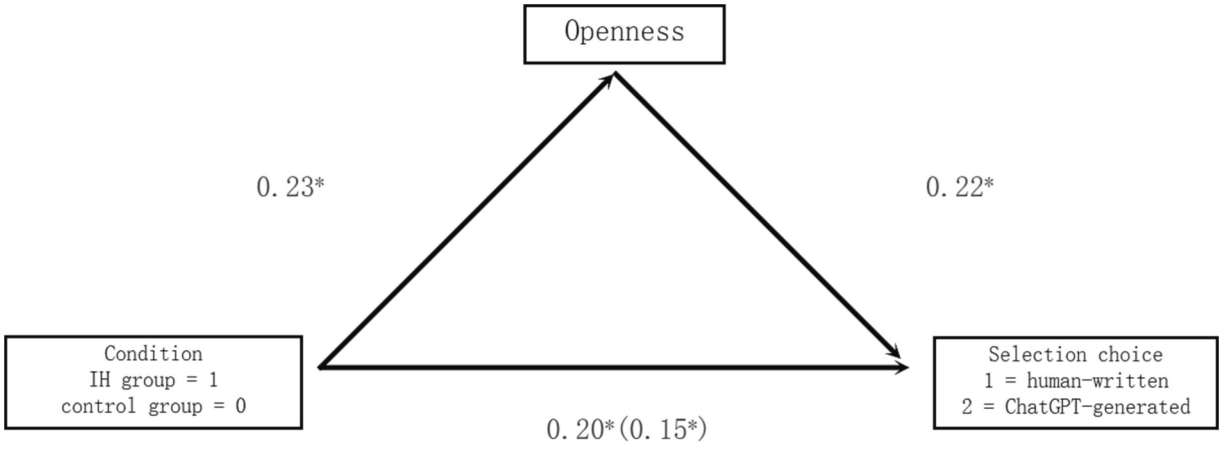


Fig. 1. Mediation model showing the effect of intellectual humility on selection choice, as mediated by openness. Along the bottom path, the value outside of the parentheses represents the total effect, and the value inside parentheses indicates the direct effect absent the mediator. Asterisks indicate significant paths ($p < .01$).

and help individuals be more prepared to embrace it.

Second, the current research demonstrates methodological strength. Although there are a handful of validated instruments for assessing human-AI relations, most of them rely on retrospective self-report questionnaires (Kieslich et al., 2021; Wang & Wang, 2022). However, recent psychological research has focused on the validity and value of self-reporting compared to behavioral data. Critics argue that intentions and attitudes may not truly reflect actual behavior in real-life situations. In other words, if individuals' supportive behavior toward AI significantly differs from their opinions on ChatGPT, our findings would become less meaningful and impactful. To address this limitation, the present research investigated the predictive relationship between intellectual humility and positive attitudes toward ChatGPT through multiple behavioral encounters.

By combining large-scale self-reporting with nonintrusive observation of behavior, we consistently found support for our theoretical perspective that individual differences in intellectual humility were related to a greater acceptance of ChatGPT. Furthermore, the results indicated that both Chinese university students and community adults displayed relatively low acceptance of ChatGPT in different settings (e.g., the acceptance score did not significantly differ from the middle point in Study 1, and the vast majority of participants chose texts they thought were written by a human in Studies 2 and 3). These findings suggest that the questionnaire measure may converge with overt behavioral outcome variables. Hence, the current work provides a more thorough understanding of the predictive relationship and refutes the idea that some of these associative patterns arise solely from a measurement artefact in traditional self-report techniques.

Third, this study highlights a broader practical implication of the effect of intellectual humility in business corporations, universities, and governments. It is evident that the effect sizes across the three studies are relatively low. Some may argue that the small effect size may have minimal consequences in practical settings. Empirically, this is not surprising since mixed feelings about AI technology are a complex psychological phenomenon influenced by a wide range of factors (Venkatesh, 2000). Thus, numerous small individual factors can only account for a limited portion of the total variance and are expected to yield a small effect.

However, it is important to note that all of the effect sizes reported in this study surpass the "realistic minimum practical effect" suggested by Ferguson (2009) as a significant benchmark for social science researchers. Thus, this magnitude of experimental effects in this research suggests that there are indeed significant implications. For example, an increasing number of organizations and institutions are concerned about the negative effects of ChatGPT, with some even going as far as completely banning it. At the same time, it is undeniable that this new language model has many advantages, such as improving the learning process and enhancing work effectiveness.

As demonstrated in our Studies 3 and 4, a brief reading of a 250-word article for a minute or two can significantly promote favorable attitudes toward ChatGPT. This offers an easy and feasible way to keep students and teachers updated with this development in a creative manner. Moreover, intellectual humility can also contribute to the cultivation of good intellectual conduct and productive discussions regarding the applications of AI technologies in various aspects of life. For example, individuals who are duly attentive to one's own intellectual limitations may be more willing to embrace differing opinions and maintain an open attitude in the continuing debate about the risks and rewards of ChatGPT.

6.2. Limitations and future directions

Like any other studies, the present research has several limitations that set an agenda for future inquiries. To begin with, our research was conducted with participants from the Chinese Mainland. While ChatGPT has taken the world by storm, public understanding of and access to AI technologies may vary across countries and over time (Ng et al., 2021). For example, ChatGPT has been removed from several popular Chinese apps, while major Chinese tech companies are racing to develop their own equivalents. Thus, the relatively low acceptance of ChatGPT may arise from the fact that the targeted chatbot is developed by American research labs. Future research may further explore the effect of in-group-out-group bias on distrust and cynical hostility toward different AI chatbots.

Second, in addition to the key variables of interest, we did not collect much demographic information and other interest categories. For example, previous research has shown that performance expectancy, individual AI anxiety, and need for cognition co-shape the the acceptance of artificial intelligence (Kelly et al., 2022; Nikoloudakis et al., 2018). Integrating a broader range of variables into building a multiple regression model in future studies can allow researchers to account for more factors that influence the adoption of AI technologies and reduce the error and bias in the estimates.

Third, future research could take into account other individual differences that may moderate the observed effect. For example, AI literacy, which refers to "a set of competencies that enables individuals to critically evaluate AI technologies; communicate and collaborate effectively with AI" (Long & Magerko, 2020, p.2), may be associated with people's attitudes toward ChatGPT. However, in the psychology and educational literature, the conceptualization of AI literacy is still under-explored. Based on a consolidated definition of this newly emerging concept, it would be valuable for future research to explore the implications of how AI literacy alters our findings.

CRediT authorship contribution statement

Heng Li: Conceptualized the study, developed the methodology, generated the writing, original draft, revising, review, and editing, Data curation and validation.

Declaration of competing interest

The author declared no conflict of interest.

Data availability

Data will be made available on request.

References

Bernabé-Valero, G., Iborra-Marmolejo, I., Beneyto-Arrojo, M. J., & Senent-Capuz, N. (2018). The moderating role of intellectual humility in the adoption of ICT: A study across life-span. *Frontiers in Psychology, 9*, 2433.

Bochniarz, K. T., Czerwiński, S. K., Sawicki, A., & Atroszko, P. A. (2022). Attitudes to AI among high school students: Understanding distrust towards humans will not help us understand distrust towards AI. *Personality and Individual Differences, 185*, Article 111299.

Broadbent, E. (2017). Interactions with robots: The truths we reveal about ourselves. *Annual Review of Psychology, 68*(1), 627–652.

Buchtel, E. E., Guan, Y., Peng, Q., Su, Y., Sang, B., Chen, S. X., & Bond, M. H. (2015). Immorality East and West: Are immoral behaviors especially harmful, or especially uncivilized? *Personality and Social Psychology Bulletin, 41*, 1382–1394.

Cao, Y., & Li, H. (2023). Everything has a limit: How intellectual humility lowers the preference for naturalness as reflected in drug choice. *Social Science & Medicine, 317*, Article 115625.

ChatGPT sets record for fastest-growing user base - analyst note. (2023). Reuters. Available from https://www.reuters.com/technology/chatgpt-sets-record-fastest-growing-user-base-analyst-note-2023-02-01/.

China Internet Network Information Center. (2019). 中国网民搜索引擎使用情况研究报告 [A research report on Chinese netizens' use of the Internet]. Retrieved from https://www.cnnic.net.cn/hlwfzyj/hlwxzbg/ssbg/201910/P020191025506904765613.pdf.

Choung, H., David, P., & Ross, A. (2023). Trust in AI and its role in the acceptance of AI technologies. *International Journal of Human Computer Interaction, 39*(9), 1727–1739.

Davis, D. E., Rice, K., McElroy, S., DeBlaere, C., Choe, E., Van Tongeren, D. R., & Hook, J. N. (2016). Distinguishing intellectual humility and general humility. *The Journal of Positive Psychology, 11*(3), 215–224.

Davis, F. D. (1985). *A technology acceptance model for empirically testing new end-user information systems: Theory and results. (Doctoral dissertation, Massachusetts Institute of Technology)*.
Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*, 319–340.
Fan, J., Zhang, L., & Chen, C. (2018). Thinking styles: Distinct from personality? *Personality and Individual Differences, 125*, 50–55.
Ferguson, C. J. (2009). An effect size primer: A guide for clinicians and researchers. *Professional Psychology: Research and Practice, 40*(5), 532–538.
Gallimore, A. (2020). Can open-mindedness be primed? An investigation into creativity, openness to experience, and open-mindedness among college students with implications for counselors. *Journal of Interdisciplinary Graduate Research, 5*(1), 3.
Gessl, A. S., Schlögl, S., & Mevenkamp, N. (2019). On the perceptions and acceptance of artificially intelligent robotics and the psychology of the future elderly. *Behaviour & Information Technology, 38*(11), 1068–1087.
Gorichanaz, T. (2022). Relating information seeking and use to intellectual humility. *Journal of the Association for Information Science and Technology, 73*(5), 643–654.
Granulo, A., Fuchs, C., & Puntoni, S. (2019). Psychological reactions to human versus robotic job replacement. *Nature Human Behaviour, 3*(10), 1062–1069.
Gregg, A. P., Mahadevan, N., & Sedikides, C. (2017). Intellectual arrogance and intellectual humility: Correlational evidence for an evolutionary-embodied-epistemological account. *The Journal of Positive Psychology, 12*(1), 59–73.
Gursoy, D., Chi, O. H., Lu, L., & Nunkoo, R. (2019). Consumers acceptance of artificially intelligent (AI) device use in service delivery. *International Journal of Information Management, 49*, 157–169.
Hong, Y., Chiu, C., Dweck, C. S., Lin, D. M.-S., & Wan, W. (1999). Implicit theories, attributions, and coping: A meaning system approach. *Journal of Personality and Social Psychology, 77*(3), 588–599.
Hoyle, R. H., Davisson, E. K., Diebels, K. J., & Leary, M. R. (2016). Holding specific views with humility: Conceptualization and measurement of specific intellectual humility. *Personality and Individual Differences, 97*, 165–172.
Huynh, H. P., & Senger, A. R. (2021). A little shot of humility: Intellectual humility predicts vaccination attitudes and intention to vaccinate against COVID-19. *Journal of Applied Social Psychology, 51*(4), 449–460.
Kelly, S., Kaye, S. A., & Oviedo-Trespalacios, O. (2022). What factors contribute to acceptance of artificial intelligence? A systematic review. *Telematics and Informatics, 77*, Article 101925.
Kieslich, K., Lünich, M., & Marcinkowski, F. (2021). The Threats of Artificial Intelligence Scale (TAI) development, measurement and test over three application domains. *International Journal of Social Robotics, 13*, 1563–1577.
Krumrei-Mancuso, E. J., & Rouse, S. V. (2016). The development and validation of the comprehensive intellectual humility scale. *Journal of Personality Assessment, 98*(2), 209–221.
Leary, M. R., Diebels, K. J., Davisson, E. K., Jongman-Sereno, K. P., Isherwood, J. C., Raimi, K. T., … Hoyle, R. H. (2017). Cognitive and interpersonal features of intellectual humility. *Personality and Social Psychology Bulletin, 43*(6), 793–813.
Leman, J., Kurinec, C., & Rowatt, W. (2023). Overconfident and unaware: Intellectual humility and the calibration of metacognition. *The Journal of Positive Psychology, 18*, 178–196.
Liebrenz, M., Schleifer, R., Buadze, A., Bhugra, D., & Smith, A. (2023). Generating scholarly content with ChatGPT: Ethical challenges for medical publishing. *The Lancet Digital Health.*. https://doi.org/10.1016/S2589-7500(23)00019-5
Long, D., & Magerko, B. (2020). *What is AI literacy? Competencies and design considerations. CHI 2020, April 25–30, 2020, Honolulu, HI, USA (Paper 598)*. https://doi.org/10.1145/3313831.3376727
Lu, J. G., Liu, X. L., Liao, H., & Wang, L. (2020). Disentangling stereotypes from social reality: Astrological stereotypes and discrimination in China. *Journal of Personality and Social Psychology, 119*(6), 1359–1379.
McCrae, R. R., & Costa, P. T., Jr. (2007). Brief versions of the NEO-PI-3. *Journal of Individual Differences, 28*, 116–128.
McElroy, S., Rice, K., Davis, D. E., Hook, J. N., Hill, P. C., Worthington, E. L., Jr., & Van Tongeren, D. R. (2014). Intellectual humility: Scale development and theoretical elaborations in the context of religious leadership. *Journal of Psychology and Theology, 42*, 19–30.
Mortensen, C. R., Becker, D. V., Ackerman, J. M., Neuberg, S. L., & Kenrick, D. T. (2010). Infection breeds reticence: The effects of disease salience on self-perceptions of personality and behavioral avoidance tendencies. *Psychological Science, 21*(3), 440–447.
Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence, 2*, Article 100041.
Nikoloudakis, I. A., Crutzen, R., Rebar, A. L., Vandelanotte, C., Quester, P., Dry, M., … Short, C. E. (2018). Can you elaborate on that? Addressing participants' need for cognition in computer-tailored health behavior interventions. *Health Psychology Review, 12*(4), 437–452.
Noah, B., & Sethumadhavan, A. (2019). Generational differences in trust in digital assistants. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 63*(1), 206–210. https://doi.org/10.1177/1071181319631029
Nussbaum, A. D., & Dweck, C. (2008). Defensiveness versus remediation: Self-theories and modes of self-esteem maintenance. *Personality and Social Psychology Bulletin, 34*(5), 599–612.
Oksanen, A., Savela, N., Latikka, R., & Koivula, A. (2020). Trust toward robots and artificial intelligence: An experimental approach to human–technology interactions online. *Frontiers in Psychology, 11*, Article 568256.
Porter, T., Baldwin, C. R., Warren, M. T., Murray, E. D., Cotton Bronk, K., Forgeard, M. J., … Jayawickreme, E. (2022). Clarifying the content of intellectual humility: A systematic review and integrative framework. *Journal of Personality Assessment, 104*(5), 573–585.
Porter, T., & Schumann, K. (2018). Intellectual humility and openness to the opposing view. *Self and Identity, 17*, 139–162.
Porter, T., Schumann, K., Selmeczy, D., & Trzesniewski, K. (2020). Intellectual humility predicts mastery behaviors when learning. *Learning and Individual Differences, 80*, Article 101888.
Rodriguez, D., Hook, J. N., Farrell, J. E., Mosher, D. K., Zhang, H., Van Tongeren, D. R., … Hill, P. C. (2019). Religious intellectual humility, attitude change, and closeness following religious disagreement. *The Journal of Positive Psychology, 14*(2), 133–140.
Sindermann, C., Sha, P., Zhou, M., Wernicke, J., Schmitt, H. S., Li, M., … Montag, C. (2021). Assessing the attitude towards artificial intelligence: Introduction of a short measure in German, Chinese, and English Language. *KI-Künstliche Intelligenz, 35*, 109–118.
Sindermann, C., Yang, H., Elhai, J. D., Yang, S., Quan, L., Li, M., & Montag, C. (2022). Acceptance and fear of Artificial Intelligence: Associations with personality in a German and a Chinese sample. *Discover Psychology, 2*(1), 8.
Sisk, B. A., Antes, A. L., Burrous, S., & DuBois, J. M. (2020). Parental attitudes toward artificial intelligence-driven precision medicine technologies in pediatric healthcare. *Children, 7*(9), 145.
Suen, H. Y., & Hung, K. E. (2023). Building trust in automatic video interviews using various AI interfaces: Tangibility, immediacy, and transparency. *Computers in Human Behavior, 107713*.
Szalma, J. L., & Taylor, G. S. (2011). Individual differences in response to automation: The five factor model of personality. *Journal of Experimental Psychology. Applied, 17*(2), 71–96.
Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. *Smart Learning Environments, 10*(1), 1–24.
van Dis, E. A., Bollen, J., Zuidema, W., van Rooij, R., & Bockting, C. L. (2023). ChatGPT: Five priorities for research. *Nature, 614*(7947), 224–226.
Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research, 11*(4), 342–365.
Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186–204.
Wang, Y. Y., & Wang, Y. S. (2022). Development and validation of an artificial intelligence anxiety scale: An initial application in predicting motivated learning behavior. *Interactive Learning Environments, 30*(4), 619–634.
Wong, I. H., & Wong, T. T. (2021). Exploring the relationship between intellectual humility and academic performance among post-secondary students: The mediating roles of learning motivation and receptivity to feedback. *Learning and Individual Differences, 88*, Article 102012.
Xu, X., Xia, M., Zhao, J., & Pang, W. (2021). Be real, open, and creative: How openness to experience and to change mediate the authenticity-creativity association. *Thinking Skills and Creativity, 41*, Article 100857.
Zmigrod, L., Zmigrod, S., Rentfrow, P. J., & Robbins, T. W. (2019). The psychological roots of intellectual humility: The role of intelligence and cognitive flexibility. *Personality and Individual Differences, 141*, 200–208.