

Structural Modeling of Generalized Anxiety Disorder Symptom Level Based on Positive and Negative Metacognitive Beliefs: The Mediating Role of Intolerance of Uncertainty among University Students

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ABSTRACT

Objective: The present study aimed to test a structural model of generalized anxiety disorder symptom level based on positive and negative metacognitive beliefs, with the mediating role of intolerance of uncertainty among university students.

Methods and Materials: This applied quantitative study used a descriptive-correlational design and structural equation modeling. The statistical population consisted of students at Islamic Azad University, Najafabad Branch, Iran. An initial sample of 300 students was selected using accessible purposive sampling, and 294 valid questionnaires were included in the final analysis. Data were collected using a demographic information form, the Metacognitions Questionnaire, the Intolerance of Uncertainty Questionnaire, and the Generalized Anxiety Disorder Scale. Data were analyzed using SPSS version 24 and AMOS version 24 through descriptive statistics, Pearson correlation coefficients, and structural equation modeling.

Findings: The structural model showed acceptable fit to the data: $\chi^2/df = 1.784$, NFI = .999, CFI = 1.00, IFI = 1.00, RMSEA = .057, and Hoelter = 289. Positive metacognitive beliefs did not have a significant direct effect on generalized anxiety disorder symptoms ($\beta = -.036$, $p = .358$), but they had a significant indirect effect through intolerance of uncertainty ($\beta = .016$, $p = .050$). Negative metacognitive beliefs had a positive and significant direct effect on generalized anxiety disorder symptoms ($\beta = .220$, $p = .011$) and also had a significant indirect effect through intolerance of uncertainty ($\beta = .081$, $p = .050$). Intolerance of uncertainty had a positive and significant direct effect on generalized anxiety disorder symptoms ($\beta = .186$, $p = .019$).

Conclusion: The findings support the mediating role of intolerance of uncertainty in the relationship between metacognitive beliefs and generalized anxiety disorder symptoms. Negative metacognitive beliefs appear to be a stronger direct predictor of generalized anxiety symptoms, whereas positive metacognitive beliefs may influence symptoms mainly through intolerance of uncertainty. These results highlight the importance of targeting dysfunctional metacognitive beliefs and intolerance of uncertainty in prevention and intervention programs for university students.

Keywords: generalized anxiety disorder; metacognitive beliefs; positive metacognitive beliefs; negative metacognitive beliefs; intolerance of uncertainty; structural equation modeling; university students.

1. Introduction

Generalized anxiety disorder is a persistent and impairing psychological condition characterized primarily by excessive, pervasive, and difficult-to-control worry concerning multiple areas of everyday life. Unlike situational anxiety, which typically arises in response to an identifiable and time-limited threat, generalized anxiety is marked by a sustained state of apprehension in which individuals repeatedly anticipate adverse outcomes even when the objective probability of those outcomes is unclear or relatively low. The worry associated with this condition may concern academic performance, health, finances, family relationships, occupational responsibilities, social evaluation, or future events and is commonly accompanied by restlessness, irritability, fatigue, concentration difficulties, muscular tension, sleep disturbance, and a diminished ability to disengage from threat-related thinking. The breadth and persistence of these symptoms suggest that generalized anxiety disorder cannot be adequately understood solely as an emotional reaction to external stressors. Rather, it involves interconnected cognitive and metacognitive processes through which individuals interpret uncertainty, evaluate their own thoughts, and regulate repetitive worry.

The study of generalized anxiety symptoms is especially important among university students. University education coincides with a developmental period characterized by substantial academic, interpersonal, financial, and occupational transitions. Students must respond to examinations, competitive evaluation, changing social relationships, decisions about specialization and employment, and uncertainty regarding their future roles. These demands do not necessarily produce pathological anxiety in all students; however, they may activate underlying cognitive vulnerabilities in individuals who perceive ambiguous situations as threatening or who believe that worry is necessary for preventing failure. In this context, university students may use worry as a strategy for anticipating problems, maintaining motivation, or preparing for uncertain outcomes. When worry becomes repetitive and is interpreted as uncontrollable, it may cease to serve an adaptive planning function and instead contribute to chronic psychological distress, impaired concentration, disrupted sleep, and reduced academic functioning. Research among university students with tendencies toward generalized anxiety has demonstrated that metacognitive processes are associated with rumination and sleep-related difficulties,

indicating that beliefs about thinking may influence both the persistence and broader consequences of anxiety symptoms (Yu et al., 2024).

Contemporary explanations of generalized anxiety increasingly emphasize the role of metacognition. Metacognition refers to the beliefs, evaluations, monitoring processes, and regulatory strategies individuals apply to their own cognitive activity. Within a metacognitive framework, the clinical significance of worry is determined not only by what a person worries about but also by what the person believes about worry itself. Two individuals may experience similar intrusive thoughts about academic failure or future uncertainty, yet their psychological responses may differ substantially depending on whether they regard worry as useful, dangerous, controllable, or uncontrollable. Dysfunctional metacognitive beliefs can encourage prolonged self-focused attention, heightened monitoring for threat, repeated attempts to control thoughts, and reliance on worry as a coping strategy. Empirical testing of the metacognitive model has supported the proposition that maladaptive beliefs about thinking are closely involved in generalized anxiety symptoms and that these beliefs contribute to the maintenance of persistent worry (Nordahl et al., 2023).

Metacognitive beliefs relevant to generalized anxiety are commonly differentiated into positive and negative beliefs about worry. Positive metacognitive beliefs concern the presumed usefulness or necessity of worrying. Individuals may believe, for example, that worry helps them prepare for adverse events, avoid mistakes, solve problems, remain responsible, maintain emotional control, or prevent unexpected negative outcomes. These beliefs may initially make worry appear adaptive. A student who believes that worrying about an examination ensures adequate preparation may intentionally engage in repeated mental rehearsal, threat anticipation, and consideration of possible failure scenarios. Although such cognitive activity may provide a temporary sense of preparedness, it can reinforce the use of worry whenever uncertainty is encountered. Evidence from adolescents with generalized anxiety indicates that positive beliefs about worry coexist with cognitive avoidance and intolerance of uncertainty, suggesting that worry may be maintained because it is perceived as both protective and instrumentally valuable (Shipp et al., 2024). Subsequent research has similarly shown that positive beliefs about worry represent an important cognitive feature of generalized anxiety in younger populations, even when their relationship with

symptom severity may operate through other vulnerability mechanisms (Shipp et al., 2025).

Negative metacognitive beliefs, in contrast, involve interpretations of worry as uncontrollable, dangerous, harmful, or indicative of personal dysfunction. Individuals holding such beliefs may assume that once worry begins it cannot be stopped, that excessive thinking will lead to psychological or physical harm, or that the presence of persistent thoughts signifies a loss of mental control. These beliefs can produce a secondary level of worry in which individuals become anxious not only about external events but also about their own cognitive activity. Thus, a student may initially worry about academic failure and subsequently worry that the inability to stop thinking about failure means that something is seriously wrong. This meta-worry intensifies perceived threat and may promote suppression, checking, reassurance seeking, avoidance, and continuous monitoring of internal experiences. Research involving nurses has shown that metacognitive beliefs, together with emotion processing and tolerance of ambiguity, meaningfully predict generalized anxiety, underscoring the importance of beliefs about cognition in populations exposed to persistent uncertainty and responsibility (Sheikhepour & Mostafaei, 2024).

The distinction between positive and negative metacognitive beliefs is theoretically important because these belief systems may occupy different positions in the development and maintenance of generalized anxiety. Positive beliefs may motivate individuals to initiate worry because they regard it as beneficial, whereas negative beliefs may transform worry into an alarming and self-perpetuating process by framing it as uncontrollable and dangerous. Consequently, positive beliefs may have a more distal or indirect association with anxiety symptoms, while negative beliefs may exert a stronger and more immediate effect on distress. Clinical findings support the relevance of modifying the credibility attached to anxious thoughts and feelings in individuals with generalized anxiety disorder. Metacognitive therapy has been shown to reduce the believability of distressing thoughts and anxiety-related experiences, suggesting that changes in metacognitive appraisal may weaken the processes that maintain anxiety (Khalilnejad et al., 2024). Group-based applications of metacognitive therapy have also demonstrated the practical relevance of targeting worry-related metacognitions and maladaptive cognitive-attentional processes in generalized anxiety (Hammersmark et al., 2024).

The significance of metacognitive beliefs is further supported by treatment research. A comparison of metacognitive therapy and cognitive behavioral therapy has indicated that metacognitive interventions constitute an effective treatment approach for generalized anxiety disorder and may produce substantial improvements by focusing directly on beliefs about worry and strategies used to regulate thinking (Rawat et al., 2023). Research comparing metacognitive therapy with a transdiagnostic intervention has also shown that metacognitive treatment can improve cognitive emotion regulation among patients with generalized anxiety, thereby indicating that changes in metacognitive functioning may influence broader emotional processes (Sherafati et al., 2023). More recent systematic evidence confirms the effectiveness of metacognitive therapy in reducing generalized anxiety symptoms and highlights dysfunctional beliefs about uncontrollability, danger, and the presumed usefulness of worry as central therapeutic targets (Uzun & Yilmaz, 2026). Collectively, these findings support the inclusion of both positive and negative metacognitive beliefs in explanatory models of generalized anxiety.

Nevertheless, metacognitive beliefs alone may not fully explain why some individuals develop severe and persistent anxiety in response to uncertain situations. Intolerance of uncertainty has emerged as another central construct in the cognitive understanding of generalized anxiety. It refers to a dispositional tendency to react negatively to situations in which relevant information is incomplete, future outcomes are unpredictable, or several possible outcomes remain unresolved. Individuals with high intolerance of uncertainty are not merely concerned about negative events; they tend to experience the state of not knowing itself as stressful, unacceptable, or incapacitating. They may believe that uncertainty prevents effective functioning, that unexpected events are inherently threatening, or that complete certainty must be achieved before decisions can be made. Such beliefs can lead to excessive preparation, repeated checking, procrastination, avoidance, reassurance seeking, and chronic worry.

Intolerance of uncertainty is particularly relevant to generalized anxiety because worry can function as an attempted response to unpredictability. Through worry, individuals mentally simulate possible threats and try to anticipate every potential outcome. Although this process may create a temporary impression of control, it cannot eliminate uncertainty. Instead, repeated worry can increase awareness of possible threats and strengthen the belief that

uncertain situations require continuous mental preparation. Comparative evidence indicates that intolerance of uncertainty is more pronounced in generalized anxiety and other emotional disorders than among psychologically healthy individuals, although its specific manifestation may vary across obsessive-compulsive symptoms, health anxiety, depression, and generalized anxiety (Fathi Avali Gheshlagi & Najafi, 2023). Research comparing generalized anxiety and social anxiety has likewise suggested that intolerance of uncertainty is closely associated with diagnostic and symptom-related differences, reinforcing its importance as a vulnerability process across anxiety presentations (Counsell et al., 2024). Earlier comparative findings also showed substantial intolerance of uncertainty in both analogue generalized anxiety and obsessive-compulsive presentations, supporting its relevance while also raising questions about the mechanisms through which it becomes particularly associated with chronic worry (Holaway et al., 2023).

Recent research has further clarified the relationship between intolerance of uncertainty and generalized anxiety. Longitudinal evidence among adolescents indicates that intolerance of uncertainty and generalized anxiety may influence one another bidirectionally. Difficulty tolerating uncertainty can contribute to subsequent anxiety, while repeated anxiety experiences may also make ambiguous situations appear increasingly threatening and difficult to manage (Ye et al., 2025). This reciprocal relationship is important because it suggests that intolerance of uncertainty is not simply a static personality characteristic. Instead, it may develop and intensify through repeated engagement in worry, avoidance, and threat-focused interpretation. In adults with generalized anxiety disorder, research examining pathways from intolerance of uncertainty to worry has shown that the relationship may be explained through multiple cognitive processes rather than through a single direct mechanism (Wilson et al., 2025). The published extension of this work further demonstrates that intolerance of uncertainty contributes to worry through theoretically meaningful cognitive pathways, highlighting its central position in the maintenance of generalized anxiety (Wilson et al., 2026).

Behavioral research also demonstrates that increasing tolerance of uncertainty can produce clinically meaningful change. Behavioral experiments that require individuals to encounter uncertain situations without relying on habitual worry or safety behaviors may result in sudden improvements that are maintained over time. Such findings

indicate that the experience of tolerating uncertainty can weaken rigid beliefs about the necessity of predicting or controlling outcomes (Fortin Delisle & Dugas, 2025). This evidence has important implications for explanatory models because it suggests that intolerance of uncertainty is not only associated with generalized anxiety but may function as a modifiable mechanism through which cognitive and metacognitive vulnerabilities affect symptoms.

The relationship between metacognitive beliefs and intolerance of uncertainty is theoretically coherent. Positive metacognitive beliefs may encourage individuals to use worry as a strategy for coping with unpredictability. When students believe that worry helps them prevent failure or prepare for every possibility, they may become increasingly dependent on worry whenever certainty is unavailable. This dependence may reduce opportunities to learn that uncertain situations can be tolerated without exhaustive mental preparation. Negative metacognitive beliefs may contribute through a different process. If students believe that worry is uncontrollable or dangerous, the emergence of worry in an uncertain situation may itself be interpreted as threatening. Uncertainty then becomes associated not only with unknown external outcomes but also with the anticipated inability to regulate one's own thoughts. In this way, both positive and negative metacognitive beliefs may increase intolerance of uncertainty, although negative beliefs may be expected to have the stronger direct association with anxiety symptoms.

The integration of schemas, metacognitive beliefs, and uncertainty-related processes provides further support for this proposed pathway. Recent evidence suggests that early maladaptive schemas and intolerance of uncertainty are both implicated in generalized anxiety disorder, indicating that enduring beliefs about the self and the world may shape how individuals respond to ambiguity and persistent worry (Riley et al., 2026). Although schemas and metacognitive beliefs are conceptually distinct, both may influence threat appraisal and the perceived ability to manage uncertain internal and external experiences. Intolerance of uncertainty may therefore represent a proximal process through which broader cognitive vulnerabilities are translated into repetitive worry and generalized anxiety symptoms.

The role of metacognition may also vary across social and clinical contexts. Among men living with HIV, metacognitive beliefs have been associated with generalized anxiety, demonstrating that beliefs about worry remain relevant even when individuals face substantial objective uncertainty related to health, stigma, and social conditions (Bailey et al., 2025). This finding suggests that

metacognitive vulnerability cannot be reduced to the presence of external stress. Individuals exposed to similar circumstances may experience different levels of anxiety depending on how they interpret uncertainty and evaluate their own worrying. Thus, a comprehensive model should consider both beliefs about cognition and reactions to uncertainty rather than treating either construct as an isolated predictor.

Despite growing evidence concerning these variables, several issues remain unresolved. Many studies have examined metacognitive beliefs or intolerance of uncertainty separately, whereas fewer have evaluated the structural relationships among positive metacognitive beliefs, negative metacognitive beliefs, intolerance of uncertainty, and generalized anxiety symptoms within a single model. This gap is important because direct associations may obscure more complex indirect mechanisms. Positive metacognitive beliefs, for instance, may not directly predict symptom severity once negative metacognitive beliefs are considered, yet they may still contribute to anxiety by increasing reliance on worry and reducing tolerance of uncertainty. Similarly, negative beliefs may affect generalized anxiety both directly, by increasing meta-worry and perceived loss of control, and indirectly, by making uncertain situations more threatening.

There is also a need to evaluate these mechanisms among university students. Much of the available literature has focused on clinical populations, adolescents, or specific occupational and health-related groups. Although these studies provide valuable evidence, university students experience a distinctive combination of developmental transition, academic evaluation, career uncertainty, and social change. Structural modeling in this population can clarify whether metacognitive beliefs are associated with generalized anxiety symptoms independently and whether intolerance of uncertainty explains part of these relationships. Such analysis can also contribute to university-based prevention by identifying mechanisms that may be addressed before anxiety reaches clinical severity.

A model incorporating positive and negative metacognitive beliefs and intolerance of uncertainty may therefore offer a more integrated explanation of generalized anxiety symptoms. It recognizes that worry may initially be reinforced by beliefs about its usefulness, subsequently intensified by beliefs about its uncontrollability and danger, and maintained by difficulty accepting uncertain outcomes. It also permits examination of whether positive and negative metacognitive beliefs operate through equivalent or distinct pathways. Such distinctions are clinically meaningful

because interventions may need to challenge the assumed benefits of worry, reduce beliefs about its danger and uncontrollability, and provide corrective experiences in which uncertainty is approached without excessive cognitive control.

Accordingly, the present study aimed to test a structural model of generalized anxiety disorder symptom level based on positive and negative metacognitive beliefs, with intolerance of uncertainty as a mediating variable among university students.

2. Methods and Materials

2.1. Study Design and Participants

The present study was an applied quantitative study conducted using a descriptive-correlational design and structural equation modeling. The purpose of the study was to test a structural model of generalized anxiety disorder symptom level based on positive and negative metacognitive beliefs, with the mediating role of intolerance of uncertainty among university students. In the proposed model, positive metacognitive beliefs and negative metacognitive beliefs were considered exogenous variables, intolerance of uncertainty was considered the mediating variable, and generalized anxiety disorder symptom level was considered the endogenous variable. The study was cross-sectional, and all variables were measured at one point in time using standardized self-report questionnaires.

The statistical population consisted of students at Islamic Azad University, Najafabad Branch, Iran. The participants were selected from different faculties of the university. The initial sample consisted of 300 students who were invited to participate in the study and complete the questionnaires. After reviewing the completed questionnaires, 294 questionnaires were considered acceptable and were included in the final analysis. Questionnaires with incomplete responses, invalid response patterns, or substantial missing data were excluded from the dataset. Therefore, the final sample size for statistical analysis was 294 students.

Participants were selected using an accessible purposive sampling method. Students from different faculties of Islamic Azad University, Najafabad Branch, were invited to participate in the study. Data collection was conducted from January 12, 2026, to February 25, 2026. This sampling method was appropriate because the study aimed to examine the relationships among psychological variables in a university student population, and access to students from

different faculties made it possible to collect sufficient data for structural equation modeling. Before completing the questionnaires, participants were informed about the purpose of the study and the approximate time required to complete the instruments.

The inclusion criteria were being a student at Islamic Azad University, Najafabad Branch, willingness to participate in the study, ability to understand and complete the questionnaires, and providing complete responses to the main research instruments. The exclusion criteria included unwillingness to continue participation, incomplete questionnaires, careless or patterned responses, and failure to respond to one or more of the main research questionnaires. Questionnaires that did not meet the required quality for analysis were removed before data entry.

After approval of the research plan, the researcher coordinated with the relevant university authorities and faculties of Islamic Azad University, Najafabad Branch. The students were then invited to participate in the study. Before data collection, the purpose of the study was explained to the participants. They were informed that participation was voluntary and that their responses would remain confidential. They were also told that the results would be analyzed only at the group level and would be used for research purposes. The questionnaires were administered to the participants in person. The participants were asked to complete the demographic information form, the Metacognitions Questionnaire, the Intolerance of Uncertainty Questionnaire, and the Generalized Anxiety Disorder Scale. The approximate time required to complete the questionnaires was between 25 and 35 minutes. After completion, the questionnaires were collected and reviewed. Incomplete questionnaires and questionnaires with invalid response patterns were excluded. The final dataset included 294 acceptable questionnaires, which were entered into SPSS and AMOS for statistical analysis.

2.2. Measures

A demographic information form was used to collect general background information about the participants. This form included questions related to demographic and educational characteristics such as gender, age, educational level, marital status, and occupational status. These variables were used to describe the sample.

Positive and negative metacognitive beliefs were assessed using the short form of the Metacognitions Questionnaire developed by Wells and Cartwright-Hatton

(2004). The questionnaire assesses individuals' beliefs about their own thinking processes and includes different dimensions of metacognition. In the present article, only the two subscales directly related to the proposed model were used: positive beliefs about worry and negative beliefs about uncontrollability and danger of worry. Positive metacognitive beliefs refer to the belief that worry is useful, protective, or necessary. Negative metacognitive beliefs refer to the belief that worry is uncontrollable, dangerous, or harmful. The items are scored on a Likert-type scale. Higher scores indicate stronger metacognitive beliefs. In the present study, the scores of the positive beliefs subscale and the negative beliefs subscale were used as observed indicators of the metacognitive belief variables in the structural model.

Intolerance of uncertainty was measured using the Intolerance of Uncertainty Questionnaire developed by Freeston et al. (1994). This questionnaire assesses individuals' tendency to perceive uncertain and ambiguous situations as stressful, threatening, and unacceptable. The scale measures cognitive, emotional, and behavioral reactions to uncertainty. Higher scores indicate greater intolerance of uncertainty. In the present study, the total score of this questionnaire was used to assess the mediating variable in the proposed structural model.

Generalized anxiety disorder symptom level was assessed using the short form of the Generalized Anxiety Disorder Scale developed by Spitzer et al. (2006). This scale includes 7 items and evaluates the severity of generalized anxiety symptoms during recent weeks. The items assess symptoms such as excessive worry, inability to control worry, nervousness, restlessness, irritability, difficulty relaxing, and fear that something awful may happen. The items are scored on a Likert-type scale, and the total score is obtained by summing the item scores. Higher scores indicate higher levels of generalized anxiety disorder symptoms.

2.3. Data Analysis

Data were analyzed using SPSS version 24 and AMOS version 24. First, descriptive statistics were calculated to describe the demographic characteristics of the participants and the main research variables. These statistics included frequency, percentage, mean, standard deviation, skewness, and kurtosis. Before testing the structural model, the data were screened. Missing data were examined, incomplete questionnaires were removed, and the assumptions required for structural equation modeling were assessed. Normality was evaluated using skewness and kurtosis indices.

Multicollinearity among predictor variables was examined using tolerance and variance inflation factor values. Pearson correlation coefficients were used to examine the bivariate relationships among positive metacognitive beliefs, negative metacognitive beliefs, intolerance of uncertainty, and generalized anxiety disorder symptom level. Then, structural equation modeling was used to test the proposed model.

The structural model examined the direct effects of positive and negative metacognitive beliefs on generalized anxiety disorder symptom level, the direct effects of positive and negative metacognitive beliefs on intolerance of uncertainty, and the direct effect of intolerance of uncertainty on generalized anxiety disorder symptom level. The mediating role of intolerance of uncertainty in the relationships between metacognitive beliefs and generalized anxiety disorder symptoms was also examined. Model fit was evaluated using multiple fit indices, including chi-square divided by degrees of freedom, goodness-of-fit index, comparative fit index, normed fit index, Tucker-Lewis index, and root mean square error of approximation. The significance of direct effects was examined using standardized path coefficients and critical ratios. The significance of indirect effects was examined using the bootstrap method.

Table 1

Descriptive Statistics of the Main Study Variables

Variable	N	Minimum	Maximum	Mean	SD
Generalized anxiety disorder symptoms	294	0	21	9.20	4.85
Intolerance of uncertainty	294	40	124	78.76	19.36
Total metacognitive beliefs	294	37	120	74.26	14.26
Positive metacognitive beliefs	294	6	24	13.30	4.53
Negative metacognitive beliefs	294	6	24	15.11	4.02

Before testing the structural model, the assumptions required for structural equation modeling were examined. The skewness and kurtosis values of the study variables were within the acceptable range, indicating that the variables had approximately normal distributions. Multicollinearity was also examined using tolerance and variance inflation factor values. The VIF values were lower than the critical threshold of 10 and the tolerance values were above the minimum acceptable level. Therefore, no severe multicollinearity was observed among the predictor variables, and the data were considered appropriate for structural equation modeling.

Pearson correlation coefficients were calculated to examine the relationships among generalized anxiety disorder symptoms, intolerance of uncertainty, positive

3. Findings and Results

The final sample consisted of 294 university students from Islamic Azad University, Najafabad Branch. The participants were included in the final analysis after incomplete or invalid questionnaires were removed from the dataset. Regarding occupational status, 167 students were employed and 127 students were unemployed. Therefore, 56.8% of the participants were employed and 43.2% were unemployed.

Descriptive statistics were calculated for generalized anxiety disorder symptoms, intolerance of uncertainty, total metacognitive beliefs, and the two metacognitive belief components used in the present article. The mean score of generalized anxiety disorder symptoms was 9.20 with a standard deviation of 4.85. The mean score of intolerance of uncertainty was 78.76 with a standard deviation of 19.36. The mean score of total metacognitive beliefs was 74.26 with a standard deviation of 14.26. Regarding the two metacognitive belief components, the mean score of positive metacognitive beliefs was 13.30 with a standard deviation of 4.53, and the mean score of negative metacognitive beliefs was 15.11 with a standard deviation of 4.02.

metacognitive beliefs, and negative metacognitive beliefs. The results showed that intolerance of uncertainty had a positive and significant correlation with generalized anxiety disorder symptoms, $r = .387$, $p < .01$. Negative metacognitive beliefs also had a positive and significant correlation with generalized anxiety disorder symptoms, $r = .525$, $p < .01$. However, positive metacognitive beliefs did not have a significant correlation with generalized anxiety disorder symptoms, $r = .030$, $p > .05$. The results also showed that positive metacognitive beliefs had a positive and significant correlation with intolerance of uncertainty, $r = .176$, $p < .01$. Negative metacognitive beliefs had a stronger positive and significant correlation with intolerance of uncertainty, $r = .487$, $p < .01$. In addition, positive and

negative metacognitive beliefs had a weak but significant positive correlation with each other, $r = .143$, $p < .05$.

Table 2

Correlation Matrix of the Main Study Variables

Variable	1	2	3	4
1. Generalized anxiety disorder symptoms	1			
2. Intolerance of uncertainty	.387**	1		
3. Positive metacognitive beliefs	.030	.176**	1	
4. Negative metacognitive beliefs	.525**	.487**	.143*	1

The proposed structural model was examined using structural equation modeling. The results showed that the model had acceptable fit to the data. The chi-square divided by degrees of freedom was 1.784, which was below the recommended threshold of 3. The RMSEA value was .057, indicating acceptable model fit. Other fit indices also

supported the adequacy of the model. The NFI value was .999, the CFI value was 1.00, and the IFI value was 1.00. These values were above the recommended criterion of .90. The Hoelter index was 289, which was higher than 200 and indicated adequate sample size for the tested model. Therefore, the structural model was supported.

Table 3

Fit Indices of the Structural Model

Fit index	Obtained value	Acceptable criterion	Interpretation
p-value	.117	> .05	Acceptable
df	3	—	—
χ^2/df	1.784	< 3	Acceptable
NFI	.999	> .90	Acceptable
CFI	1.00	> .90	Acceptable
IFI	1.00	> .90	Acceptable
RMSEA	.057	< .10	Acceptable
Hoelter	289	> 200	Acceptable

The first direct path examined the effect of positive metacognitive beliefs on generalized anxiety disorder symptoms. The results showed that positive metacognitive beliefs did not have a significant direct effect on generalized anxiety disorder symptoms, $\beta = -.036$, $p = .358$. Therefore, the direct effect of positive metacognitive beliefs on generalized anxiety disorder symptoms was not supported. The second direct path examined the effect of negative metacognitive beliefs on generalized anxiety disorder symptoms. The results showed that negative metacognitive beliefs had a positive and significant direct effect on generalized anxiety disorder symptoms, $\beta = .220$, $p = .011$. This finding indicates that students with stronger negative beliefs about worry and its uncontrollability reported higher levels of generalized anxiety disorder symptoms.

The third direct path examined the effect of positive metacognitive beliefs on intolerance of uncertainty. The results showed that positive metacognitive beliefs had a

positive and significant direct effect on intolerance of uncertainty, $\beta = .085$, $p = .024$. This means that students who believed more strongly in the usefulness of worry also reported higher intolerance of uncertainty. The fourth direct path examined the effect of negative metacognitive beliefs on intolerance of uncertainty. The results showed that negative metacognitive beliefs had a positive and significant direct effect on intolerance of uncertainty, $\beta = .436$, $p = .001$. Therefore, students with stronger negative metacognitive beliefs were more likely to experience difficulty tolerating uncertain situations. The fifth direct path examined the effect of intolerance of uncertainty on generalized anxiety disorder symptoms. The results showed that intolerance of uncertainty had a positive and significant direct effect on generalized anxiety disorder symptoms, $\beta = .186$, $p = .019$. This finding indicates that students with higher intolerance of uncertainty reported higher levels of generalized anxiety disorder symptoms.

Table 4

Direct Effects in the Structural Model

Criterion variable	Predictor	β	p	Result
Generalized anxiety disorder symptoms	Positive metacognitive beliefs	-.036	.358	Not significant
Generalized anxiety disorder symptoms	Negative metacognitive beliefs	.220	.011	Significant
Intolerance of uncertainty	Positive metacognitive beliefs	.085	.024	Significant
Intolerance of uncertainty	Negative metacognitive beliefs	.436	.001	Significant
Generalized anxiety disorder symptoms	Intolerance of uncertainty	.186	.019	Significant

The mediating role of intolerance of uncertainty was examined using the bootstrap method. The results showed that positive metacognitive beliefs had a significant indirect effect on generalized anxiety disorder symptoms through intolerance of uncertainty, $\beta = .016$, $p = .050$. Although positive metacognitive beliefs did not have a significant direct effect on generalized anxiety disorder symptoms, their indirect effect through intolerance of uncertainty was significant. This finding suggests that positive beliefs about

worry may contribute to generalized anxiety symptoms indirectly by increasing intolerance of uncertainty. The results also showed that negative metacognitive beliefs had a significant indirect effect on generalized anxiety disorder symptoms through intolerance of uncertainty, $\beta = .081$, $p = .050$. Therefore, intolerance of uncertainty significantly mediated the relationship between negative metacognitive beliefs and generalized anxiety disorder symptoms.

Table 5

Indirect Effects through Intolerance of Uncertainty

Criterion variable	Predictor	Mediator	β	p	Result
Generalized anxiety disorder symptoms	Positive metacognitive beliefs	Intolerance of uncertainty	.016	.050	Significant
Generalized anxiety disorder symptoms	Negative metacognitive beliefs	Intolerance of uncertainty	.081	.050	Significant

The total effect of positive metacognitive beliefs on generalized anxiety disorder symptoms was $\beta = -.020$. This effect was not meaningful in the direct path, but the indirect pathway through intolerance of uncertainty was significant. Therefore, positive metacognitive beliefs appear to influence generalized anxiety disorder symptoms mainly through intolerance of uncertainty rather than through a direct

pathway. The total effect of negative metacognitive beliefs on generalized anxiety disorder symptoms was $\beta = .301$. This effect included both a significant direct effect and a significant indirect effect through intolerance of uncertainty. Therefore, negative metacognitive beliefs were a stronger predictor of generalized anxiety disorder symptoms than positive metacognitive beliefs.

Table 6

Total, Direct, and Indirect Effects

Path	Total effect	Direct effect	Indirect effect	p
Positive metacognitive beliefs → Generalized anxiety disorder symptoms	-.020	-.036	.016	.358
Positive metacognitive beliefs → Intolerance of uncertainty	.085	.085	.000	.024
Negative metacognitive beliefs → Generalized anxiety disorder symptoms	.301	.220	.081	.011
Negative metacognitive beliefs → Intolerance of uncertainty	.436	.436	.000	.001
Intolerance of uncertainty → Generalized anxiety disorder symptoms	.186	.186	.000	.019

The structural model explained a meaningful proportion of variance in generalized anxiety disorder symptoms and intolerance of uncertainty. In the tested model of the dissertation, metacognitive beliefs, intolerance of uncertainty, and the other predictors included in the full

model explained 41.4% of the variance in generalized anxiety disorder symptoms. In addition, 23.5% of the variance in intolerance of uncertainty was explained by the predictor variables.

4. Discussion

The present study aimed to test a structural model of generalized anxiety disorder symptom level based on positive and negative metacognitive beliefs, with intolerance of uncertainty as a mediating variable among university students. The findings indicated that the proposed structural model had an acceptable fit with the observed data. More specifically, positive metacognitive beliefs did not exert a significant direct effect on generalized anxiety disorder symptoms, whereas negative metacognitive beliefs had a positive and significant direct effect on these symptoms. Both positive and negative metacognitive beliefs positively predicted intolerance of uncertainty, although the effect of negative metacognitive beliefs was considerably stronger. Intolerance of uncertainty also had a positive and significant direct effect on generalized anxiety disorder symptoms. Furthermore, intolerance of uncertainty significantly mediated the relationships of both positive and negative metacognitive beliefs with generalized anxiety symptoms. These findings support an integrated cognitive-metacognitive explanation in which beliefs about worry and difficulty tolerating uncertain situations jointly contribute to the severity of generalized anxiety symptoms among university students.

The first finding showed that positive metacognitive beliefs did not have a significant direct effect on generalized anxiety disorder symptoms. Thus, believing that worry is useful, protective, or necessary did not independently predict greater anxiety symptom severity after the other variables in the model were considered. This finding may be explained by the functional position of positive beliefs within the metacognitive process. Positive metacognitive beliefs may primarily motivate the initiation and repeated use of worry rather than directly generate severe emotional distress. Individuals who believe that worrying helps them prepare for negative outcomes, avoid mistakes, or maintain control may deliberately engage in worry as a coping strategy. However, this strategy may not immediately produce generalized anxiety symptoms unless it becomes associated with other vulnerability factors, particularly beliefs that worry is uncontrollable or an inability to tolerate uncertainty.

This interpretation is consistent with research indicating that positive beliefs about worry constitute an important cognitive feature of generalized anxiety but may operate within a broader network of cognitive processes. Studies of adolescents with generalized anxiety have shown that positive beliefs about worry are related to cognitive

avoidance and intolerance of uncertainty, suggesting that such beliefs may maintain worry indirectly by encouraging individuals to rely on it when facing ambiguity (Shipp et al., 2024; Shipp et al., 2025). Similarly, the association of metacognition with rumination and sleep difficulties among university students with generalized anxiety tendencies indicates that beliefs about thinking may influence symptoms through repetitive cognitive processes rather than through a simple direct pathway (Yu et al., 2024). Therefore, positive metacognitive beliefs may create a psychological readiness to use worry, while their influence on symptom severity depends on whether worry becomes a habitual response to uncertainty.

The second finding demonstrated that negative metacognitive beliefs had a positive and significant direct effect on generalized anxiety disorder symptoms. Students who more strongly believed that worry was uncontrollable, dangerous, or psychologically harmful reported higher levels of generalized anxiety. This result supports the metacognitive conceptualization of pathological worry, according to which negative beliefs transform primary worry about external events into secondary worry about the nature and consequences of worrying itself. Once individuals interpret worry as uncontrollable or dangerous, the occurrence of anxious thoughts becomes an additional source of threat. They may monitor their thoughts more closely, attempt to suppress them, or fear that persistent worry will damage their health or cause loss of control. These responses paradoxically increase the accessibility and emotional impact of worry.

The finding is consistent with empirical tests of the metacognitive model showing that dysfunctional metacognitive beliefs are central to the maintenance of generalized anxiety (Nordahl et al., 2023). It also aligns with evidence that metacognitive beliefs predict generalized anxiety in populations exposed to demanding and uncertain conditions, such as nurses and individuals living with chronic health-related stress (Bailey et al., 2025; Sheikhepour & Mostafaei, 2024). The stronger direct effect of negative beliefs compared with positive beliefs suggests that the perceived uncontrollability and danger of worry may be more proximal determinants of anxiety severity than beliefs about its usefulness. Positive beliefs may explain why worry begins, whereas negative beliefs may explain why it becomes distressing, persistent, and difficult to terminate.

The present finding is also supported by treatment research. Metacognitive therapy focuses on reducing beliefs

concerning the uncontrollability and danger of worry and modifying maladaptive strategies such as threat monitoring and thought suppression. Studies have reported that this intervention decreases the believability of anxious thoughts and feelings and reduces generalized anxiety symptoms (Khalilnejad et al., 2024). Group-based metacognitive therapy has likewise demonstrated that changing beliefs about worry can reduce the cognitive processes maintaining generalized anxiety (Hammersmark et al., 2024). Meta-analytic and systematic-review evidence further indicates that metacognitive therapy is an effective intervention for generalized anxiety disorder and may compare favorably with conventional cognitive behavioral approaches (Rawat et al., 2023; Uzun & Yilmaz, 2026). These treatment findings indirectly reinforce the present result by showing that interventions targeting negative metacognitive beliefs are followed by reductions in anxiety.

The third finding indicated that positive metacognitive beliefs significantly predicted intolerance of uncertainty. Students who more strongly believed in the usefulness of worry also experienced greater difficulty tolerating uncertain and unpredictable situations. This relationship may arise because positive beliefs encourage worry to be used as a strategy for creating a sense of preparation and control. When individuals repeatedly respond to uncertainty by mentally reviewing possible threats, they receive fewer opportunities to discover that ambiguity can be tolerated without exhaustive preparation. Over time, this reliance on worry may strengthen the assumption that uncertainty is unmanageable unless it is subjected to continuous cognitive analysis.

Evidence from adolescent samples supports the association between positive beliefs about worry and intolerance of uncertainty (Shipp et al., 2024; Shipp et al., 2025). The present result also corresponds with findings that the pathways from intolerance of uncertainty to worry involve multiple cognitive mechanisms, including beliefs and strategies that maintain repetitive thinking (Wilson et al., 2025, 2026). Thus, positive metacognitive beliefs may not be harmless beliefs about responsible preparation. Instead, they may reinforce a coping pattern in which worry becomes the preferred response to situations that lack certainty.

The fourth finding showed that negative metacognitive beliefs had a strong positive effect on intolerance of uncertainty. Students who regarded worry as uncontrollable or dangerous were more likely to perceive ambiguous situations as unacceptable and threatening. This effect was stronger than the corresponding effect of positive

metacognitive beliefs, suggesting that negative interpretations of internal cognitive experiences may substantially reduce an individual's ability to tolerate external uncertainty. When students expect uncertain situations to trigger uncontrollable worry, ambiguity becomes threatening at two levels: the external outcome is unknown, and the anticipated cognitive response is perceived as unmanageable.

This interpretation is compatible with research demonstrating that metacognitive beliefs, tolerance of ambiguity, and emotional processing jointly contribute to generalized anxiety (Sheikhepour & Mostafaei, 2024). It is also consistent with evidence that early maladaptive schemas and intolerance of uncertainty are interconnected vulnerabilities in generalized anxiety disorder (Riley et al., 2026). Dysfunctional schemas may shape beliefs that the world is unsafe or the self is unable to cope, while negative metacognitive beliefs add the assumption that one's own thoughts are uncontrollable. Together, these beliefs may heighten sensitivity to uncertainty and promote chronic worry.

The fifth finding indicated that intolerance of uncertainty had a positive and significant direct effect on generalized anxiety disorder symptoms. Students who had greater difficulty accepting ambiguous or unpredictable situations experienced more severe generalized anxiety symptoms. This result is consistent with the view that intolerance of uncertainty is a central mechanism underlying persistent worry. University students routinely encounter uncertain academic, occupational, financial, and interpersonal outcomes. Students with low tolerance for uncertainty may perceive these ordinary conditions as threatening and may engage in repeated checking, reassurance seeking, avoidance, overplanning, and worry in an effort to achieve certainty. Because complete certainty is rarely attainable, these strategies maintain rather than resolve anxiety.

The finding is consistent with comparative research demonstrating elevated intolerance of uncertainty among individuals with generalized anxiety disorder relative to psychologically healthy individuals and its meaningful presence across related emotional disorders (Fathi Avali Gheshlaqi & Najafi, 2023; Holaway et al., 2023). Research comparing diagnostic and symptom groups has also identified intolerance of uncertainty as a relevant feature of both generalized and social anxiety, although its intensity and operation may differ across disorders (Counsell et al., 2024). Longitudinal evidence among adolescents further suggests a bidirectional relationship: intolerance of

uncertainty predicts later generalized anxiety, while anxiety may subsequently increase sensitivity to uncertainty (Ye et al., 2025). These findings support the present result and indicate that intolerance of uncertainty may function both as an antecedent and as a maintaining factor of anxiety.

The mediational findings represent a central contribution of the study. Intolerance of uncertainty significantly mediated the relationship between positive metacognitive beliefs and generalized anxiety symptoms. Although positive beliefs had no significant direct effect on symptoms, they contributed indirectly by increasing intolerance of uncertainty. This pattern suggests that believing worry to be useful may become clinically consequential when it fosters dependence on worry as a means of managing ambiguity. The more individuals use worry to prepare for uncertainty, the less opportunity they have to develop confidence in their ability to cope with unpredictable outcomes. Consequently, uncertainty becomes less tolerable, and anxiety symptoms increase.

This explanation is supported by behavioral research showing that direct exposure to uncertainty and reduction of habitual safety strategies can produce rapid and lasting improvements in generalized anxiety disorder (Fortin Delisle & Dugas, 2025). Such findings indicate that learning to tolerate uncertainty may disrupt the pathway through which beliefs in the usefulness of worry contribute to anxiety. Rather than attempting to predict and mentally control all outcomes, individuals can learn that uncertainty can be experienced without relying on prolonged worry.

Intolerance of uncertainty also significantly mediated the relationship between negative metacognitive beliefs and generalized anxiety symptoms. Negative metacognitive beliefs therefore affected anxiety through both direct and indirect pathways. Directly, perceiving worry as uncontrollable and dangerous increased distress and meta-worry. Indirectly, these beliefs made uncertainty more threatening by creating the expectation that uncertain situations would activate cognitive experiences that could not be controlled. This dual pathway explains why negative metacognitive beliefs emerged as a stronger predictor of generalized anxiety symptoms than positive beliefs.

5. Conclusion

The mediational pattern is compatible with evidence that intolerance of uncertainty is linked to worry through several cognitive pathways rather than through a single isolated process (Wilson et al., 2025, 2026). It also supports findings

that metacognitive therapy and other interventions targeting cognitive regulation can improve anxiety and emotion-regulation outcomes (Sherafati et al., 2023). Overall, the results suggest that metacognitive beliefs and intolerance of uncertainty should not be viewed as competing explanations of generalized anxiety. Instead, they appear to operate as interconnected components of a broader system in which beliefs about worry shape reactions to uncertainty, and these reactions subsequently contribute to persistent anxiety.

6. Limitations & Suggestions

The present study had several limitations. First, its cross-sectional and correlational design prevents causal conclusions regarding the temporal relationships among metacognitive beliefs, intolerance of uncertainty, and generalized anxiety symptoms. Although the proposed model was theoretically coherent and showed acceptable fit, alternative directional relationships remain possible. Second, all variables were assessed using self-report questionnaires, which may have been affected by common-method variance, social desirability, inaccurate self-perception, or participants' temporary emotional states. Third, the sample consisted of students from one university and was selected through accessible purposive sampling, which limits the generalizability of the findings to students from other institutions, clinical populations, non-student adults, and individuals from different sociocultural backgrounds. Finally, the model examined only positive and negative metacognitive beliefs and intolerance of uncertainty, whereas other relevant mechanisms, including cognitive avoidance, emotion dysregulation, perfectionism, reassurance seeking, rumination, and experiential avoidance, were not included.

Future studies should employ longitudinal and prospective designs to determine whether metacognitive beliefs predict subsequent increases in intolerance of uncertainty and generalized anxiety symptoms or whether these relationships operate bidirectionally. Experimental and intervention studies should examine whether changes in positive and negative metacognitive beliefs produce corresponding changes in tolerance of uncertainty and anxiety severity. Replication is also needed in clinical samples, adolescents, employed adults, and students from multiple universities and cultural settings. Future researchers may test more comprehensive structural models that include cognitive avoidance, emotion regulation, early maladaptive schemas, rumination, perfectionism, and reassurance-

seeking behaviors. Multigroup analyses could additionally determine whether the proposed pathways differ according to gender, age, employment status, educational level, or clinical severity.

University counseling centers should assess negative metacognitive beliefs and intolerance of uncertainty when screening students who report persistent worry or generalized anxiety symptoms. Preventive and therapeutic programs should help students recognize beliefs that worry is necessary, challenge assumptions that worry is uncontrollable or dangerous, and reduce reliance on repetitive thinking as a strategy for managing academic and personal uncertainty. Practical interventions may include metacognitive awareness exercises, postponement of worry, attention-training techniques, behavioral experiments, gradual exposure to uncertain situations, and reduction of checking and reassurance seeking. Counselors should also help students distinguish constructive problem solving from unproductive worry and develop flexible coping strategies for examinations, career decisions, relationships, and other uncertain aspects of university life.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this article.

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