

From Perceived AI Threat to Future Anxiety: The Mediating Role of Intolerance of Uncertainty in A Multi-Regional Study From Türkiye

Prof. Dr. Derya BERRAK¹, Prof. Dr. Kürşat Şahin YILDIRIMER²

¹Northwest University, Department of Sociology Faculty Member / USA Orcid ID: 0000-0002-0601-2331

² November 15, Cyprus University – Cyprus Orcid: 0000-0001-5896-2956

ABSTRACT: In today's world, where technological transformation is accelerating, it has become important to examine the psychological effects of artificial intelligence (AI) on individuals not only through direct outcomes but also through the cognitive processes through which these effects are shaped. This study aims to examine the mediating role of intolerance of uncertainty in the relationship between perceived AI threat and future anxiety. The research was conducted with the participation of 682 university students from seven geographical regions of Türkiye and adopted an embedded mixed-method design in which quantitative data were supported by qualitative findings. Quantitative findings show that perceived AI threat significantly predicts future anxiety and that this relationship is partially explained through intolerance of uncertainty. Qualitative findings reveal how this statistical relationship is constructed at the experiential level. Participant statements indicate that AI is interpreted not only as a threat to employment but also as a source of uncertainty that increases the unpredictability of the future. The themes of "loss of foresight," "difficulty in planning," and "cognitive fog" indicate that perceived threat does not directly transform into anxiety; rather, it operates through a process that weakens individuals' capacity to anticipate and control the future. These findings suggest that explaining the relationship between technological transformation and anxiety through a linear model may be limited and that the experience of uncertainty may function as a central mechanism in this process. In this respect, the study points to the importance of supporting not only technical skills but also the capacity to cope with uncertainty in technological adaptation processes.

KEYWORDS: Artificial intelligence threat perception, future anxiety, intolerance of uncertainty, mixed methods, technological transformation

INTRODUCTION

Rapid developments in artificial intelligence and automation technologies are fundamentally transforming the structure of working life. In particular, studies on the automation risk of occupations reveal that a significant proportion of existing jobs are under the threat of transformation. For example, Frey and Osborne (2017) show that approximately 47% of jobs in the United States are at high risk of automation. Such findings indicate that technological transformation directly affects not only production processes but also individuals' expectations regarding their professional futures.

The reflections of this transformation at the individual level are becoming increasingly visible. While AI-based technologies are evaluated as new opportunities by some individuals, they are perceived by others as a serious threat in terms of job security and career continuity. Existing studies show that perceived technological threat can increase individuals' anxiety about their future (Brougham & Haar, 2018). However, a significant part of this literature addresses this relationship through direct effects and explains in a limited way the processes through which this effect emerges.

This situation reveals the need for approaches that explain not only the existence of the relationship between technological transformation and future anxiety but also how this relationship is formed. Existing studies focus mostly on direct effects rather than explaining the mechanisms through which this relationship operates. In this context, the question of why perceived AI threat produces higher levels of anxiety in some individuals while not producing a similar effect in others remains to be explained.

Accordingly, this study aims to examine the relationship between perceived AI threat and future anxiety by taking into account the psychological mechanisms underlying this relationship. Conducted in the context of Türkiye, this research aims to contribute to the literature by focusing on the processes that explain the effect of perceived technological threat on individuals' future anxiety.

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THEORETICAL FRAMEWORK

Perceived Artificial Intelligence Threat and Future Anxiety

The transformation created by artificial intelligence-based technologies in the labor market directly affects individuals' perceptions of their professional futures. It has been shown that technological change transforms not only the structure of employment but also individuals' subjective perceptions of security. In this context, perceived artificial intelligence threat may increase individuals' sense of uncertainty regarding job security, income continuity, and social status (Brougham & Haar, 2018; Nam, 2019).

However, a significant portion of existing studies addresses this relationship through direct effects and remains insufficient in explaining variations among individuals. The fact that some individuals develop high levels of anxiety under the same technological transformation conditions while others show more limited reactions indicates that this relationship cannot be explained solely by external conditions. This suggests that the impact of perceived technological threat on individuals is closely related to how individuals evaluate this situation.

Intolerance of Uncertainty

The intolerance of uncertainty approach provides an important theoretical framework for explaining how individuals evaluate uncertain and unpredictable situations. According to this perspective, while some individuals perceive uncertain situations as tolerable, others perceive them directly as threats, and this mode of evaluation significantly affects their levels of anxiety (Carleton, 2016).

This perspective indicates that perceived artificial intelligence threat may operate not by directly producing anxiety, but through individuals' relationship with uncertainty. In other words, the uncertainty created by technological transformation is processed differently by individuals, and this cognitive evaluation process leads to differences in anxiety levels. Based on this theoretical framework, the present study proposes that the relationship between perceived artificial intelligence threat and future anxiety is established through a mechanism operating via intolerance of uncertainty.

Türkiye, as a context in which the transition of a young population into the labor force involves uncertainties and technological transformation is accelerating, provides an analytical setting in which this relationship becomes more visible. In this respect, the study aims to contribute to the literature by offering both a theoretical and contextual perspective on the relationship between technological transformation, uncertainty, and anxiety.

RESEARCH QUESTIONS AND HYPOTHESES

Research Questions

RQ1: Is there a significant relationship between perceived artificial intelligence threat and future anxiety?

RQ2: Does perceived artificial intelligence threat significantly predict intolerance of uncertainty?

RQ3: Does intolerance of uncertainty significantly predict future anxiety?

RQ4: Does intolerance of uncertainty play a mediating role in the relationship between perceived artificial intelligence threat and future anxiety?

Hypotheses

It has been shown that the effects of technological transformation on job security negatively influence individuals' expectations about the future (Brougham & Haar, 2018). In this context, perceived artificial intelligence threat is expected to increase individuals' future anxiety.

H1: As perceived artificial intelligence threat increases, individuals' levels of future anxiety increase.

Perceived artificial intelligence threat may lead individuals to evaluate the future as unpredictable and uncontrollable. This may increase the level of intolerance of uncertainty.

H2: As perceived artificial intelligence threat increases, individuals' intolerance of uncertainty increases.

The intolerance of uncertainty approach suggests that individuals' evaluation of uncertain situations as threats increases their levels of anxiety (Carleton, 2016). Accordingly, individuals with higher levels of intolerance of uncertainty are expected to experience higher levels of future anxiety.

H3: As intolerance of uncertainty increases, individuals' future anxiety increases.

Perceived artificial intelligence threat may operate not by directly producing anxiety, but through individuals' relationship with uncertainty. In this respect, intolerance of uncertainty is expected to play a mediating role in this relationship.

H4: Intolerance of uncertainty plays a partial mediating role in the relationship between perceived artificial intelligence threat and future anxiety.

PURPOSE OF THE STUDY

The primary aim of this study is to examine the relationship between perceived artificial intelligence threat and future anxiety, and to test the mediating role of intolerance of uncertainty in this relationship. The study aims to go beyond the existing literature that

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addresses the impact of technological transformation on individuals at the level of direct outcomes, and instead to explain the mechanism through which this relationship is established. In this respect, the research seeks to contribute to the literature by offering a mechanism-based explanation of the relationship between artificial intelligence–driven transformation, uncertainty, and future anxiety.

METHOD

Research Design

This study was designed to examine the relationship between perceived artificial intelligence threat and future anxiety, and the mediating role of intolerance of uncertainty in this relationship. An embedded mixed-method design was adopted, in which quantitative data constituted the main analytical framework and qualitative data obtained through open-ended questions were used to deepen these findings.

The quantitative component is based on a cross-sectional and explanatory research design aimed at testing the relationships among variables. Within the research model developed in this context, perceived artificial intelligence threat was positioned as the independent variable, future anxiety as the dependent variable, and intolerance of uncertainty as the mediating variable. Age, gender, department, and class level were included in the model as control variables in order to account for potential confounding effects. This research design was structured not only to examine the effect of perceived technological threat on future anxiety through direct relationships, but also to explain the psychosocial mechanism through which this relationship is established. The full content of the questionnaire and the scale items used in the study are presented in Appendix A.

Participants and Sample

The sample of the study consists of a total of 682 university students ($N = 682$) enrolled in public and private universities across seven different geographical regions of Türkiye. In the sampling process, convenience sampling and snowball sampling methods were used together in order to increase diversity and enable access to different social networks. The primary rationale for selecting university students as the focal group is that this group is in the transition process to the labor market and is directly exposed to the effects of artificial intelligence–based technological transformation. The age range of the participants varies between 18 and 30. This distribution includes not only individuals who continue undergraduate education within the traditional age range, but also students who continue their education at different stages, those enrolled in a second university program, or those whose education has been prolonged for various reasons. This situation reflects the heterogeneous structure of the sample and provides an analytical opportunity to examine how perceived technological threat and future anxiety are shaped across different educational and life stages. In this respect, the sample offers an extended analytical framework by including not only the typical university student age group but also individuals who experience diverse educational trajectories.

Data Collection Instruments

The data collection instrument used in the study is a structured questionnaire developed within the scope of the research and consisting of a total of 51 items. The average completion time of the questionnaire is 7–10 minutes. The items measuring perceived artificial intelligence threat, future anxiety, and intolerance of uncertainty were structured using a 5-point Likert-type scale (1 = Strongly disagree, 5 = Strongly agree). Demographic variables were measured using categorical and multiple-choice formats, while psychosocial items were designed as rating-based statements aimed at determining participants' levels of perception. Open-ended questions were structured to allow participants to express their views freely.

Measurement Scales

Perceived Artificial Intelligence Threat (12 items)

This scale was developed within the scope of the study to measure individuals' perceptions regarding the effects of artificial intelligence on the labor market, career opportunities, and individual competence. During the scale development process, an item pool was created to assess perceived artificial intelligence threat, drawing on relevant literature (e.g., Brougham & Haar, 2018; Nam, 2019). The items in the initial form were evaluated by field experts in terms of content validity, and necessary revisions were made based on their feedback. Exploratory factor analysis (EFA) results indicated that the scale has a single-factor structure, explaining 58.4% of the total variance. The resulting factor structure suggests that the construct represents a holistic dimension. Confirmatory factor analysis (CFA) is recommended for future studies. The scale includes statements related to the evaluation of technological transformation as a threat or opportunity by individuals. Reverse-coded items in the scale were recoded prior to analysis.

Future Anxiety (10 items)

The future anxiety scale consists of items designed to measure individuals' concerns regarding economic uncertainty, job acquisition, loss of control, and negative expectations about the future. The scale evaluates individuals' general level of future anxiety within a multidimensional structure.

Intolerance of Uncertainty (8 items)

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Intolerance of uncertainty is conceptualized as a construct that measures individuals' cognitive and emotional responses to uncertain situations. The scale includes items reflecting dimensions such as the tendency to perceive uncertainty as a threat, sensitivity to unpredictability, and the need for control.

Psychosocial Effects (9 items)

Psychosocial effect items were developed to assess perceptions of the emotional and social impacts of artificial intelligence on individuals. These items were used in descriptive analyses and were not included in the main research model.

Demographic Information (6 items)

In the demographic section, information regarding participants' characteristics such as age, gender, department, and class level was collected using multiple-choice and categorical formats.

Open-Ended Questions (6 items)

Through open-ended questions, participants' subjective evaluations, expectations, and concerns regarding artificial intelligence and technological transformation were obtained as qualitative data. This section was designed to support the interpretation of quantitative findings.

Procedure and Ethical Considerations

The study was conducted by an international and interdisciplinary research team in collaboration with Northwest University and November 15, Cyprus University. The overall coordination and scientific supervision of the project were carried out by Prof. Dr. Derya Berrak and Prof. Dr. Kürşat Şahin Yıldırım. The research team consisted of academics and researchers from different disciplines, and the other team members (Prof. Dr. Halise Heves Özyılmaz, Dr. Aydemir Bozkaya, and Research Assistant Deniz Gönüllü) actively contributed to the data collection, analysis, and reporting processes. The data collection process was carried out by reaching participants studying at different universities through both face-to-face and online methods. The process was conducted in four stages: (1) questionnaire development and literature-based item generation, (2) evaluation of content validity through expert review, (3) pilot implementation, and (4) main data collection. The entire research process lasted 13 months and was completed between February 2025 and March 2026. During the scale development process, the item pool was evaluated by three experts from the fields of Sociology, Psychology, and Computer Science to ensure content validity, and necessary revisions were made. Prior to the main data collection, an online pilot study was conducted between July and August 2025 with an independent group of 50 participants. Pilot participants were selected through convenience sampling among undergraduate students studying at different universities in Türkiye. In this stage, the clarity of the items, item performance, and internal consistency levels were evaluated. Preliminary analyses indicated that item factor loadings were above .40 and Cronbach's Alpha values were within acceptable ranges. Based on these findings, some items were revised in terms of wording and expression, and the final scale form was determined accordingly. Pilot data were not included in the main analyses. In order to assess the temporal stability of the measurement instruments, test-retest analysis was conducted for all psychometric scales used in the study. For this purpose, the same measurement instruments were re-administered to 50 participants, selected independently from the pilot group, with a four-week interval. Participant matching was ensured through anonymous codes, and data confidentiality was maintained. Test-retest data were not included in the main analyses. The correlation coefficients between the two measurements ranged between $r = .80$ and $.90$. Full compliance with ethical principles was ensured throughout the research process. During data collection, participants were informed about the purpose of the study, and it was clearly stated that participation was entirely voluntary. Informed consent was obtained from all participants. No identifying information was collected, and the data were obtained anonymously and used solely for scientific research purposes. Data confidentiality and security were ensured, and no data were shared with third parties. The study was conducted with the approval of the relevant ethics committee (Decision No: 2025/73-121, Date: 11.11.2024).

Validity and Reliability Analyses

The construct validity of the scales used in the study was tested through Exploratory Factor Analysis (EFA). The results indicated that the dataset was suitable for factor analysis ($KMO = .89$; Bartlett's Test of Sphericity: $\chi^2 = 8423.51$, $p < .001$). The findings revealed that the scales exhibited single-factor structures, with total variance explained rates of 58.4% for perceived artificial intelligence threat, 61.2% for future anxiety, and 55.7% for intolerance of uncertainty.

When the internal consistency coefficients (Cronbach's Alpha) were examined, they were calculated as $\alpha = .88$ for perceived artificial intelligence threat, $\alpha = .91$ for future anxiety, and $\alpha = .86$ for intolerance of uncertainty. Item-total correlations were found to be above .30, and split-half reliability coefficients were at high levels. To evaluate the temporal stability of the scales, a test-retest procedure was conducted with a subgroup of 50 participants selected from the sample, with a four-week interval between measurements. The correlation coefficients between the two measurements ranged between $r = .80$ and $.90$. These findings indicate that the measurement instruments have a high level of reliability. Detailed statistics regarding the factor structures and reliability values of the scales are presented in Table 1.

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Data Analysis

Data analyses were conducted using SPSS 26.0. Within the scope of the analysis process, descriptive statistics were first calculated, and Pearson correlation analysis was applied to examine the relationships between variables. Multiple linear regression analysis was conducted to determine the effects of independent variables on the dependent variable. To test the mediating relationship proposed in the research model, the PROCESS Macro (Model 4) developed by Hayes (2018) was used, and the significance of indirect effects was evaluated using 5000 bootstrap samples. Prior to analysis, the dataset was examined for outliers; extreme values were removed based on Mahalanobis distance and z-scores. Skewness and kurtosis values of the variables were found to be between -1.5 and +1.5, indicating that the assumption of normal distribution was met. To assess multicollinearity, VIF and tolerance values were examined; VIF values were below 10 and tolerance values were above 0.10, confirming that there was no multicollinearity problem. To control for the risk of common method bias, both procedural and statistical measures were taken. Procedurally, item order in the questionnaire was randomized and reverse-coded items were included. Statistically, Harman's single-factor test (Harman, 1976) was conducted; the results showed that a single factor did not account for the majority of the total variance, indicating that common method bias did not pose a serious threat.

Qualitative Data Analysis

The qualitative data obtained from open-ended questions were analyzed using content analysis. During the analysis process, codes were compared iteratively, and relationships between themes were reorganized based on the logic of constant comparative analysis. The coding process was terminated when thematic saturation was reached.

The data were systematically coded, similar codes were grouped together to form themes, and the resulting themes were used to deepen the interpretation of quantitative findings. When deemed necessary, direct quotations from participant statements were included.

This analytical approach aims to reveal how the relationship between perceived artificial intelligence threat and future anxiety is shaped not only through direct effects but also through indirect (mediating) processes.

Table 1. Factor Structure and Reliability Results of the Scales

Scale	Number of Items	KMO	Bartlett's χ^2	Explained Variance (%)	Cronbach's α	Item–Total Correlation (min–max)
Perceived AI Threat	12	.87	2563.41***	58.4	.88	.34 – .71
Future Anxiety	10	.90	2987.62***	61.2	.91	.38 – .76
Intolerance of Uncertainty	8	.85	1872.15***	55.7	.86	.32 – .69

***p < .001

DATA COLLECTION PROCESS AND DATA ANALYSIS

The data collection and analysis process of the study was carried out within a systematic and staged structure. The study consists of a series of planned steps ranging from the development of the conceptual framework to data analysis, and each stage was structured to serve the development and testing of the research model. The stages and timeline of the research process are presented below.

Table 2. Research Process and Analysis Stages

Research Stages	Start Date	End Date	Description
Literature review and development of conceptual framework	February 2025	April 2025	Research model was developed and variables were identified
Scale development and item pool creation	April 2025	June 2025	Literature-based item pool was created and the initial form was prepared
Expert review and content validity assessment	June 2025	July 2025	Scale items were evaluated by field experts
Pilot implementation	July 2025	August 2025	Clarity of the scales was tested and necessary revisions were made
Main data collection process	September 2025	January 2026	Data were collected from different regions of Türkiye
Data cleaning and preliminary analyses	January 2026	February 2026	Missing data, outliers, and data suitability were analyzed

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Statistical analyses (SPSS & PROCESS)	February 2026	March 2026	Correlation, regression, and mediation analyses were conducted
Interpretation of findings and reporting	March 2026	March 2026	Findings were analyzed and the manuscript writing process was completed

RESULTS

Demographic Findings

The demographic characteristics of the participants are presented in Table 3. The sample exhibits a balanced and analytically interpretable distribution in terms of key demographic variables. When the gender distribution is examined, it is observed that 52.3% of the participants are female ($n = 357$) and 47.7% are male ($n = 325$). This distribution indicates that the sample has a balanced gender structure and limits the risk of gender-based bias in the analyses. In terms of age groups, participants are distributed across the ranges of 18–20, 21–23, and 24–30 years, with the 21–23 age group representing the largest proportion of the sample at 41.6%. This finding indicates that individuals who are at the final stage before graduation and on the threshold of entering the labor market are prominently represented in the study. At the same time, the inclusion of the 24–30 age group demonstrates that the university student population is not limited to individuals within the traditional age range. It also includes those who continue their education at different stages, those enrolled in a second university program, or those whose education has been prolonged for various reasons. This diversity adds analytical depth to the study by enabling the examination of how perceived technological threat and future anxiety are experienced across different educational and life stages.

When educational status is examined, it is determined that all participants are enrolled at the undergraduate level and that participation was obtained from different class levels. This indicates that the sample is both homogeneous in terms of educational level and representative of different stages within the educational process.

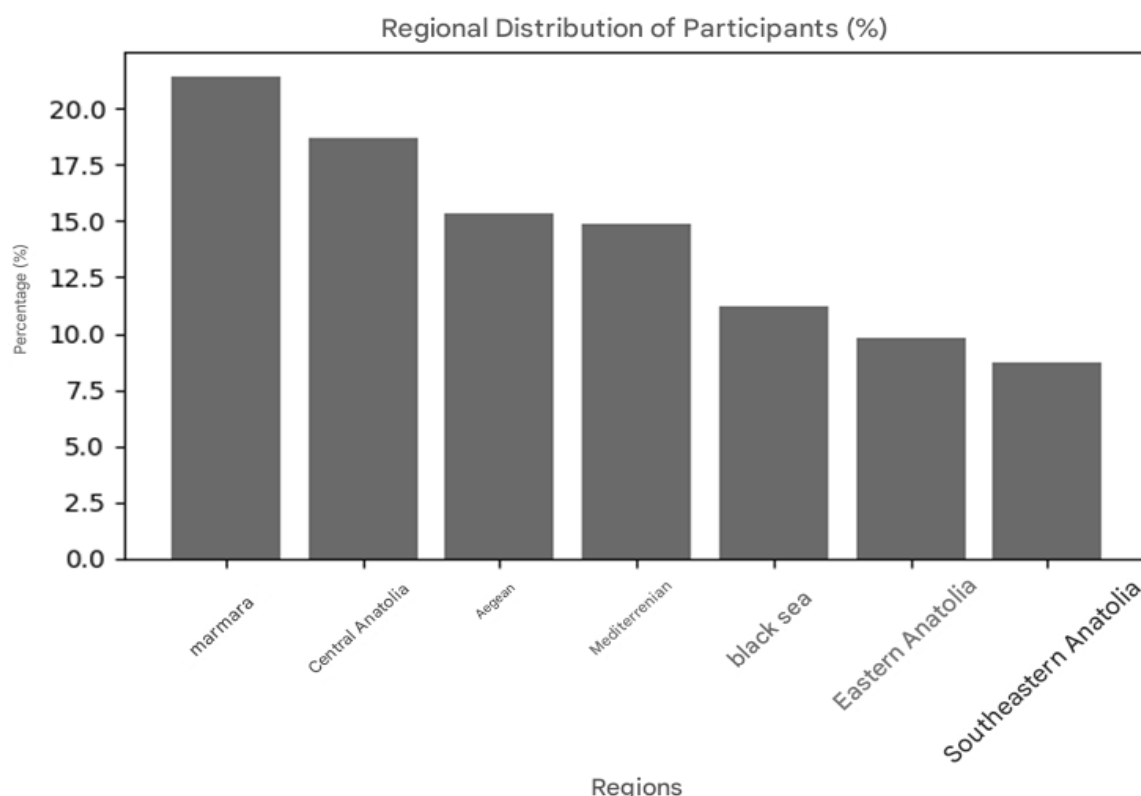
Table 3. Demographic Characteristics of Participants (N = 682)

Variable	Category	n	%
Gender	Female	357	52.3
	Male	325	47.7
Age Group	18–20	198	29.0
	21–23	284	41.6
	24–30	200	29.3
Class Level	1st year	168	24.6
	2nd year	174	25.5
	3rd year	169	24.8
	4th year	171	25.1
Regional Distribution	Marmara	146	21.4
	Central Anatolia	128	18.7
	Aegean	104	15.3
	Mediterranean	102	14.9
	Black Sea	76	11.2
	Eastern Anatolia	67	9.8
	Southeastern Anatolia	59	8.7
Total		682	100.0

In terms of regional distribution, the research was conducted to cover seven geographical regions of Turkey. Participants came from the Marmara (21.4%), Central Anatolia (18.7%), Aegean (15.3%), Mediterranean (14.9%), Black Sea (11.2%), Eastern Anatolia (9.8%), and Southeastern Anatolia (8.7%) regions. This distribution shows that the sample exhibits a balanced structure in terms of geographical diversity. Furthermore, the inclusion of all geographical regions in the sample provides an opportunity to examine not only whether structures such as technological threat perception and future anxiety are specific to a particular region, but also how they exhibit a pattern throughout Turkey. A visual presentation of the regional distribution is shown in Figure 1.

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Figure 1.



Correlation Analyses

Pearson correlation analysis was conducted to examine the relationships among the main variables of the study. The results are presented in Table 4.

The findings indicate that perceived artificial intelligence threat is positively and significantly associated with future anxiety ($r = .52, p < .001$) and intolerance of uncertainty ($r = .47, p < .001$). In addition, intolerance of uncertainty is positively and significantly related to future anxiety ($r = .58, p < .001$).

These results suggest that higher levels of perceived artificial intelligence threat are associated with increased levels of both intolerance of uncertainty and future anxiety. Similarly, individuals with higher intolerance of uncertainty tend to report higher levels of future anxiety.

Furthermore, all correlation coefficients are below the threshold value of .70, indicating that multicollinearity is not a concern and that each variable represents a distinct construct within the model.

Table 4. Correlations and Descriptive Statistics of Variables

Variables	Mean (M)	SD	1	2	3
1. Perceived AI Threat	3.42	0.74	—		
2. Intolerance of Uncertainty	3.58	0.69	.46***	—	
3. Future Anxiety	3.71	0.72	.52***	.58***	—

**N = 682, *p < .001

Pearson correlation analysis was conducted to examine the relationships among the variables included in the study. The means, standard deviations, and correlation coefficients are presented in Table 4.

The results indicate a positive and statistically significant relationship between perceived artificial intelligence threat and future anxiety ($r = .52, p < .001$). This finding suggests that perceiving artificial intelligence as a threat tends to increase individuals' levels of future anxiety. Similarly, a moderate positive and significant relationship was found between perceived artificial intelligence threat and intolerance of uncertainty ($r = .46, p < .001$). This result suggests that technological transformation may strengthen individuals' perception of uncertainty and contribute to lower tolerance toward uncertain situations. The relationship between intolerance of uncertainty and future anxiety appears to be stronger ($r = .58, p < .001$). This finding supports the role of intolerance of uncertainty as an important psychological mechanism that increases individuals' future anxiety. The fact that all relationships among the variables are positive and significant indicates that the directions proposed in the research model are empirically

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supported. In addition, the correlation coefficients being below the threshold value of .70 suggests that the risk of multicollinearity is low. Consistently, VIF and tolerance values were within acceptable ranges, confirming that the assumptions required for regression analyses were met. Overall, the findings are consistent with the relationships proposed in the research model and provide an appropriate statistical basis for conducting mediation analysis.

Mediation Analysis (PROCESS Model 4)

To test the mediating role of intolerance of uncertainty in the relationship between perceived artificial intelligence threat and future anxiety, the PROCESS Macro (Model 4) developed by Hayes (2018) was used. The significance of indirect effects was evaluated using 5000 bootstrap samples, and a 95% confidence interval was applied. The results indicate that perceived artificial intelligence threat has a direct and significant effect on future anxiety ($\beta = .41$, $p < .001$). Additionally, the effect of perceived artificial intelligence threat on intolerance of uncertainty was found to be significant ($\beta = .46$, $p < .001$). The effect of intolerance of uncertainty on future anxiety was also strong and significant ($\beta = .49$, $p < .001$). When intolerance of uncertainty was included in the mediation model, the direct effect of perceived artificial intelligence threat on future anxiety decreased but remained significant ($\beta = .23$, $p < .001$).

This result indicates that intolerance of uncertainty plays a partial mediating role in the relationship. Bootstrap analysis results showed that the indirect effect was statistically significant ($\beta = .18$, $SE = .03$, 95% CI [.12, .25]). The fact that the confidence interval does not include zero confirms the significance of the mediation effect.

Overall, the findings demonstrate that perceived artificial intelligence threat affects individuals' future anxiety not only directly but also indirectly through intolerance of uncertainty. This result empirically supports the mediating mechanism proposed in the research model.

Table 5. Regression Results for the Mediation Model (PROCESS Model 4)

Dependent Variable	Predictor	β	SE	t	p	95% LLCI	95% ULCI
Intolerance of Uncertainty (M)	Constant	1.84	0.12	15.33	<.001	1.60	2.08
	Perceived AI Threat (X)	0.46	0.03	14.12	<.001	0.40	0.52
Future Anxiety (Y)	Constant	0.92	0.15	6.13	<.001	0.62	1.21
	Perceived AI Threat (X)	0.23	0.04	5.75	<.001	0.15	0.31
	Intolerance of Uncertainty (M)	0.49	0.04	12.25	<.001	0.41	0.57
Total Effect (X $\rightarrow$ Y)		0.41	0.04	10.25	<.001	0.33	0.49

Table 6. Bootstrap Results for Indirect Effect

Path	Effect	Boot SE	95% LLCI	95% ULCI
X $\rightarrow$ M $\rightarrow$ Y	0.22	0.03	0.16	0.28

Bootstrap samples = 5000; LLCI = Lower Limit Confidence Interval; ULCI = Upper Limit Confidence Interval

Mediation Analysis Results

The results indicate that the direct effect of perceived artificial intelligence threat on future anxiety remains significant; however, this effect decreases when intolerance of uncertainty is included in the model. This finding indicates the presence of partial mediation in the relationship. The indirect effect analysis shows that a substantial portion of the effect of perceived artificial intelligence threat on future anxiety occurs through intolerance of uncertainty ($\beta = 0.22$, 95% CI [0.16, 0.28]). When the proportion of the indirect effect relative to the total effect is examined, approximately 54% of the relationship is explained by this mediating mechanism. This finding suggests that the impact of technological transformation on individuals is shaped not primarily by direct threat perception, but by individuals' capacity to cope with the uncertainty generated by this threat.

Group Comparisons

Gender-Based Comparisons (t-Test)

The results of the independent samples t-test indicate that female participants have significantly higher levels of future anxiety compared to male participants ($t(680) = 2.87$, $p = .004$). Similarly, intolerance of uncertainty was found to be higher among female participants ($t(680) = 2.45$, $p = .015$). In contrast, no significant gender difference was found in perceived artificial intelligence threat ($t(680) = 1.12$, $p = .263$). This finding suggests that the perception of artificial intelligence as a threat is formed at similar levels across genders among university students; however, the psychological burden associated with this perception appears to be more pronounced among female participants.

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Table 7. Independent Samples t-Test Results by Gender

Variable	Gender	n	Mean ($\bar{X}$)	SD	t(df)	p
Future Anxiety	Female	357	3.98	0.86	2.87 (680)	.004
	Male	325	3.72	0.94		
Intolerance of Uncertainty	Female	357	3.65	0.72	2.45 (680)	.015
	Male	325	3.48	0.78		
Perceived AI Threat	Female	357	3.44	0.85	1.12 (680)	.263
	Male	325	3.37	0.81		

Comparisons by Age Groups (ANOVA)

The results of the one-way analysis of variance performed by age groups show that the levels of future anxiety differ significantly according to age ($F(2, 679) = 5.42, p = .005$). Post-hoc analyses (Tukey) reveal that participants in the 24–30 age group have a higher level of future anxiety compared to the 18–20 age group. This indicates that factors such as the prolonged transition process to the labor market, increased career uncertainty, and intensified time pressure may increase anxiety.

Regional Differences (ANOVA)

Analyses conducted by region show that the levels of perceived threat to artificial intelligence ($F(6, 675) = 3.84, p = .001$) and future anxiety ($F(6, 675) = 4.12, p < .001$) differ significantly according to geographical context. Post-hoc comparisons reveal that these differences are particularly pronounced between the Marmara region and regions with relatively lower technological intensity. The higher perception of threat in the Marmara region, in particular, can be associated with being closer to labor markets where technological transformation is intense. This finding shows that the impact of technological transformation on individuals is not limited only to individual assessment processes; it is also shaped by structural factors such as regional economic structure, technological exposure, and inequalities of opportunity.

Table 8. ANOVA Results by Age Group and Region

Variable	Source	F(df)	p	Post-Hoc
Future Anxiety	Age Group	5.42 (2, 679)	.005	24–30 > 18–20
Perceived AI Threat	Region	3.84 (6, 675)	.001	Marmara > Eastern Anatolia
Future Anxiety	Region	4.12 (6, 675)	<.001	Significant regional differences

Note. Post-hoc analyses were conducted using the Tukey test.

Content Analysis of Open-Ended Questions

To explain the indirect effects ($ab = .18$) identified in the quantitative model and the cognitive processes underlying the relationships between variables, the open-ended data were analyzed using the continuous comparative analysis method (Glaser & Strauss, 1967). The analysis process was terminated at the point where thematic saturation was reached; the coding process was carried out by two independent researchers, and the inter-coder reliability coefficient was found to be high (Holsti's $CR = .89$). This approach shows that the obtained themes have a structure that is not only interpretive but also analytically consistent. The participants' ways of understanding artificial intelligence exhibit a multi-layered structure beyond a one-dimensional threat perception. A total of 1,240 codes were grouped under four main themes (see Table 9).

Table 9. Analytical Categorization and Visibility Levels of Qualitative Codes

Main Theme	Subdimensions (Codes)	f	Analytical Level
Professional Devaluation	Degree invalidation, loss of expertise, competition	542	Concrete Threat
Cognitive Fog (Uncertainty)	Planning paralysis, loss of control, lack of foresight	418	Psychological Mechanism
Strategic Adaptation	New skills, flexibility, digital adaptation	165	Coping
Systemic Distrust	Ethical concerns, inequality, algorithmic control	115	Structural Critique

This distribution indicates that participants primarily define artificial intelligence in terms of concrete economic threats; however, the impact of these threats on individuals is largely structured through the experience of uncertainty. The thematic distribution of qualitative codes is presented in Figure 2. An examination of the figure shows that the theme of professional devaluation constitutes the largest proportion of the total codes (43.7%; $f = 542$), followed by the theme of cognitive fog (uncertainty) (33.7%; $f = 418$). In contrast, the themes of strategic adaptation (13.3%; $f = 165$) and systemic distrust (9.3%; $f = 115$) are represented to a more limited extent. This distribution suggests that participants primarily interpret artificial intelligence through concrete economic threats;

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however, the psychological impact of these threats on individuals is largely concentrated through the experience of uncertainty. Accordingly, the visual distribution provides qualitative support for the mediating relationship identified in the quantitative findings.

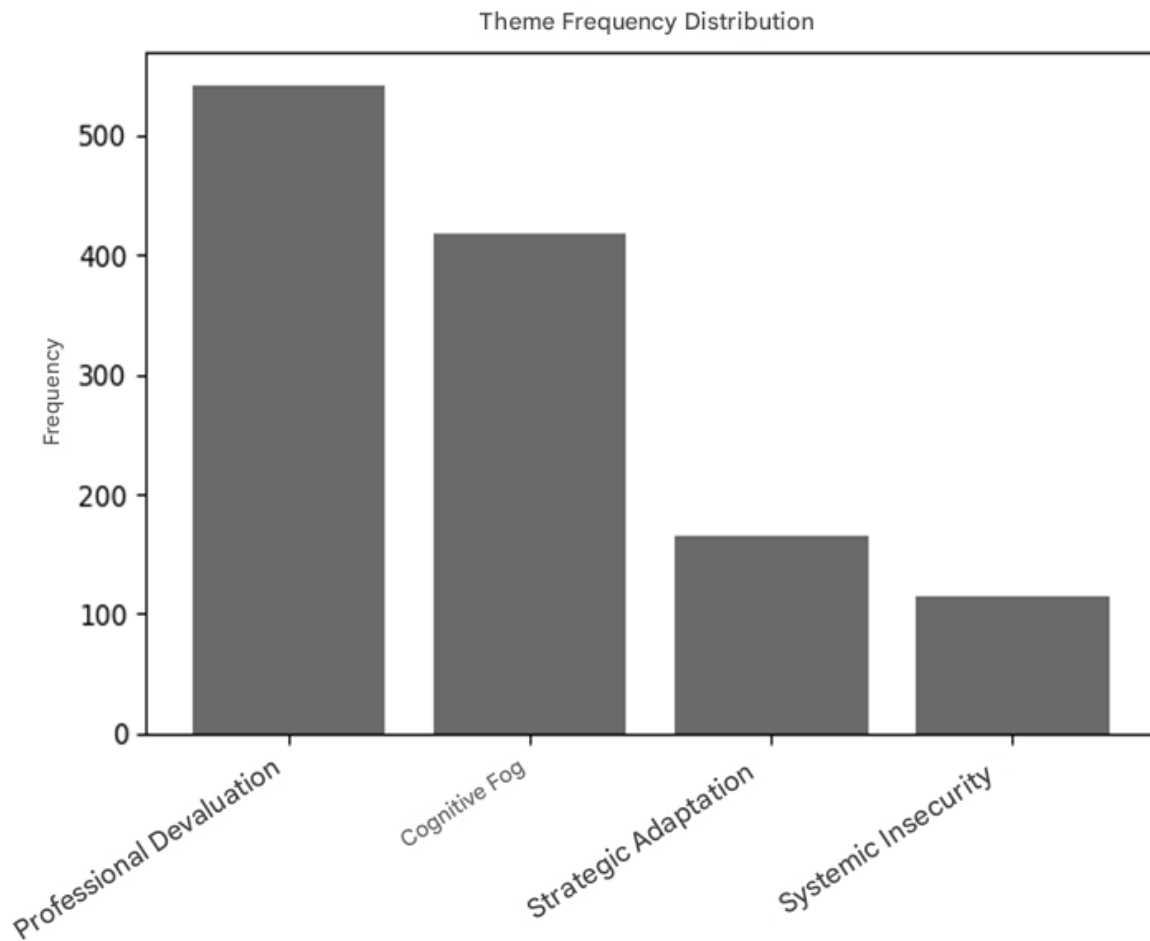


Figure 2 - Thematic distribution (%) of qualitative codes obtained from open-ended questions.

The analysis reveals that the variable "intolerance of uncertainty" in the quantitative model corresponds to a state that can be described as "cognitive fog" in the participants' experience. Statements under this theme indicate that the perceived threat from artificial intelligence does not directly generate anxiety, but rather weakens the individual's capacity to predict the future, transforming it into anxiety. Representative statements reflecting this process are presented below: "It's not just about losing my job; I can no longer predict what will remain valuable." (K-142, Engineering) "Planning becomes meaningless because we don't know which professions will survive." (E-312, Faculty of Economics and Administrative Sciences) "The real fear isn't unemployment, it's not knowing what to prepare for." (K-87, Education) These statements demonstrate that uncertainty is not merely a state, but a form of cognitive processing that influences an individual's decision-making processes. In this context, uncertainty emerges as a critical intermediary mechanism that transforms the perception of threat into anxiety. The conceptual mechanism developed based on qualitative findings is presented in Figure 3.

The model indicates that perceived artificial intelligence threat does not produce future anxiety directly; rather, it generates an indirect effect through individuals' experience of uncertainty. In particular, this intermediate process, conceptualized as "cognitive fog," operates through subcomponents such as loss of foresight, planning paralysis, and a weakening of perceived control.

The flow illustrated in the figure shows that perceived artificial intelligence threat is first processed by the individual as uncertainty, and this uncertainty subsequently transforms into future anxiety.

This visualization demonstrates that the mediating effect identified in the quantitative analysis ($\beta = .18$) corresponds to a process reflected in the qualitative data and conceptually clarifies the underlying logic of the relationships among variables. The model presented in Figure 3 offers an integrated interpretative framework developed through the integration of quantitative mediation analysis (PROCESS Model 4) with qualitative findings.

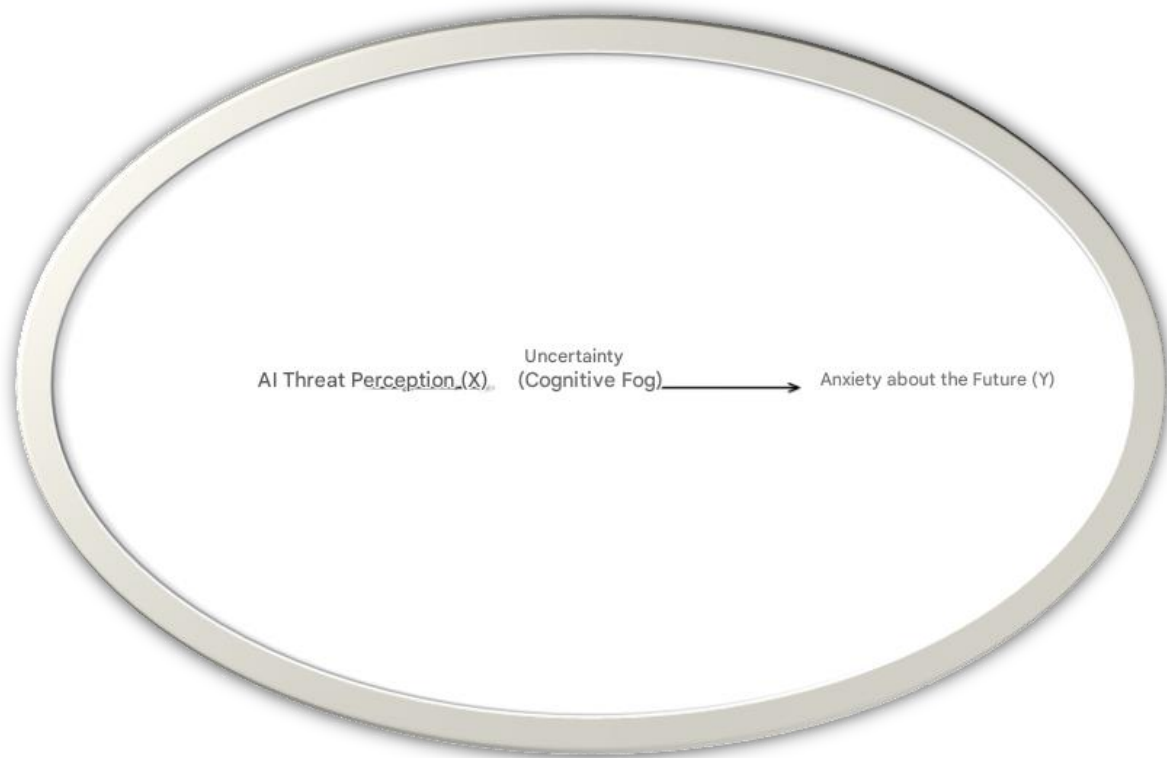


Figure 3. Mechanism Model

Perceived artificial intelligence threat and future anxiety: a mechanism operating through uncertainty (cognitive fog), supported by qualitative findings.

Qualitative analysis shows that participants interpret artificial intelligence within three main cognitive frameworks:

- Threat-Oriented Framework (f = 542):

AI is directly associated with job loss and competition; anxiety levels are high in this group.

- Uncertainty-Oriented Framework (f = 418):

A perception of threat exists, but the focus is on the unpredictability of the future. This framework constitutes the experiential counterpart of the mediation mechanism.

- Adaptation-Oriented Framework (f = 165):

AI is seen as a manageable transformation, and individual adaptation is prioritized.

This divergence shows that the fact that the same technological transformation produces different levels of anxiety in different individuals is related to how this threat is interpreted, rather than the perception of the threat itself. Qualitative findings provide consistent patterns supporting the mediation model revealed in quantitative analysis. Participants with particularly high levels of intolerance for uncertainty showed a more intense use of the themes of "uncertainty," "unpredictability," and "loss of control." When code frequencies and thematic densities are considered together, it becomes clear that the theme of uncertainty plays a linking role between threat perception and anxiety about the future. This indicates that the indirect effect ($\beta = .18$) obtained in the quantitative analysis is a process with a corresponding qualitative data. In this context, the qualitative analysis findings reveal that the effect of perceived threat from artificial intelligence on anxiety about the future is not direct, but rather structured through the experience of uncertainty. This finding shows that intolerance for uncertainty is not only an individual trait but also functions as a mechanism that transforms threat perception. In this respect, the qualitative findings not only support the quantitative results but also add theoretical depth to the research by explaining how this relationship is established at the cognitive and semantic levels.

DISCUSSION

This study examined how the relationship between perceived artificial intelligence threat and future anxiety is structured. The findings suggest that this relationship may not be explained solely by a direct effect, but may instead be linked to a process operating through the experience of uncertainty. The quantitative results indicate that there is a significant relationship between perceived artificial intelligence threat and future anxiety, and that intolerance of uncertainty may play a mediating role in this relationship. This suggests that technological change is evaluated by individuals not only in terms of concrete risks but also in terms of the

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unpredictability of the future. While existing studies generally address this relationship through direct effects (Brougham & Haar, 2018; Nam, 2019), the present findings indicate that uncertainty may function as a noteworthy mediating variable in this process. Qualitative findings provide a clearer understanding of how this relationship is experienced by individuals. Participants' expressions regarding difficulties in planning for the future and lack of foresight suggest that uncertainty is not only an external condition but also an experience associated with cognitive processes. In this context, uncertainty can be considered not merely as a factor accompanying threat perception, but as a component that plays a role in the relationship between threat perception and anxiety. The different patterns of interpretation identified in the study help explain why the same technological development may be associated with different levels of anxiety across individuals. While some participants evaluate artificial intelligence as a direct threat, others emphasize the dimension of uncertainty, and some consider it as a manageable transformation. This differentiation suggests that individual evaluative processes may be a determining factor in this relationship. The data obtained from across Türkiye indicate that this process should be considered within a broader contextual framework. Participation from different regions suggests that perceptions of technological transformation may vary depending on socio-economic conditions. In this respect, Türkiye provides a meaningful context for examining this relationship, given characteristics such as relatively high youth unemployment and rapidly advancing technological adaptation processes.

When the findings are considered together, it can be stated that future anxiety should not be understood solely as an individual trait, but as an experience related to how individuals interpret the transformation process they are embedded in. This highlights the importance of addressing technological change and psychological processes together. The study is based on a cross-sectional design. Therefore, the findings should be interpreted not as evidence of causal relationships, but as patterns of associations among variables.

CONCLUSION AND IMPLICATIONS

This study demonstrates that the relationship between perceived artificial intelligence threat and future anxiety may not be limited to concrete risks alone; rather, it may be substantially related to how individuals experience and process uncertainty. The findings indicate that the impact of technological transformation on individuals is closely associated not only with objective conditions but also with how these conditions are interpreted.

The multi-regional findings obtained within the context of Türkiye suggest that this relationship can be observed across different socio-economic conditions. Dynamics such as relatively high youth unemployment and the rapid acceleration of technological adaptation processes may contribute to making the experience of uncertainty more visible. This situation indicates that the psychological effects of technological transformation may be shaped through interaction with contextual conditions.

At the same time, the findings are not considered to be limited to Türkiye alone; rather, they may offer patterns that could be explanatory for other developing economies undergoing similar technological transformation processes. With the global expansion of artificial intelligence applications, the increasing level of uncertainty faced by individuals suggests that such psychological processes may emerge in similar ways across different societies. However, these potential generalizations need to be tested through comparative studies conducted in different cultural and economic contexts.

Within this framework, it is important for future research to examine the trajectory of these relationships over time using longitudinal designs and to conduct comparative analyses across different occupational groups and cultural contexts. Such studies are expected to contribute to a more comprehensive understanding of the effects of technological transformation on individuals.

From an applied perspective, approaches that focus solely on technical skills in adaptation processes to technological change may remain limited. Supporting individuals' capacities to cope with uncertainty, adapt, and develop cognitive flexibility may play an important role in this process. In this regard, it is recommended that educational institutions and policymakers develop holistic approaches that also take into account the psychosocial dimensions of technological transformation.

LIMITATIONS AND ETHICAL STATEMENT

This study has several limitations. First, as the study is based on a cross-sectional design, the findings should be interpreted in terms of relational patterns among variables rather than causal relationships. Second, the sample is limited to university students, which restricts the generalizability of the findings to different age groups and occupational groups. In addition, the use of self-report measures may introduce the risk of common method bias. Although this risk was addressed through procedural and statistical techniques, it cannot be assumed to have been completely eliminated. Finally, the study was conducted within the context of Türkiye, which suggests that the findings may exhibit different patterns in different cultural and economic contexts.

Ethical Approval: The study was conducted with the approval of the relevant ethics committee (Decision No: 2025/73-121, Date: 11.11.2025). National and international ethical standards were followed throughout the research process.

Informed Consent: Informed consent was obtained from all participants, and participation was entirely voluntary.

Confidentiality and Data Protection: No identifying information was collected; data were obtained anonymously and used solely for scientific purposes.

Conflict of Interest: The authors declare that there is no conflict of interest regarding this study.

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REFERENCES

- 1) Brougham, D., & Haar, J. (2018). Smart technology, artificial intelligence, robotics, and algorithms (STARA): Employees' perceptions of our future workplace. *Journal of Management & Organization*, 24(2), 239–257. <https://doi.org/10.1017/jmo.2016.55>
- 2) Carleton, R. N. (2016). Into the unknown: A review and synthesis of contemporary models involving uncertainty. *Journal of Anxiety Disorders*, 39, 30–43. <https://doi.org/10.1016/j.janxdis.2016.02.007>
- 3) Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, 114, 254–280. <https://doi.org/10.1016/j.techfore.2016.08.01>
- 4) Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Aldine.
- 5) Harman, H. H. (1976). *Modern factor analysis* (3rd ed.). University of Chicago Press.
- 6) Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2nd ed.). Guilford Press.
- 7) Nam, T. (2019). Technology usage, expected job sustainability, and perceived job insecurity. *Technological Forecasting and Social Change*, 138, 155–165. <https://doi.org/10.1016/j.techfore.2018.08.017>
- 8) Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903.

APPENDIX 2. SURVEY INSTRUMENT

The Role of Intolerance of Uncertainty in the Relationship Between Artificial Intelligence Threat Perception and Future Anxiety

INFORMED CONSENT FORM

Participation in this study is voluntary. Your responses are anonymous and will be used solely for scientific purposes.

☐ I agree to participate

☐ I do not agree to participate

GENERAL INSTRUCTIONS

Please select only one response for each statement.

Response Scale:

1 = Strongly Disagree | 2 = Disagree | 3 = Neutral | 4 = Agree | 5 = Strongly Agree

SECTION 1. DEMOGRAPHIC INFORMATION

No	Item	Response Options
1	Gender	☐ Female ☐ Male ☐ Other
2	Age	☐ 18–20 ☐ 21–23 ☐ 24–30
3	Marital Status	☐ Single ☐ Married
4	Type of University	☐ Public ☐ Private (Foundation)
5	Department	_____
6	Year of Study	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5+
7	Region	☐ Marmara ☐ Aegean ☐ Mediterranean ☐ Central Anatolia ☐ Black Sea ☐ Eastern Anatolia ☐ Southeastern Anatolia

SECTION 2. ARTIFICIAL INTELLIGENCE THREAT PERCEPTION

No	Statement	1	2	3	4	5
8	Artificial intelligence will eliminate many professions	☐	☐	☐	☐	☐
9	Artificial intelligence will make it harder to find a job	☐	☐	☐	☐	☐
10	Artificial intelligence will replace humans in many roles	☐	☐	☐	☐	☐
11	Artificial intelligence negatively affects my career plans	☐	☐	☐	☐	☐
12	Artificial intelligence reduces job security	☐	☐	☐	☐	☐

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13	Artificial intelligence creates opportunities (reverse-coded)	☐	☐	☐	☐	☐
14	Artificial intelligence is a threat to me	☐	☐	☐	☐	☐
15	Artificial intelligence will reduce the value of professions	☐	☐	☐	☐	☐
16	Artificial intelligence makes the job market more uncertain	☐	☐	☐	☐	☐
17	My future is at risk due to artificial intelligence	☐	☐	☐	☐	☐
18	The development of artificial intelligence worries me	☐	☐	☐	☐	☐

SECTION 3. FUTURE ANXIETY

No	Statement	1	2	3	4	5
19	I feel anxious about my future	☐	☐	☐	☐	☐
20	I am worried about finding a job	☐	☐	☐	☐	☐
21	My economic future concerns me	☐	☐	☐	☐	☐
22	I feel that I cannot control my future	☐	☐	☐	☐	☐
23	Uncertainty makes me uncomfortable	☐	☐	☐	☐	☐
24	I have fears about the future	☐	☐	☐	☐	☐
25	I am afraid that my plans will not come true	☐	☐	☐	☐	☐
26	The future makes me uneasy	☐	☐	☐	☐	☐
27	I experience fear of failure	☐	☐	☐	☐	☐
28	I cannot look to the future with confidence	☐	☐	☐	☐	☐
29	The direction of my life is uncertain	☐	☐	☐	☐	☐
30	My future plans are unclear	☐	☐	☐	☐	☐

SECTION 4. INTOLERANCE OF UNCERTAINTY

No	Statement	1	2	3	4	5
31	Uncertain situations make me uncomfortable	☐	☐	☐	☐	☐
32	Not being able to predict the future disturbs me	☐	☐	☐	☐	☐
33	Unknown situations are difficult for me	☐	☐	☐	☐	☐
34	Uncertainty creates anxiety	☐	☐	☐	☐	☐
35	Ambiguous situations make me uneasy	☐	☐	☐	☐	☐
36	Everything should be planned	☐	☐	☐	☐	☐
37	I have difficulty adapting to unexpected situations	☐	☐	☐	☐	☐
38	I avoid uncertainty	☐	☐	☐	☐	☐
39	I experience a sense of loss of control	☐	☐	☐	☐	☐
40	Uncertain environments stress me	☐	☐	☐	☐	☐
41	Clarity is very important to me	☐	☐	☐	☐	☐
42	I find it difficult to cope with uncertainty	☐	☐	☐	☐	☐

SECTION 5. PSYCHOSOCIAL EFFECTS

No	Statement	1	2	3	4	5
43	Artificial intelligence affects me psychologically	☐	☐	☐	☐	☐
44	Technological change creates stress	☐	☐	☐	☐	☐
45	I do not feel secure	☐	☐	☐	☐	☐
46	I am worried about my social future	☐	☐	☐	☐	☐
47	Technology makes me feel under pressure	☐	☐	☐	☐	☐
48	Digital transformation worries me	☐	☐	☐	☐	☐

SECTION 6. OPEN-ENDED QUESTIONS

No	Question
49	How do you think artificial intelligence will affect your future?
50	What is your biggest concern about the future?
51	Is there anything else you would like to add?

THANK YOU

Thank you for your participation.



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