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ORIGINAL ARTICLE

From Fear of Innovation to AI Dependency: the Mediating Roles of Fear of Failure and Self-Doubt

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Abstract

The rapid growth of artificial intelligence (AI) has improved decision-making and learning efficiency. However, it also carries risks of over-reliance and potential negative consequences. Therefore, it is important to examine the cognitive factors associated with artificial intelligence dependency. This study aimed to examine the relationships among neophobia (fear of innovation), fear of failure, self-doubt, and AI dependency. A total of 1105 volunteer (mean age 22.88, SD = 5.28; 77.4% female, 22.6% male) participated. Structural equation modeling (SEM) was employed to examine the data. SEM results revealed significant positive correlations among fear of innovation, fear of failure, and self-doubt. Findings showed that fear of failure and self-doubt fully mediated the relationship between neophobia and AI dependency. These results suggest that strengthening students' self-efficacy may be associated with lower levels of AI dependency.

Keywords Artificial intelligence · Fear of innovation · Self-doubt · Fear of failure · AI dependency

Artificial intelligence (AI) has transformed how people interact with the world. It has moved from simple automation and data-based decisions to improving daily life, solving complex problems, and addressing environmental challenges (Gruetzemacher & Whittlestone, 2022). As a result, AI has been widely adopted across domains, from marketing to defense, influencing both individuals and society. One of the fields most significantly influenced by this transformation is education. As AI reshapes everyday life, modern education systems now goes beyond the mere transfer of knowledge to emphasize critical thinking, collaboration, and problem-solving skills. The aim is to enhance students' cognitive abilities such as learning, applying, evaluating, and synthesizing new information,

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thereby equipping them to adapt effectively to a rapidly changing world (Kustitskaya et al., 2023). In this context, the digital transformation of the twenty-first century has profoundly impacted educational processes. Smart board applications, tablet applications, and different educational programmes have started to be used in the classroom. In particular, the integration of AI in education has changed how students access, analyze, and create knowledge (Hwang & Chien, 2022). Such new instructional technologies provide various benefits by enabling educational environments to better handle crisis situations and to complete missing information in a short time (Crompton et al., 2021). In short, students' learning experiences are being reshaped. This rapid and serious transformation may bring new opportunities as well as various risks.

While these technologies accelerate information acquisition, they also raise certain concerns such as over reliance on AI, which may affect decision-making, self-image, and interpersonal relationships (Morales-García et al., 2024). The concept of over reliance or dependency is a multifaceted concept with multiple meanings across multiple fields of study. Dependence, in a broader context, implies a compulsive necessity for something to operate or attain a sense of completeness. In the era of AI, it can be considered as an over-reliance on AI applications to fulfill tasks and make choices. This dependency has been associated with conditions such as FOMO (Li, 2024), digital amnesia (Greenwood & Quinn, 2017), diminished human decision-making ability, the feeding of laziness (Zhang et al., 2024), decline in cognitive skills, and decrease in motivation (Ahmad et al., 2023). It is therefore crucial to clarify the concept of AI dependence and identify the associated risk factors. Understanding the underlying reasons for the growing dependency on AI, particularly in the field of education, is essential for developing effective strategies that both harness its benefits and mitigate its potential drawbacks. This comprehension is essential for ensuring educational quality and protecting students' mental health during their academic experience.

With the digitalization of education, students now experience the learning process not only from information itself but also through their interaction with technology (van den Berg & du Plessis, 2023). However, not every individual may respond to this transformation in the same way. At this point, individuals' attitudes toward innovation play a decisive role. One key attitude toward innovation is fear of innovation or neophobia. Neophobia is defined as anxiety, fear, and resistance reactions that individuals show towards new life situations they encounter (Mettke-Hofmann, 2022). Fear of innovation, a form of neophobic reaction, can be defined as anxiety toward new methods or changes. Research shows that this is often seen as one of the biggest barriers to innovation in organizations (Furstenthal et al., 2022). Such fear can stem from uncertainty and can breed resistance, stifling creativity, and change (Polat, 2025). In educational environments, students' negative attitudes toward innovations decrease students' self-efficacy and negatively affects the development of autonomy skills (Audet et al., 2021). Moreover, negative attitudes toward new instructional technologies may be linked to delays in adaptation processes, loss of motivation for learning, and technology avoidance behaviors (Kütük, 2025; Mammadov, 2022). Particularly, as stated by Park and Woo (2022), having a closed attitude toward new educational technologies can reduce the functionality of the educational process. In addition, a closed attitude toward new experiences is also linked to lower motivation to use AI-based applications (Stein et al., 2024). Students' reluctance to embrace new technologies shows that neophobic tendencies often place them beyond the "early adopter" and "early majority" stages in Rogers et al.'s (2019) diffusion curve.

The diffusion curve highlights that individuals with strong fear of innovation are more skeptical than early adopters, often missing opportunities offered by new technologies.

Nevertheless, this negative situation can be overcome. For example, Park and Cho (2016) reported that taste education reduces neophobia and increases the willingness to try novel foods in individuals with food neophobia. However, this brings up another issue that needs to be addressed carefully.

While the fear of innovation in individuals can be overcome with experience, use that once exceeds the "comfort zone" may make it difficult to return. The relationship between fear of innovation and AI use can be nonlinear. Moderate familiarity may alleviate fears, but excessive reliance may again trigger anxiety due to a sense of loss of control (Afroogh et al., 2024). Frankenberg and Hochman (2025) propose the relationship between AI dependency and anxiety as a U-shaped relationship. This relationship indicates that individuals with minimal use of AI have high levels of anxiety, and similarly, individuals with high levels of AI use have a different type of anxiety. From the perspective of dual-process theory, intense emotional states such as fear can encourage individuals to choose more superficial and quick ways of thinking. When individuals feel anxious about unfamiliar tasks or technologies, they may avoid them by taking cognitive shortcuts. Students who feel inadequate or anxious about their ability to perform innovative tasks may rely more heavily on AI tools for academic tasks (Zhang & Zhang, 2025; Zhang et al., 2024). Research by Zhai et al. (2024) has revealed that students with access to AI increasingly prefer quick solutions generated by AI rather than tackling difficult analyses themselves. This tendency explains why users prefer efficient cognitive shortcuts despite the ethical issues raised by AI technologies. Moreover, this avoidance of effort also illustrates how fear of innovation can direct people to a dependence on AI for convenience. It is emphasized that the instant feedback and sense of convenience provided by AI tools push users toward excessive comfort, thereby reducing their critical thinking practices (Yankouskaya et al., 2025). People who are low on fear of innovation may be more open to embracing technology, while those who are high on fear may initially resist AI. Once they start using it, they may avoid complex tasks and show a greater tendency to rely on the convenient outputs of AI. Those with low fear of novelty tend to adapt quickly and use AI in a controlled way, whereas those with high fear may develop dependency after initial acceptance. Therefore, fear of innovation and AI dependency may be interrelated, and this association may be shaped by various other factors.

It is believed that one possible outcome of fear of innovation and one possible reason for dependency on AI may be fear of failure. Fear of failure is the attitude to evaluate risks in situations where failure may occur (Chuang et al., 2022). This attitude is developed to avoid feelings of shame, humiliation, and embarrassment. As mentioned above, fear of innovation may stem from uncertainty about outcomes and the potential for negative consequences if the innovation goes wrong (Polat, 2025). In other words, individuals who are afraid of innovation tend to focus on the possible risk of failure associated with trying something novel. Because of these risks, individuals may avoid activities whose outcomes seem uncertain (Villanueva & Martins, 2022). Individuals with high fear of innovation prefer others to test and validate new ideas rather than risk failure themselves (Kaasinen, 2005). Students who do not want to feel ostracized by the people who matter to them in their educational life may be afraid of failing in their studies. In this context, fearing innovation can further fuel the fear of failure. This may encourage them to use AI applications that provide quick access to information and assist with decision-making. Once this fear of failure sets in, it may influence behavior. Fear of failure is fundamentally an avoidance-oriented attitude. Individuals with fear of failure are likely to tend to shun situations where one might fail and face shame or embarrassment (Elliot & Trash, 2004).

Fear of innovation may initially cause an individual to adopt a more distant relationship with new technologies. However, observing others around them using these technologies effectively can encourage the individual to develop a closer relationship with these tools and, in particular, to position artificial intelligence as an external support resource. Students or professionals who fear failure often seek ways to guarantee success or avoid personal failure when faced with challenging tasks. One such way may be to place greater reliance on AI applications that can assist with decision-making or problem-solving. Such reliance may be associated with seeking external aids to ensure things go right. Research by Margulieux et al. (2024) revealed that students with a greater fear of failure tend to use AI tools for problem-solving more frequently and at earlier stages than their less anxious peers. This may suggest that fear of failure encourages students to lean on AI for quick answers or guidance, believing it will reduce the chance of making mistakes on their own.

Another mediator between fear of innovation and AI dependency may be self-doubt. Self-doubt is the state of doubting one's own competencies and experiencing hesitation when making decisions. Lack of self-confidence and indecisiveness are considered to be the main dimensions of self-doubt (Hallenbeck et al., 2022). Individuals with a fear of novelty may develop the thought of "what if I fail?" toward a new technology, which may be related to lower self-confidence and higher self-doubt (Wu et al., 2022). Fear of failure and self-doubt can also be interrelated. If a person constantly fears failure, they may begin to question their own competence and ask themselves, "What if I'm just not capable?" Over time, this can undermine their self-confidence (Dang & Middlemiss, 2025), which is a fundamental component of self-doubt. Failure-avoidant individuals are often "driven by fear of failure and self-doubt," feeling anxious and uncertain about their ability to succeed (Duru et al., 2024). In practice, a student who fears failure (in an exam, task, or innovation) may begin to question their ability to learn the subject. This lack of self-confidence (a sign of self-doubt) may be related to their increased hesitation in overcoming difficulties independently.

A self-doubting student often seeks external support, perceiving their own ability as inadequate. This external support may be AI in some contexts. Students lacking confidence in their knowledge or decisions may view AI as a constant assistant offering "second opinions." It was found that students with low academic self-confidence, characterized by lower self-efficacy beliefs and higher self-doubt, utilized AI technology more frequently when executing tasks (Margulieux et al., 2024; Zhang et al., 2024). As a result, it was observed that students with low academic self-confidence experienced more academic stress and developed overuse of AI tools such as ChatGPT to cope with this stress. This is consistent with another study by Athar (2025), which found that students who doubt themselves or struggle with imposter syndrome often turn to AI tools as a coping mechanism. Captivated by its convenience, they may be inclined to temporarily alleviate their concerns about "failing" by relying on AI's quick answers or suggestions. In their minds, if AI helps them find the right answer, they will not have to face the embarrassment of failure or confirm their negative self-confidence. However, AI dependency driven by self-doubt can become problematic. When individuals credit success to AI rather than their own ability, their self-doubt persists or worsens. Research cautions that such dependence may weaken critical thinking and confidence, creating a self-perpetuating cycle of reliance (Li et al., 2025).

The Present Study

Although previous research has predominantly addressed technology use from behavioral or acceptance perspectives, limited attention has been given to the dependency mechanism that develops through the joint influence of cognitive and emotional factors. In this study, the relationship between emotional reactions such as fear of innovation and fear of failure and cognitive evaluations such as self-doubt and perceived competence is emphasized to explain how these intertwined processes contribute to AI dependency. By addressing the emotional roots that trigger avoidance and the cognitive mechanisms that reinforce reliance, the present study aims to clarify the relational dynamics that connect fear driven responses to patterns of technological dependency. Therefore, this study is designed to explore the associations between fear of innovation and AI dependency. In this pathway, the authors examined the serial mediating role of fear of failure and self-doubt. This study seeks to further investigate the connections between AI dependency and the fear of innovation, fear of failure, and self-doubt, as identified in existing work. Drawing from prior work, the authors present the subsequent hypotheses (*Hs*):

H1. Fear of innovation will be positively associated with fear of failure.
H2. Fear of innovation will be positively associated with self-doubt.
H3. Fear of failure will be positively associated with self-doubt.
H4. Fear of failure will be positively associated with AI dependency.
H5. Self-doubt will be positively associated with AI dependency.
H6. Fear of innovation will be positively associated with AI dependency through the serial mediation of fear of failure and self-doubt.

Method

Participants and Procedure

In this study, data were collected online via Google Forms from 1105 volunteer participants. The participants were selected through convenience sampling and they completed an informed consent form before participating in the study. Although informed consent was obtained, participants were free to withdraw from the study at any time without providing a reason. To ensure data validity, several control procedures were implemented. The Google Form was configured to prevent multiple submissions from the same Google account; however, no personally identifiable information (such as email addresses) was recorded. Missing data were not permitted within the form, ensuring that each completed questionnaire was fully answered. Additionally, attention-check items were included to detect inattentive or inconsistent responses. Questionnaires that failed attention checks or were identified as duplicates were excluded, resulting in the removal of 101 responses before proceeding with the final analyses. The mean age of the participants was 22.88 (SD = 5.28; range = 18–54 years). While 855 (77.4%) of the participants identified themselves as female, 250 (22.6%) identified themselves as male. The participants were predominantly undergraduate students, with 314 (28.4%) in second year, 194 (17.6%) in first year, 189 (17.1%) in fourth year, and 183 (16.6%) in third year. In addition, 160 (14.4%) are graduate students and 65 (5.9%) are enrolled in scientific preparation programs. Further informations about participants are given in Table 1.

Table 1 Demographic information of participants

Variable	Frequency	%
Gender		
Female	855	77.4
Male	250	22.6
Marital status		
Single	856	77.5
Has a relationship	249	22.5
Grade		
First year of university	194	17.6
Second year of university	314	28.4
Third year of university	183	16.6
Fourth year of university	189	17.1
Master	160	14.4
Scientific Preparations	65	5.9
How often do you follow technological innovations?		
Never	19	1.7
Rarely	123	11.1
Sometimes	482	43.6
Usually	396	35.8
Always	85	7.7
Housing status		
Living with my family	705	63.8
Living in dormitory	314	28.4
Living in my own house	86	7.8
What is the main purpose of using AI?		
Access to Information and Learning	667	60.4
Creativity and Content Creation	91	8.2
Problem Solving and Decision Support	222	20.1
Communication and Language Support	40	3.6
Entertainment and Personal Usage	85	7.7
Parental marital status		
Together	968	87.6
Separate	137	12.4

Measures

Fear of Failure Scale

Fear of Failure Scale (FOFS) was developed by Conroy et al. (2002) and adapted into Turkish by Balkıs and Duru (2019). The scale is a 5-point Likert scale (1 = *totally disagree* to 5 = *totally* agree) consisting of 5 items (e.g., "People are less interested in me when I'm not successful.") and one dimension. High scores obtained from the scale indicate that individuals are more afraid of failure. In the adaptation study, the internal consistency coefficient of the scale was calculated as .78.

Self-Doubt Scale

The Self-Doubt Scale (SDS) was originally developed by Oleson et al. (2000) and adapted into Turkish by Duru and Balkıs (2014). The scale is a 5-point Likert scale (1 = *totally disagree* to 5 = *totally agree)* consisting of 8 items (e.g., "I often feel inadequate in my abilities.") and one dimension. High scores obtained from the scale indicate that individuals doubt themselves more. In the adaptation study of the scale, the internal consistency coefficient was calculated as .76.

The Artificial Intelligence Dependency Scale

The Artificial Intelligence Dependency Scale (TAIDS) was originally developed by Morales-Garcia et al. (2024) and adapted into Turkish by Savaş (2024). The scale is a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*) consisting of 5 items (e.g., "I feel vulnerable when I don't have access to AI.") and one dimension. High scores obtained from the scale indicate that individuals are more dependent on AI. In the adaptation study of the scale, the internal consistency coefficient was calculated as .82.

Neophobia Scale

High scores on this scale indicate high fear of new environments, situations, or people. Therefore, the level of fear of innovation was aimed to be investigated through this scale. The scale consists of two sub-dimensions and 8 items (e.g., "I am very uncomfortable with new situations") on a 7-point Likert (1 = *totally disagree* to 7 = *totally agree*) scale. Adaptation study of the scale was carried out by Karataş Yücel (2021), and the internal consistency reliability coefficient was found to be .84. In the Turkish context, the terms *fear of novelty* and *neophobia* are often used interchangeably to describe individuals' anxiety and avoidance toward novelty. Therefore, since both concepts reflect resistance and apprehension toward new experiences and technological changes, the Neophobia Scale was used in this study to measure the construct of fear of innovation.

Data Analysis

Whether fear of failure and self-doubt mediate the relationship between neophobia, and AI dependency was evaluated using structural equation modeling technique. AMOS Graphics 24 and IBM SPSS version 27 were used for all data analyses. Descriptive statistics (mean, standard deviation, skewness, and kurtosis) and Pearson correlations were calculated for each variable. To examine the potential impact of common method bias (CMB), Harman's single-factor test was conducted prior to model testing. Then, a measurement model was created, and the structural model was tested. The significance of the measurement model and the structural model was evaluated by looking at the fit indices (χ^2/df, CFI, GFI, AGFI, NFI, TLI, IFI, SRMR, RMSEA). In addition, the item parceling method, which is used to reduce measurement errors in single-factor measurements, was integrated into the structural equation model (SEM) (Little et al., 2002). Thus, each of the unidimensional constructs such as fear of failure, self-doubt, and AI dependency was divided into two plots. Neophobia was added to the observed variables through its sub-dimensions. Additionally, age and gender were included as control variables in the structural equation model to account for potential demographic influences on AI dependency. Both variables

were included as observed covariates in relation to the dependent variable. Finally, 5000 bootstrap samples were used to assess the significance of the mediating variable. Using this method, 95% confidence intervals (CIs) were produced for indirect effects.

Ethics

This research was ethically approved by the Yıldız Technical University Institute of Social Sciences Ethics Committee (document number 007823) and was conducted in accordance with the Declaration of Helsinki.

Results

Preliminary Analysis

Descriptive statistics, reliabilities, and Pearson correlation coefficients for the study variables are shown in Table 2. As a result of the analyses, significant relationships at different levels were found between the variables in the study. According to the correlation analysis in Table 2, all study variables were positively and significantly correlated. Specifically, neophobia was positively correlated with fear of failure ($r = .44$, $p < .01$), self-doubt ($r = .52$, $p < .01$), and AI dependency ($r = .24$, $p < .01$). Fear of failure was also positively correlated with self-doubt ($r = .67$, $p < .01$) and AI dependency ($r = .35$, $p < .01$). Finally, self-doubt showed a significant positive correlation with AI dependency ($r = .35$, $p < .01$).

To assess the potential influence of common method bias (CMB), Harman's single-factor test was performed. All measurement items from the study were entered into an unrotated exploratory factor analysis. The results showed that the first factor accounted for 28.13% of the total variance, which is well below the recommended threshold of 50% (Podsakoff et al., 2024). Therefore, common method bias was not considered a serious concern in this study.

Measurement Model

The measurement model consists of four latent variables: neophobia, fear of failure, self-doubt, and AI dependency, and eight observed variables: two for neophobia, two for fear of failure, two for self-doubt, and two for AI dependency. According to results, the model fit was satisfactory ($\chi^2/df = 2.63$; CFI = 0.986; GFI = 0.984; AGFI = 0.969; NFI = 0.978; TLI = 0.978; IFI = 0.986; SRMR = 0.0452; RMSEA = 0.042). In addition,

Table 2 Descriptive statistics and correlation findings

Variable	Descriptive statistics					Correlations			
	Mean	SD	Skewness	Kurtosis	α	1	2	3	4
1. Neophobia	31.57	9.58	.027	− .241	.87	–			
2. Fear of failure	14.19	4.20	.010	− .417	.79	.437**	–		
3. Self-doubt	23.10	5.90	− .210	− .313	.83	.518**	.670**	–	
5. AI dependency	11.52	4.18	.522	− .057	.81	.242**	.350**	.346**	–

factor loadings were found to range from 0.768 to 0.908. It can be said that the observed variables can represent the latent variables in a meaningful way.

Structural Model

Initially, a partial mediation model including a direct path from neophobia to AI dependency was tested. The model demonstrated acceptable fit indices (χ^2/df = 4.53; CFI = 0.971; GFI = 0.974; AGFI = 0.948; NFI = 0.964; TLI = 0.954; IFI = 0.972; SRMR = 0.0643; RMSEA = 0.063; AIC = 180.935; ECVI = 0.200). However, the direct path from neophobia to AI dependency was found to be non-significant ($B = 0.456$), suggesting that the effect of neophobia may be transmitted through mediating variables. Accordingly, a full mediation model was subsequently examined. Structural equation modeling results indicated that the full mediation model also demonstrated acceptable fit (χ^2/df = 4.39; CFI = 0.972; GFI = 0.974; AGFI = 0.950; NFI = 0.964; TLI = 0.956; IFI = 0.972; SRMR = 0.0646; RMSEA = 0.061; AIC = 179.475; ECVI = 0.199). Furthermore, comparative model evaluation based on the Akaike information criterion (AIC) and the Expected Cross-Validation Index (ECVI) favored the full mediation model, which showed lower values indicating better model parsimony and predictive accuracy. In this final model, both fear of failure and self-doubt were identified as full mediators in the relationship between neophobia and AI dependency. The standardized path coefficients for all constructs are depicted in Fig. 1.

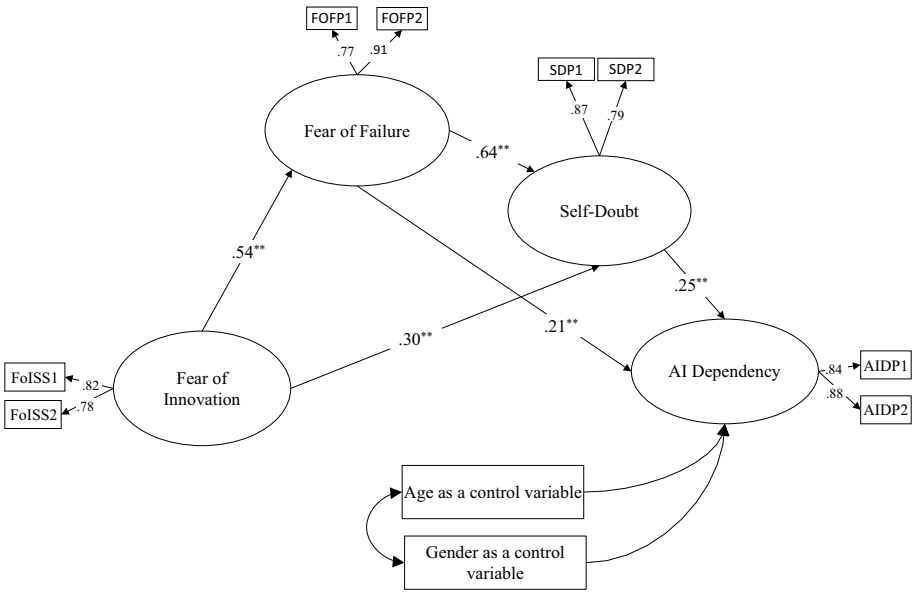


Fig. 1 Structural equation modeling for the serial mediation model. *Note*: *$p < .05$, **$p < .01$, *FOFP* parcel of fear of failure, *SDP* parcel of self-doubt, *FoISS* subscale of fear of innovation, *AIDP* parcel of artificial intelligence dependency

Table 3 Indirect and direct effects for the paths of the final model

Model pathways	Estimated	95% C.I		*p*
		Lower	Upper	
Direct link				
Neophobia → Fear of failure	.539	.464	.607	< .001
Fear of failure → Self-doubt	.641	.564	.714	< .001
Neophobia → Self-doubt	.303	.217	.390	< .001
Self-doubt → AI dependency	.209	.046	.372	< .001
Fear of failure → AI dependency	.216	.055	.379	< .001
Indirect link				< .001
Neophobia → Fear of failure → AI dependency	.049	.013	.088	< .001
Neophobia → Self-doubt → AI dependency	.026	.006	.052	< .001
Neophobia → Fear of failure → Self-doubt → AI dependency	.030	.007	.056	< .001

Bootstrapping

Bootstrapping technique was applied to the full mediation model, which was hypothetically tested in the study and preferred as the best model in the SEM results. The results of bootstrapping provide additional evidence for the significance of direct and indirect paths in the model are presented in Table 3.

Discussion

Modern education system is a structure that attaches importance to the integration of new instructional technologies into the education process. One of these instructional technologies is AI. However, some negative attitudes toward new instructional technologies may reduce the effectiveness of this process. This study investigated the relationships among fear of innovation (neophobia), fear of failure, self-doubt, and AI dependency among university students. The results revealed significant positive correlations among all variables. Structural equation modeling showed that fear of failure and self-doubt fully mediated the association between fear of innovation and AI dependency. These findings indicate that individuals' cognitive and emotional responses to novelty were statistically associated with students' reported reliance on AI technologies within the scope of this model. The findings are discussed below within the framework of the literature.

To begin with, the correlation results of the study indicate that there are significant relationships between the variables. In particular, neophobia was found to be positively correlated with both fear of failure and self-doubt. In addition, significant positive relationships were found between AI dependency and fear of failure and self-doubt. In line with these findings, individuals who experience greater discomfort with novelty are also likely to display higher levels of fear of failure and self-doubt, both of which are associated with stronger tendency on AI tools. These results suggest that the negative evaluations that the individual develops about new situations may be related to his/her perception of self-efficacy and coping skills with failure (Rashid et al., 2020). It also provides important

clues that such internal cognitive representations may be related to technology use behaviors (Chiu, 2022). It is seen that individuals with high neophobia may tend to experience weakness in their self-efficacy perceptions and be more sensitive to the possibility of failure. These psychological tendencies may also be associated with individual differences in technology use patterns observed in this sample.

Beyond correlations, the structural equation modeling provided deeper insight into the psychological mechanisms linking fear of innovation and AI dependency. According to the results of structural equation modeling, within this model, fear of failure and self-doubt were found to be statistically significant indirect pathways linking neophobia and AI dependency. The findings obtained indicate that cognitive processes such as fear of failure and self-doubt can be experienced more intensely in individuals with high levels of neophobia, and that these processes may be related to AI usage tendencies. Furthermore, the finding that self-doubt and fear of failure fully mediate this relationship is theoretically significant and provides important insight. This highlights the role of self-related beliefs. It is not just fear that leads to dependency tendencies, but the crisis of self-efficacy underlying that fear. Theoretically, this result explains why fear of failure or fear of new technology can be detrimental; these fears weaken a person's belief in their own capabilities (self-efficacy), which in turn increases their dependence on external aid. This insight is an important conceptual contribution to the literature on technology use and motivation. This is consistent with classical and contemporary theories: for example, research has shown that the effect of fear of failure on behavior can be fully mediated by self-efficacy beliefs (Tan & Prihadi, 2022). This study extends this understanding to the context of AI, proposing that an individual's low sense of competence (high self-doubt) is a fundamental mechanism that transforms fear into AI dependency.

Previous studies in literature also coincide with these findings (Can et al., 2023; Dietrich et al., 2024). In this context, when the findings are evaluated within the framework of self-determination theory (Ryan & Deci, 2000b), the psychological need deficiencies underlying individuals' technological orientations can be better understood. According to the theory, three basic psychological needs of individuals need to be met for healthy development and motivational continuity: autonomy, competence, and relatedness (Deci & Ryan, 2008). The neophobia, which stands out in this study, can be considered as a factor that interrupts the individual's need for competence and autonomy. Situations involving novelty may create uncertainty and expectation of failure in the individual, and this may weaken the individual's beliefs about his/her own competence (Ryan et al., 2022). At the same time, individuals' fear of different experiences may be a factor that may negatively affect the need for autonomy.

University students will be in constant search, especially due to the developmental period they are in. However, their fear of new situations will negatively affect this whole process and create a deficiency (Hendrick et al., 2023). This deficiency is related to structures such as self-doubt and fear of failure. Especially university students with low competence level may perceive new situations as risky and challenging (Zhou & Li, 2023). When faced with a new situation or opportunity, if their belief in their coping skills is weak, this may trigger their perception of "I cannot succeed" and fear of failure. Neophobia may also include a perception that individuals will experience a loss of control in the face of unknown situations. Individuals with low levels of competence may weaken the individual's confidence in their own judgement, intuition, and competence in the face of new situations. This situation may increase self-doubt in university students. Because self-doubt means that the individual experiences indecision about his/her capacity for success

and questions his/her own cognitive and emotional resources (Duru et al., 2023). Neophobia may trigger this questioning because the individual may worry that his/her internal resources will be insufficient in a situation he/she has not encountered before. According to the findings of the study, a significant relationship was observed between fear of failure and self-doubt. This finding is directly related to the fragility of SDT's need for competence (Müller et al., 2021). Fear of failure reinforces the individual's beliefs that he/she is not enough. This belief causes the individual to develop doubts not only about success but also about his/her own self. Although fear of failure may seem like an expectation of external situations, it may become internalized in students over time and turn into self-evaluation schemes such as "I cannot do it anyway, I am not enough."

The unmet need for competence and autonomy among university students may be associated with lower levels of intrinsic motivation and a tendency toward more externally regulated behaviors. According to the findings obtained from the study, fear of failure and self-doubt were significantly associated with AI dependency, while neophobia showed only indirect associations. When evaluated within the scope of self-determination theory, such an orientation overlaps with external regulation or introjected regulation type of motivation (Ryan & Deci, 2000a). Rather than intrinsic motivation, the individual may act out of a desire for control and a desire to ensure success. These results suggest that, within the limits of this cross-sectional model, AI dependency tendencies may be statistically associated with unmet psychological needs rather than only technological competence or usage habits. In this context, the tendency toward AI may be linked to a way of temporarily transferring autonomy and competence to an external system when the individual does not feel competent in decision-making or problem-solving processes (Howard et al., 2021). Especially in university students, where the sense of competence is fragile, the use of AI can become a form of reassurance. This pattern may indicate that, in this sample, the use of AI is perceived more as a psychological anchor than a cognitive facilitator, thus turning into a motivational defense strategy (Xia et al., 2022). Similarly, university students who have problems with the need for autonomy may try to delegate responsibility to AI because they cannot take decisions and responsibilities on their own (Paumier & Chanal, 2022). Therefore, it can be said that university students, whose competence and autonomy needs are not satisfied, tend to position AI not only as a cognitive support tool, but also as a psychological safety mechanism and an approving external authority to which they can delegate decision-making responsibility.

Limitations and Directions for Future Research

Despite the significant findings obtained from the research, this study has some limitations. Firstly, because of the cross-sectional nature of the study, causal inferences cannot be drawn; thus, the observed mediation should be interpreted as correlational rather than directional. Therefore, future studies should focus on longitudinal and experimental studies. Secondly, given the use of self-report measures, social desirability and self-perception biases may have influenced participants' responses, particularly on sensitive constructs such as self-doubt. Therefore, interview-based qualitative research and non-self-report scales can be used in future research. Thirdly, as the research sample consisted predominantly of university students, the generalizability of the findings to other age groups, sociocultural contexts, or educational levels may be limited. Comparative studies could explore whether similar mediational mechanisms exist in professional or non-academic populations. Additionally, the sample mainly consisted of young adults and predominantly female

participants (77.4%), which limits the generalizability and representativeness of the findings. These demographic characteristics may also preclude a comprehensive examination of potential gender-related and age-related variations. The psychological and behavioral mechanisms linking fear of innovation, fear of failure, self-doubt, and AI dependency may differ across age groups and genders. Therefore, future research should include more balanced and diverse samples and consider gender as a moderating variable to determine whether the observed associations remain consistent across different demographic contexts. Finally, AI dependency is a new field and the theoretical scope and validity of the scales used in this field may need to be re-evaluated over time. These limitations require careful interpretation of the findings of the study. For these reasons, it is recommended that the scale be used in different groups in future studies. Additionally, future research should employ multi-method approaches, such as behavioral or physiological indicators of dependency, to validate the findings.

Implications

In addition to its limitations, there are some practical suggestions within the scope of this study. Within this specific model and based on this data, the findings indicate that fear of novelty alone is not associated with AI dependency, but it may be related to this dependency through the individual's cognitive expectations about failure and self-doubts. Therefore, it is suggested that intervention and prevention strategies for technological dependencies should focus on the individual's cognitive evaluations of innovation and failure and internal confidence building. In this context, it may be important for practitioners and professionals working in educational settings to assess not only students' technology use but also their motivational profiles. Developing skills to cope with fear of novelty, working with self-doubt and strengthening the perception of competence in psychoeducation programmes may contribute to the more functional and healthy use of tools such as AI.

Beyond the psychological dimension, the findings provide valuable insights for both educational design and software development. The relationship between fear of innovation and self-doubt with dependency tendencies demonstrates that learning environments should be structured to encourage gradual independence rather than complete reliance on AI. For example, educators can use adaptive feedback systems to guide students toward problem solving rather than providing immediate answers, thus sustaining cognitive engagement and preventing passive dependency. For software design, these results highlight the importance of developing user-centered AI systems that recognize patterns of excessive dependency and encourage users to re-engage their own reasoning and self-regulation skills. Integrating metacognitive feedback, or "reflective use," prompts into AI-based educational tools can support more conscious and autonomous interactions, enabling technology to play a role that facilitates learning rather than replacing it.

From an education policy perspective, the findings also highlight the need for educational institutions and policymakers to develop frameworks that encourage the responsible integration of AI into learning environments. Policies should aim to establish clear standards that prevent students from becoming overly dependent on AI tools, while also ensuring that these technologies genuinely enhance learning, creativity, and personal development. Integrating AI literacy, technopedagogical domain knowledge, Web 2.0 applications, ethical awareness, and competency development initiatives into the educational curriculum

can help strike a balance between innovation and psychological well-being and ensure that AI serves as an empowering rather than an avoidant tool.

Finally, the findings contribute theoretically by addressing AI dependency within the framework of competence and autonomy needs. Consistent with SDT, the full mediation observed in this study indicates that unmet competence and autonomy needs may drive excessive AI dependency. Therefore, interventions should focus on strengthening individuals' self-efficacy and self-regulation capacities and ensure that AI functions as an empowerment tool rather than a psychological compensatory mechanism.

Conclusion

Nowadays, the increasingly widespread use of AI in educational settings makes it important to understand individuals' psychological tendencies toward these technologies. In this study, the relationships between fear of innovation, fear of failure, self-doubt, and AI dependence in university students were examined. The findings indicate that there are significant relationships between the variables and that fear of failure and self-doubt fully mediate the relationship between fear of novelty and AI dependency. Moreover, the findings suggest that individuals' orientation toward AI may be related not only to their cognitive needs but also to their psychological needs. In particular, the link between fear of novelty and AI addiction through its relationships with self-doubt and fear of failure suggests that motivational dynamics in this field involve more complex structures. The results suggest that individuals' relationship with technology may be related not only by instrumental but also by emotional and cognitive representations. In this context, it can be suggested that making efforts to address university students' competence and autonomy needs may also affect their interactions with new technologies. However, the cross-sectional nature of the study limits inferences the direction of the relationships between variables. Future longitudinal and experimental research with individuals at different developmental stages may reveal the development of these relationships over time and their possible effects in more detail. In addition, comparative studies in different cultural contexts may also contribute to a broader understanding of attitudes towards AI.

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Data Availability Data will be available on request.

Declarations

Ethics Approval This research was ethically approved by Yıldız Technical University Institute of Social Sciences Ethics Committee with document number 007823.

Consent to Participate Informed consent was obtained from all the individual participants that were included in the study.

Pre-registration Statement This study was not pre-registered.

Conflict of interest The authors declare no conflict of interest.

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