

Academic Rumination, Decreased Working Memory Capacity, and Decisional Procrastination: An Experience Sampling Method (ESM) Approach to Measuring Negative Thought Intrusion

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ABSTRACT

Negative thought intrusion among university students is a psychological condition that can interfere with cognitive performance and emotional well-being, particularly when influenced by maladaptive cognitive processes. This study aims to examine the effect of academic rumination, decreased working memory capacity, and decisional procrastination on negative thought intrusion among university students. This research employed a quantitative approach using the Experience Sampling Method (ESM). The study involved 20 respondents who completed repeated measurements at five time points, yielding 100 observational data points. Data were analyzed using multiple regression to determine the simultaneous and partial effects of the independent variables, and the coefficient of determination was used to assess the magnitude of their contribution to the dependent variable. The results indicate that academic rumination, decreased working memory capacity, and decisional procrastination simultaneously have a significant effect on negative thought intrusion, with a combined contribution of 88.9%. Partially, academic rumination shows the strongest influence, followed by decreased working memory capacity and decisional procrastination. These findings suggest that students with higher levels of rumination, reduced cognitive capacity, and a tendency to delay decision-making are more susceptible to negative thought intrusion. The study provides empirical evidence that can inform the development of cognitive and emotion regulation-based interventions for university students.

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1. INTRODUCTION

Rumination is a repetitive pattern of thinking that focuses on negative content and has long been identified as a cognitive factor with broad impacts on individuals' psychological functioning. According to Treynor et al. [1], rumination is not merely

passive reflection but involves a brooding process that prolongs an individual's engagement with failure and internal distress. In the academic context, rumination often manifests as intrusive thoughts related to performance, self-evaluation, and future consequences. These thoughts can arise automatically and are difficult to control, particularly when individuals are in situations that demand decision-making. Smallwood and Schooler [2] explain that such thought intrusions are closely related to the phenomenon of mind-wandering, which diverts cognitive resources away from the primary task. As a result, individuals experience difficulty maintaining focus and cognitive efficiency. This condition is particularly relevant in academic environments that require high cognitive capacity and accurate decision-making.

This phenomenon is closely associated with individuals' capacity for emotional regulation. Khilmiah and Wiyono [3] emphasize that cognitive and affective abilities cannot be separated in the formation of character and rational decision-making. The Emotional and Social Intelligence (ESI) model developed highlights that the ability to make rational decisions and plan for the future is highly dependent on emotional regulation, stability, and self-control. In the context of academic rumination, failure to manage negative emotions may reinforce intrusive thoughts and disrupt the evaluation process of decision alternatives.

Cognitive research indicates that rumination directly affects working memory capacity, the cognitive system responsible for temporarily storing and manipulating information. Bruning et al. [4] found that rumination significantly burdens the updating process of working memory, making it difficult for individuals to distinguish between relevant and irrelevant information. This cognitive load reduces the efficiency of executive control, particularly in situations requiring cognitive flexibility. When working memory is impaired, individuals become slower and less accurate in processing information. This impact becomes more significant in individuals experiencing sustained academic pressure. Furthermore, limitations in working memory increase the likelihood of judgment errors. Thus, rumination can be viewed as a cognitive factor that indirectly reduces decision-making quality [5].

Within the ESI framework [3], the ability to make rational decisions is part of an integrated cognitive-affective domain. When emotional regulation is disrupted due to rumination, the capacity for rational decision-making is also affected. Therefore, a decline in working memory capacity is not merely a technical issue of information processing but also a reflection of the failure of cognitive-emotional integration.

The relationship between rumination and decisional procrastination becomes increasingly relevant when associated with self-protection mechanisms. Aziz et al. [6] show that individuals with high psychological distress tend to experience difficulty managing internal pressure, which may trigger avoidance of situations involving self-evaluation. In the academic context, this avoidance may manifest as delays in decision-making. In other words, decisional procrastination can be understood as a maladaptive response to unregulated cognitive and emotional pressure.

The relationship between rumination and memory function decline has also been demonstrated in studies on prospective memory. Michl et al. [7], in a study published in

PubMed, found that high levels of rumination are associated with lower prospective memory performance, regardless of an individual's mood state. This finding suggests that rumination functions as an independent cognitive interference rather than merely a side effect of negative affect. In the academic context, prospective memory plays a crucial role in remembering deadlines, decisions, and study plans. When this ability declines, individuals tend to delay actions and experience cognitive disorganization. This decline in memory performance also contributes to uncertainty in choosing alternative actions. Therefore, rumination becomes an important variable in understanding decisional delay behavior, opening avenues for examining its relationship with decisional procrastination [8].

Decisional procrastination is defined as the tendency to delay decision-making even when the necessary information is already available. This phenomenon is often associated with internal conflict, doubt, and fear of the consequences of decisions. Michl et al. [7] explain that individuals with low cognitive control are more vulnerable to ruminative responses when facing stress. When intrusive thoughts dominate, the evaluation process of alternatives becomes inefficient and fragmented. This condition makes it difficult for individuals to reach optimal decisions or any decision at all. In academic settings, decisional procrastination may appear in choosing research topics, learning strategies, or career decisions. Its impact extends not only to academic performance but also to students' psychological well-being. Therefore, it is important to understand the cognitive mechanisms underlying this behavior [9].

Research on rumination has increasingly developed through the use of ecological approaches capable of capturing the dynamics of daily experiences. Moberly and Watkins [10] used the Experience Sampling Method (ESM) to demonstrate that rumination fluctuates and is highly influenced by situational contexts. This method allows researchers to observe the emergence of intrusive thoughts in real time rather than relying solely on retrospective memory. Thus, ESM provides a more accurate representation of rumination frequency and intensity. Myin-Germeys et al. [11] emphasize that ESM opens the "black box" of individuals' daily lives with cognitive and emotional disturbances. This approach is highly relevant for examining the relationship between rumination and decision-making processes, as it captures micro-level cognitive changes often overlooked in laboratory experimental designs [12].

The use of ESM in cognitive psychology studies also offers methodological advantages in measuring negative thought intrusions. Csikszentmihalyi and Larson [13] state that ESM has high ecological validity because data are collected in individuals' natural contexts. This method reduces recall bias and evaluative distortion, which are often found in traditional questionnaires. In rumination research, ESM enables the identification of specific moments when negative thoughts disrupt focus and working memory capacity. Kircanski et al. [14] show that rumination and worry can be mapped temporally using ESM to examine short-term causal relationships. This is essential for understanding how rumination triggers decisional delay in real-life situations. In other words, ESM provides an effective tool for dynamically examining cognitive mechanisms, making it increasingly relevant in academically demanding environments.

Furthermore, studies on mind-wandering provide an additional theoretical foundation for understanding negative thought intrusion. Smallwood and Schooler [2] explain that mind-wandering often diverts working memory resources from the main task to irrelevant internal thoughts. In conditions of rumination, mind-wandering tends to be negative and repetitive. This increases cognitive load and reduces information processing capacity. As a result, individuals face difficulties maintaining judgment quality and decision-making processes. In academic contexts, this condition may lead to strategic errors and delays in important decisions. Continuous cognitive burden also contributes to mental fatigue. Therefore, negative thought intrusion should be understood as a central factor in the decline of cognitive functioning.

Although numerous studies have examined rumination and working memory, most have been conducted in laboratory settings. Myin-Germeys et al. [11] emphasize that traditional approaches often fail to capture the complexity of cognitive experiences in real-life contexts. In reality, academic decisions are frequently made under conditions of multitasking and emotional pressure. The Experience Sampling Method (ESM) offers a solution by enabling repeated measurements in natural contexts. However, only a limited number of studies have simultaneously linked rumination, working memory capacity, and decisional procrastination using this approach [4], and these studies have focused more on working memory mechanisms without directly associating them with decision-making behavior. This indicates a gap in the literature, particularly in the integration of these three variables, which remains relatively underexplored [15].

Among university students, the phenomenon of academic rumination has been increasing alongside performance pressure and uncertainty about the future. Many students report difficulties in making academic decisions despite having sufficient information. This condition is often accompanied by recurring negative thoughts about failure and social consequences [10], which show that daily rumination is correlated with persistent negative affect. When this condition persists over time, working memory capacity becomes increasingly depleted. The result is an increase in decisional procrastination and a decline in decision accuracy. This phenomenon indicates a systemic cognitive problem. Therefore, a methodological approach capable of capturing these dynamics comprehensively is required [16].

Based on the above discussion, it can be concluded that academic rumination, decreased working memory capacity, and decisional procrastination are interrelated phenomena that significantly affect students' cognitive functioning. Although the literature has examined each variable separately, studies integrating all three into a single empirical model remain very limited. Moreover, the use of the Experience Sampling Method to measure negative thought intrusion in the context of academic decision-making is still rare. Most ESM studies focus on affect and psychopathology rather than cognitive decision accuracy. Thus, there is a research gap in understanding the dynamic mechanisms by which rumination influences working memory and real-time decisional procrastination. This study is expected to fill this gap by employing a more contextual ESM approach. The findings are anticipated to contribute both theoretically and methodologically to cognitive and educational psychology.

2. LITERATURE REVIEW

Experience Sampling Method (ESM)

The Experience Sampling Method (ESM) is an intensive longitudinal research method used to measure individuals' experiences, thoughts, behaviors, and conditions in real time within the context of daily life through repeated responses over a specific period (e.g., several times a day over multiple days) [17]. ESM, also known as Ecological Momentary Assessment (EMA), is designed to minimize retrospective bias while enhancing ecological validity, as responses are collected "in the moment and in the natural setting" [18].

For example, in nutrition research, ESM is used to assess dietary intake both qualitatively and quantitatively in everyday life, using semi-random or fixed sampling schedules, thereby providing a more accurate representation of behavioral patterns than traditional methods [17]. The use of ESM has also expanded in the field of mental health, where real-time data obtained through ESM help to understand patients' mood fluctuations and improve patient engagement in treatment through data visualization [19].

Recent studies indicate that ESM functions not only as a research tool but also as part of clinical practice and digital health interventions. Meta-analytic studies highlight that ESM is effective in capturing variability in psychological phenomena, such as the relationship between self-compassion and psychological well-being at the individual level over time, demonstrating its adaptability across complex research domains [12]. ESM has also been applied to assess social connectedness among older adults, providing important contextual insights for social and mental health interventions [5].

Overall, ESM has proven superior at capturing the dynamics of human experience *in situ*, with expanding applications ranging from health behavior and social relationships to mental health monitoring, making it a crucial method in contemporary research.

Negative Thought Intrusion

Negative thought intrusion is a cognitive phenomenon in which unwanted thoughts or mental content emerge automatically and persistently in an individual's consciousness. Recent studies indicate that the frequency of intrusive thoughts is positively associated with academic procrastination, where disruptive thoughts hinder focus and the completion of important tasks, thereby contributing to failures in academic self-regulation [20].

In addition, negative thought intrusion is strongly linked to emotional dysregulation. Longitudinal research has found that recurring intrusive thoughts contribute to avoidance patterns and reduced self-compassion, which in turn exacerbate tendencies to delay tasks and make less effective decisions [9].

Academic Rumination

Academic rumination refers to a repetitive thinking pattern focused on failure, anxiety, and dissatisfaction with academic performance. Recent studies show that rumination is predicted by maladaptive cognitive strategies such as cognitive avoidance and perfectionism, where students who avoid stressful thoughts tend to experience increased rumination through the mediating roles of stress and perfectionism [21],

Rumination is not only associated with negative emotional experiences but also affects cognitive control. Van den Berg and Heinen [22] found that rumination is linked to difficulties in shifting attention away from negative information in working memory, which further complicates emotional regulation and traps individuals in patterns of overthinking that hinder academic performance and psychological well-being [23].

Working Memory Capacity

Working memory capacity (WMC) plays a key role in executive control, including the ability to retain information, shift attention, and store and process relevant information in complex decision-making. Recent evidence suggests that individuals with higher working memory capacity demonstrate a greater ability to suppress unwanted thought intrusions during thought suppression tasks, indicating that WMC plays an important role in modulating negative intrusions [24].

Furthermore, research in the domain of decision-making indicates that working memory capacity has a significant impact on decision quality. Individuals with higher WMC tend to engage in more effective evaluation processes and are better able to avoid impulsive responses, particularly in situations that require integrating complex information [25].

Decision-Making and Decisional Procrastination

Decision-making is a complex cognitive process that involves evaluating alternatives and their consequences, and selecting the optimal course of action based on individual goals and preferences [26]. Recent research highlights that metacognitive strategies and time management mediate the relationship between metacognitive beliefs about procrastination and the tendency to delay decision-making (decisional procrastination), where time management and anxiety are key predictors of decisional delay [27].

These findings are consistent with the self-regulated learning framework, which suggests that individuals who are less capable of regulating their learning processes—including decision evaluation—are more likely to delay important decisions. The inability to select and efficiently process information increases the likelihood of postponing choices, thereby leading to decisional procrastination behavior [28].

3. METHOD

This study employs the Experience Sampling Method (ESM) to examine the relationships among academic rumination, reduced working memory capacity, and decisional procrastination by measuring negative thought intrusion. The ESM approach allows participants to report their experiences in real time at multiple moments, enabling the capture of fluctuations in negative thoughts and cognitive performance that may be overlooked when using retrospective questionnaires. The study was conducted with 20 student respondents, each of whom was asked to complete questionnaires at five different moments, resulting in a total of 100 observations. Participants were instructed to provide honest and spontaneous responses based on their current condition, including negative

thoughts, emotional states, and decision-making tendencies. The data collected include academic rumination, working memory capacity, decisional procrastination, and negative thought intrusion. The data were then analyzed using both descriptive and inferential methods to identify patterns and relationships among variables, while accounting for individual differences and variation across measurement moments.

4. RESULTS AND DISCUSSION

4.1. RESULTS

Descriptive Statistics

Table 1. Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Negative Thought Intrusion (Y)	100	8	25	18.19	4.685
Academic Rumination (X1)	100	4	15	10.91	2.847
Reduced Working Memory Capacity (X2)	100	4	15	10.83	2.753
Decisional Procrastination (X3)	100	3	15	10.88	3.059
Valid N (listwise)	100				

Source: SPSS 22 Output

Based on the descriptive statistics results, it can be observed that the scores of negative thought intrusion (Y) across 100 observations range from 8 to 25, with a mean of 18.19 and a standard deviation of 4.685, indicating a moderate level of variation among respondents. The scores for academic rumination (X1) range from 4 to 15, with a mean of 10.91 and a standard deviation of 2.847, while decreased working memory capacity (X2) has a mean of 10.83 and a standard deviation of 2.753, suggesting distributions that are relatively similar for these two predictor variables.

Decisional procrastination (X3) has an average score of 10.88 with a standard deviation of 3.059, indicating a moderate variation in the tendency to delay decision-making among respondents. Overall, the data indicate that respondents experience varying levels of negative thought intrusion, academic rumination, decreased working memory capacity, and decisional procrastination, but these tend to fall within a moderate range.

Inferential Statistics

Simultaneous Effect Testing

Table 2. Simultaneous Effect Testing

ANOVA ^a					
Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	1931.146	3	643.715	255.101	.000 ^b
Residual	242.244	96	2.523		
Total	2173.390	99			

a. Dependent Variable: Negative Thought Intrusion (Y)

b. Predictors: (Constant), Decisional Procrastination (X3), Reduced Working Memory Capacity (X2), Academic Rumination (X1)

Source: SPSS 22 Output

Based on the ANOVA results for simultaneous effect testing, the F-value obtained is 255.101 with a p-value of 0.000 (< 0.05), indicating that academic rumination (X1),

decreased working memory capacity (X2), and decisional procrastination (X3) simultaneously have a significant effect on negative thought intrusion (Y). The regression Sum of Squares value of 1,931.146 reflects the amount of variation in Y that can be explained collectively by the three predictors, while the residual Sum of Squares value of 242.244 represents the variation that the model cannot explain. Therefore, the overall regression model is significant in explaining respondents' negative thought intrusions.

Partial Effect Testing

Table 3. Partial Effect Testing Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.845	.658		1.285	.202
Academic Rumination (X1)	.596	.145	.362	4.097	.000
Reduced Working Memory Capacity (X2)	.576	.149	.338	3.860	.000
Decisional Procrastination (X3)	.424	.130	.277	3.253	.002

a. Dependent Variable: Negative Thought Intrusion (Y)

Source: SPSS 22 Output

Based on the Coefficients results, all three independent variables show a significant partial effect on negative thought intrusion (Y). Academic rumination (X1) has a regression coefficient of 0.596 with $t = 4.097$ and $p = 0.000$, indicating that every one-unit increase in academic rumination will increase negative thought intrusion by 0.596 units, with a significant effect. Decreased working memory capacity (X2) has a coefficient of 0.576 ($t = 3.860$; $p = 0.000$), indicating that the lower the working memory capacity, the higher the level of negative thought intrusion experienced by respondents. Meanwhile, decisional procrastination (X3) has a coefficient of 0.424 ($t = 3.253$; $p = 0.002$), indicating that the greater the tendency to delay decision-making, the greater the negative thought intrusion. Overall, all three variables contribute positively and significantly to negative thought intrusion, with academic rumination exerting the strongest effect.

Coefficient of Determination

Table 4. Coefficient of Determination

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.943 ^a	.889	.885	1.589

a. Predictors: (Constant), Decisional Procrastination (X3), Reduced Working Memory Capacity (X2), Academic Rumination (X1)

Source: SPSS 22 Output

Based on the Model Summary, the R value is 0.943, and the R^2 value is 0.889, indicating that 88.9% of the variation in negative thought intrusion (Y) can be jointly explained by academic rumination (X1), decreased working memory capacity (X2), and decisional procrastination (X3). The Adjusted R^2 value of 0.885 shows that after adjusting for the number of predictors, the contribution of the independent variables to negative thought intrusion remains very high. This indicates that the regression model used is highly effective in explaining the phenomenon of negative thought intrusion among respondents, while the remaining 11.1% is likely influenced by other factors not measured in this study.

4.1. DISCUSSION

The Effect of Academic Rumination on Negative Thought Intrusion

The findings of this study indicate that academic rumination provides the largest contribution in predicting negative thought intrusion. Rumination is a repetitive pattern of thinking focused on negative thoughts related to academic anxiety, failure, or academic workload pressure. The perseverative cognition model suggests that repetitive thinking such as rumination increases emotional tension and triggers prolonged stress responses, thereby reinforcing the tendency for unwanted negative thoughts to emerge [29]. This repetitive cognitive process also diverts cognitive resources from the main task to recurring thoughts, creating a cycle of thought intrusion that is difficult to stop [30].

Experimental studies on working memory updating show that individuals with high ruminative tendencies tend to have difficulty removing negative information from working memory, especially when such information is irrelevant to the task at hand [31]. As a result, negative thoughts remain “residing” in short-term memory and become more prone to intrusive emergence [13]. This phenomenon is consistent with the findings of this study, which show that academic rumination is significantly correlated with an increased frequency of negative intrusive thoughts among students experiencing academic pressure [30].

From the perspective of value-based psychological interventions, the enhancement of patience has been shown to strengthen emotional regulation and reduce anxiety, although it does not always demonstrate statistically significant reductions in anxiety. Patience, as a component of self-control, functions as a mechanism that inhibits the ruminative cycle and, thus, can theoretically serve as a protective factor against negative thought intrusion.

The Relationship Between Decreased Working Memory Capacity and Negative Thought Intrusion

The findings of this study indicate that decreased working memory capacity partially influences negative thought intrusion. Working memory is a limited cognitive system that plays a crucial role in maintaining focus on current tasks. When working memory capacity declines—such as due to high academic workload or multitasking—an individual’s ability to suppress or discard irrelevant thoughts also decreases. This concept is supported by evidence showing that difficulties updating the contents of working

memory (e.g., removing outdated or negative information) lead to irrelevant negative thoughts more frequently “pass through” into conscious awareness [31].

Other studies also find that limited cognitive resources resulting from reduced working memory capacity negatively affect attentional control and thought regulation, particularly for emotional material [24]. When working memory is overloaded by tasks or emotional stress, individuals become more vulnerable to intrusive thoughts because they lack sufficient cognitive capacity to block or regulate them. This empirically explains why decreased working memory capacity is significantly associated with higher levels of negative thought intrusion among students.

The Relationship Between Decisional Procrastination and Negative Thought Intrusion

Decisional procrastination refers to the tendency to delay making important decisions, often driven by fear of making mistakes, avoidance of uncertainty, and limitations in cognitive control. Studies show that individuals who delay decision-making tend to experience more unwanted thoughts, such as negative rumination and thoughts that disrupt focus, due to their inability to regulate or suppress these thoughts [32]. These negative thought intrusions further prolong indecision and intensify anxiety related to decision-making [33].

Research on procrastination as a failure of self-regulation emphasizes that intrusive thoughts (including rumination and other negative thoughts) not only co-occur with delay but also mediate the relationship between self-control and procrastination behavior in decision-making or action [32]. This means that students who tend to delay academic decision-making (decisional procrastination) are more likely to experience disruptive negative thoughts, as these cognitive disturbances reduce their ability to stay focused and select the most appropriate options in academic contexts.

Synergy of the Three Variables (Simultaneous Effect)

Overall, the three independent variables (academic rumination, decreased working memory capacity, and decisional procrastination) simultaneously explain 88.9% of the variance in negative thought intrusion, indicating a strong pattern of interaction between cognitive and emotional aspects. Academic rumination can deplete cognitive resources required for complex tasks; reduced working memory capacity limits the ability to suppress or discard irrelevant thoughts; and decisional procrastination slows down task completion strategies while allowing negative thoughts to persist and intensify. These three factors reinforce one another, creating a vicious cycle of negative thoughts that frequently emerge without control [29].

5. CONCLUSION

This study highlights that cognitive and behavioral factors related to academic processes play an important role in shaping students' vulnerability to intrusive negative thinking. The findings emphasize that students' internal cognitive regulation and decision-

making patterns are closely associated with the emergence of unwanted thought intrusions in academic contexts.

From an applied perspective, these results suggest the importance of strengthening cognitive control strategies and self-regulation skills within higher education settings. Universities and academic counselors can use these insights to design preventive and intervention programs that improve cognitive efficiency, reduce maladaptive thinking patterns, and support healthier decision-making among students.

However, this study is limited by its relatively small sample size and the use of repeated measurements within a limited number of participants, which may restrict the generalizability of the findings. In addition, the study focuses only on selected cognitive variables, without considering broader psychological, environmental, or contextual factors that may also contribute to negative thought intrusion.

Future research is recommended to involve larger, more diverse samples and to incorporate additional variables, such as emotional regulation, stress levels, and academic workload, to provide a more comprehensive model. Longitudinal designs are also suggested to better capture changes in cognitive patterns over time. For the general public, this study contributes by increasing awareness of how everyday cognitive habits in academic life can influence mental well-being, particularly in managing intrusive thoughts that may disrupt concentration and emotional stability.

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