



Research Article

The Role of False Memory in Social Anxiety and Psychological Resilience: A Network Analysis in Academic Contexts

Mahmoud Ali Moussa^{*a}, Omar Atallah Al-Adamat^b, Naoual Abdessalam Adghar^c

[a] Department of Educational Psychology, Faculty of Education, Suez Canal University, Egypt

[b] Ministry of Education, Jordan

[c] Faculté des Lettres et des Sciences Humaines, Université Sidi Mohamed Ben Abdellah, Fès, Morocco

Abstract

This study applies network analysis to examine the complex relationships among social anxiety subscales, false memory, and psychological resilience in university students. A sample of 184 second-year students in scientific majors was analyzed to identify key psychological factors shaping academic cognition and emotion. The resulting network, with five nodes and eight significant edges, demonstrated moderate sparsity (sparsity index = 0.20), enabling the identification of core pathways without overfitting. Centrality measures consistently revealed anticipatory anxiety as the most influential construct, with the highest scores in betweenness, closeness, strength, and expected influence. This finding highlights anticipatory anxiety's central role as a bridge between academic social anxiety, workload stress, and memory-related processes, marking it as a primary driver of cognitive-affective dynamics in academic environments. Academic social anxiety also showed strong centrality, emphasizing its impact on students' immediate emotional responses to academic challenges.

Conversely, false memory and psychological resilience were more peripheral in the network. Their lower betweenness and closeness scores suggest they function more as outcomes or moderators rather than as core causes. Notably, psychological resilience exhibited a negative expected influence, indicating its protective role in buffering the impact of academic stress and anxiety. Academic workload stress, though less connected overall, contributed meaningfully through targeted effects, particularly by intensifying anticipatory anxiety and social evaluative concerns. These insights offer a nuanced framework for developing interventions targeting anticipatory anxiety and academic social anxiety, while enhancing psychological resilience to support student well-being and academic performance in higher education contexts.



Keywords: Social anxiety; psychological resilience; false memory; network analysis; higher education

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Psychological Thought, 2026, Vol. 19(1), 165-195, <https://doi.org/10.37708/psyct.v19i1.1147>

Received: 2025-04-25. Accepted: 2025-04-25. Published (VoR): 2025-05-02.

Handling Editor: Emelina Zaimova-Tsaneva, South-West University "Neofit Rilski", Blagoevgrad, Bulgaria.

*Corresponding author at: Department of Educational Psychology, Faculty of Education, Suez Canal University, Egypt

E-mail: mahmoud_muanna@edu.suez.edu.eg



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Memory is not a static archive of the past but a dynamic, reconstructive process, one that prioritizes adaptive flexibility over archival precision. Rather than faithfully reproducing events, episodic memory encodes discrete elements independently and recombines them at retrieval, a mechanism that supports generalization and cognitive economy but simultaneously renders recollection vulnerable to distortion. When overlapping details or emotionally charged inferences intrude during reconstruction, the result can be false memories: vivid, subjectively real recollections of events that never occurred or are significantly misrepresented ([Poncet et al., 2024](#); [Erceg et al., 2025](#)). Once confined to forensic and clinical discourse, false memory has increasingly been recognized as a phenomenon with far-reaching implications for psychological functioning, particularly when emotion and cognition intersect under conditions of stress.

The emotional modulation of memory is neither uniform nor neutral. Fear, long the focus of affective memory research, tends to heighten vigilance and sharpen encoding. Disgust, by

contrast, operates differently: it appears to stabilize emotional representations within memory traces, inadvertently facilitating the incorporation of false elements ([Matson et al., 2025](#)). This distinction matters because it reveals that emotional states do not simply intensify or impair memory, they shape its very structure, sometimes preserving affective truth at the expense of factual accuracy. Such findings challenge simplistic views of memory error and point toward a more nuanced understanding: false memories may arise not from cognitive failure alone, but from the adaptive, if sometimes maladaptive, interplay between emotional regulation and reconstructive processes ([Wade et al., 2025](#); [Murphy et al., 2023](#)).

Within this landscape, social anxiety occupies a uniquely complex position. Characterized by intense fear of negative evaluation, hypervigilance to social threat, and pervasive self-doubt, social anxiety disorder (SAD) creates a cognitive-affective context ripe for distortion. Individuals with SAD do not simply experience more anxiety; they process social information differently, allocating attentional resources toward threat-confirming cues and away from disconfirming evidence. This biased processing extends to memory: emerging evidence suggests that socially anxious individuals may generate *fewer* false memories in some contexts, perhaps due to heightened caution, yet remain disproportionately susceptible to distortion when ambiguity, stress, or self-relevant content is involved ([Palma et al., 2017](#); [Cody et al., 2015](#)). The paradox underscores a critical insight: false memory in social anxiety is not a matter of simple deficit but of context-dependent cognitive-emotional tuning.

Crucially, false memories in this population may serve functions beyond error. They can operate as psychological defense mechanisms, enabling individuals to rationalize aversive experiences, maintain coherence in self-narrative, or avoid socially painful realities ([Lobaito, 2024](#); [Leo et al., 2025](#)). From this perspective, false memories are not merely byproducts of faulty encoding but active constructions shaped by motivational and affective pressures, reconstructions that, however inaccurate, help preserve emotional equilibrium. This functional view aligns with broader frameworks positioning false memory within the dynamics of dissociation, emotional dissonance, and maladaptive coping ([Dodier et al., 2022](#); [Erceg et al., 2025](#)).

Despite these advances, the educational context remains strikingly underexplored. University students navigate a confluence of cognitive demands, social evaluative pressures, and performance-related stress, conditions known to amplify both anxiety and memory distortion. Academic settings are, in effect, natural laboratories for studying how social anxiety and false memory intersect. Yet educational psychology has largely treated memory accuracy as a given,



focusing on study strategies and retrieval practice while overlooking the emotional and reconstructive processes that shape *what* students remember, and whether what they remember is true. The consequences are not trivial: distorted recall of feedback, peer comparisons, or performance outcomes can reinforce negative self-appraisals, undermine self-efficacy, and perpetuate cycles of anxiety and disengagement.

The present study addresses this gap by investigating the structural interplay among social anxiety, false memory, and psychological resilience in academic contexts. Rather than treating these constructs as isolated variables, we employ network analysis, a methodological approach suited to capturing the complex, reciprocal interdependencies that characterize psychological systems. Network analysis models construct nodes connected by partial correlations, revealing not only which variables are central but how they influence one another through direct and indirect pathways. This approach is particularly apt for examining whether false memory functions as a driver of cognitive-affective dynamics, a downstream outcome of emotional stress, or both.

Our inquiry is guided by three overarching aims: first, to map the network structure linking academic social anxiety, anticipatory anxiety, academic workload stress, false memory, and psychological resilience; second, to identify which nodes exert the greatest structural influence; and third, to interpret the role of false memory within this system, whether it emerges as a core vulnerability, a peripheral consequence, or a mediator between emotional states and adaptive functioning. In doing so, we seek to integrate cognitive, clinical, and educational perspectives, advancing a model of academic psychological health that accounts for the reconstructive and sometimes distortive nature of human memory under stress.

Previous framework

Previous frameworks conceptualized false memory as a phenomenon rooted in the reconstructive nature of episodic memory. Rather than serving as a veridical record of past experiences, episodic memory encodes discrete elements of events independently, which are then adaptively recombined during retrieval. This reconstructive process supports cognitive flexibility and generalization but simultaneously renders memory vulnerable to interference, particularly when overlapping or similar event details intrude during recall. Such intrusions can give rise to fabricated or distorted recollections collectively known as false memories. Recent evidence ([Poncet et al., 2024](#)) suggests that false memories arise not merely from retrieval

failures but from a dynamic interplay across encoding, storage, and reconstructive retrieval processes, underscoring the inherently malleable nature of human memory.

False memories are defined as declarative recollections that feel subjectively real despite being partially or entirely inaccurate or fabricated ([Erceg et al., 2025](#)). Their manifestations range from benign misremembering to distortions with serious real-world consequences, such as wrongful convictions or clinical misdiagnoses. A novel contribution to this literature concerns the differential influence of emotions on false memory formation, with disgust, historically understudied relative to fear, emerging as a particularly potent modulator ([Matson et al., 2025](#)). Unlike fear, which typically promotes avoidance and heightened vigilance, disgust appears to stabilize emotional representations in memory traces, inadvertently facilitating the integration of false elements. This pattern suggests a psychological defense mechanism whereby emotional systems modulate memory fidelity while generating plausible yet illusory recollections to rationalize or cope with aversive experiences.

Empirical findings indicate that false memories often involve erroneous recall or recognition of events that never occurred, or memories significantly distorted in detail ([Chang et al., 2025](#)). The amplification of such distortions by disgust points to an intriguing link between specific emotional states and the quality of mnemonic representations ([Matson et al., 2025](#)). This emotional modulation is especially salient in contexts demanding high mnemonic precision, such as eyewitness testimony, where false memories can have profound legal ramifications. Consequently, psychological research has prioritized investigating the mechanisms and moderators of false memory to improve forensic reliability and inform clinical interventions ([Chang et al., 2025](#)).

[Wade et al. \(2025\)](#) emphasize that false memories frequently originate from suggestive or imaginative processes that introduce fabricated details into recollective experience. These memories often entail reinterpretations of events varying in temporal proximity and emotional salience, unified by a common propensity for inconsistency and factual inaccuracy. Temporal degradation or distortion of emotional memory details compounds these errors, producing divergence between subjective experience and actual events. Such findings align with conceptualizations of false memories as imaginative reconstructions rather than mere retrieval failures. Importantly, false memories may also function as denial mechanisms following traumatic experiences, whereby individuals consciously or unconsciously reject the reality of an event ([Murphy et al., 2023](#)). Reported prevalence rates of false memories vary widely, from 4%



to 35%, reflecting sample and methodological variability, yet consistently underscoring their significant psychological impact, often accompanied by confusion and disorientation.

The reliability of long-term memory, particularly under aversive emotional influences such as disgust, is further compromised by an adaptive yet error-prone reconstructive process. This process may function as a psychological resilience mechanism, enabling individuals to maintain emotional homeostasis by aligning past knowledge with current affective states. Key features include selective narrowing of attention and prioritized encoding of emotionally charged stimuli, affecting both subsystems of declarative memory. Semantic memory, encompassing general knowledge and facts, may be defensively distorted to facilitate repression or projection of distressing content; episodic memory, encoding personal experiences, may undergo reimagining via identification or daydreaming to attenuate emotional distress tied to distorted perceptions ([Leo et al., 2025](#)). This dual impact highlights the complex interplay between emotion regulation and mnemonic fidelity.

False memory emergence is frequently associated with intense negative emotions, such as anxiety, sadness, and anger, alongside persistent negative mood traits. These factors jointly infuse semantic and episodic memories, precipitating psychological dissociation characterized by fragmentation of consciousness and disrupted cognitive-affective processing. The resulting dissociation manifests as obsessive thought patterns and a sense of self-alienation, representing a critical domain of psychopathology ([Dodier et al., 2022](#); [Erceg et al., 2025](#)). Expanding this view, [Lobaito \(2024\)](#) conceptualizes false memories as manifestations of emotional dissonance rooted in flawed cognitive appraisals, existential reflections, and maladaptive responses to shame-inducing experiences. This framework situates false memories within broader affective and motivational disruptions, suggesting these illusory recollections function as compensatory mechanisms for psychological incongruence.

Age-related factors also significantly influence false memory formation. [Gülseren and İkier \(2025\)](#) argue that age stereotypes modulate information processing and recall, with stereotype-consistent information preferentially encoded and remembered. This facilitation, however, is double-edged, as it simultaneously increases susceptibility to memory errors, including fabrications and distortions aligned with social stereotypes. These findings implicate social cognition and age-related biases as critical, yet underappreciated, determinants of mnemonic accuracy and error, warranting further interdisciplinary research.

[Palma et al. \(2017\)](#) emphasize the multifaceted nature of false memory, defining it as recall of events that never occurred or distorted recall of actual events, regardless of emotional valence. Their work highlights individual differences in emotional instability and maladaptive coping, particularly in social anxiety disorder (SAD). Intriguingly, individuals with SAD may produce fewer false memories than their non-anxious counterparts, suggesting complex interactions among anxiety, vigilance, and memory accuracy. In contrast, [Brust and Stein \(2012\)](#) report that emotionally arousing events tend to be remembered more accurately when assessed immediately post-exposure via free recall, underscoring the critical role of temporal factors and memory assessment methods in observed emotion-memory effects. [Neufeld et al. \(2013\)](#) further complicate this picture by demonstrating that emotional content can simultaneously enhance true memory and increase false memories during emotionally provocative narratives, indicating bidirectional influences of emotion on mnemonic fidelity.

[Cody et al. \(2015\)](#) provide additional nuance by examining social anxiety's role in false memory formation across social and non-social contexts. Their findings indicate that social anxiety elevates false memory rates primarily in non-social situations marked by anticipatory social stress. However, this effect diminishes when social materials are employed, suggesting that the anticipatory cognitive-emotional state tied to social pressure, rather than social content per se, is the key modulator of memory distortion. This insight enhances understanding of the contextual and affective specificity of false memory processes, with significant clinical and forensic implications. [Putri et al. \(2025\)](#) explored how psychological resilience and social support influence the reduction of social anxiety among prisoners before release, anxiety often exacerbated by societal stigma, uncertainty about the future, and challenges related to reintegration. Their findings demonstrated that enhancing psychological resilience and social support significantly explained decreases in social anxiety levels. The conceptual model emerging from this framework is summarized in Figure 1.

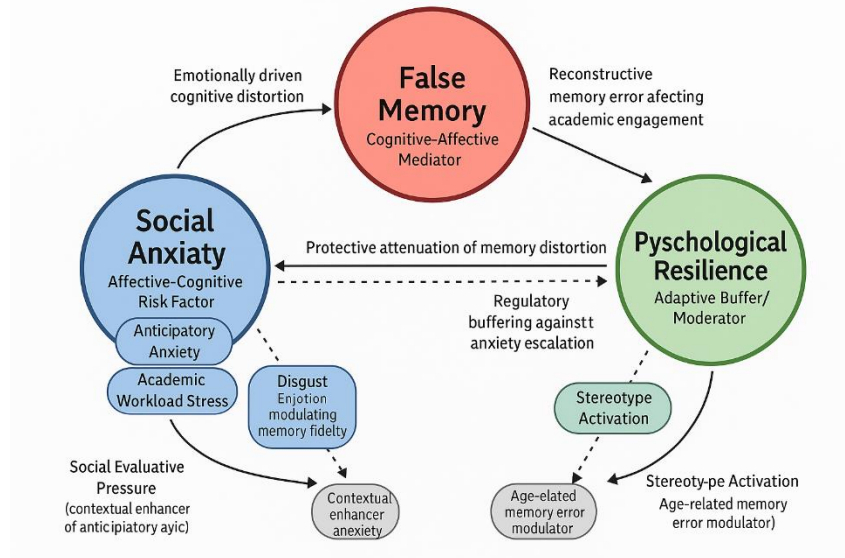


Figure 1. Conceptual model of dynamic interplay of study variables (original).

The suggested conceptual model presented in Figure 1 offers a theoretically grounded visualization of the reciprocal and dynamic interplay among false memory, social anxiety, and psychological resilience within academic environments. Central to the model is the construct of *false memory*, posited as a critical mediating hub that synthesizes maladaptive cognitive distortions with both emotional vulnerability and adaptive functioning. Surrounding this core are three interlinked subcomponents of *social anxiety*, namely, academic social anxiety, anticipatory anxiety, and academic workload stress, each contributing distinct yet interconnected pathways that intensify the cognitive-affective load experienced in high-stakes educational settings. These components are hypothesized to influence the genesis and consolidation of false memories via neurocognitive mechanisms such as working memory depletion, affective misappraisal, and attentional dysregulation (Cody et al., 2015; Erceg et al., 2025; Poncet et al., 2024). In contrast, *psychological resilience* is conceptualized as a buffering construct that counteracts the anxiety-memory feedback loop. By modulating the deleterious effects of anxiety on mnemonic distortion, resilience facilitates greater metacognitive oversight and emotional homeostasis. The model's bidirectional pathways reflect the recursive, nonlinear nature of these relationships: heightened social anxiety may exacerbate false memory susceptibility, which in turn may undermine resilience, thus reinforcing a maladaptive cognitive-affective cycle. However, enhanced resilience can interrupt this cycle, promoting cognitive control and emotion regulation. As such,

the model serves as a heuristic framework that integrates principles from cognitive psychology, affective neuroscience, and educational adaptation, offering a novel perspective on the mechanisms underlying student vulnerability and resilience in cognitively demanding academic contexts.

Problem statement

In modern educational environments, students navigate a confluence of emotional and cognitive pressures that pose significant challenges to learning, psychological well-being, and academic persistence. While considerable research has examined affective and cognitive contributors to academic performance, the phenomenon of false memory, the subjective recollection of events that are partially or wholly inaccurate, has received limited attention in educational research. Traditionally investigated within forensic ([Roediger & McDermott, 1995](#); [Loftus, 2005](#)) and clinical domains ([Clancy et al., 2000](#)), false memory has increasingly been linked to affective regulation mechanisms such as anxiety, emotional dissonance, and maladaptive coping ([Erceg et al., 2025](#); [Palma et al., 2017](#)). However, its role in shaping academic experiences, particularly through its interactions with social anxiety and psychological resilience, remains markedly underexplored.

Emerging evidence suggests that students with elevated social anxiety may internalize and distort academic experiences, reinforcing negative self-appraisals through erroneous memory reconstructions (e.g., recalling underperformance or exaggerated peer criticism). These maladaptive cognitive distortions can diminish self-efficacy, suppress academic engagement, and exacerbate anxiety over time. Conversely, resilience, conceptualized as a dynamic capacity for adaptive functioning in the face of stress, may either buffer against or be compromised by the presence of emotionally laden false memories. This bidirectional relationship implies that false memory may not merely be a cognitive artifact but a functional mediator in students' affective-cognitive adaptation to academic stress.

Despite robust findings in cognitive science linking emotional valence to memory distortion, educational psychology has yet to integrate these insights into models of academic vulnerability and resilience. Moreover, traditional linear methodologies are ill-suited to capture the complex, reciprocal interdependencies among psychological constructs. Network analysis offers a promising framework for elucidating the structural role of false memory within a broader constellation of affective and adaptive variables. By modeling the interplay between false

memory, social anxiety, and resilience, such an approach may reveal novel cognitive-affective pathways that contribute to academic functioning.

Accordingly, a critical gap exists in our understanding of how false memory operates in academic settings, not merely as a source of memory error, but as a node within a dynamic psychological system influencing student adjustment. Investigating these interrelations may yield valuable insights into targeted psychological interventions and educational practices aimed at reducing anxiety and fostering resilience. The following problem can be summarized as: What is the structural and psychological role of false memory within the network of social anxiety and psychological resilience among students in academic contexts?

Method

Design

This study employed a cross-sectional correlational design grounded in psychological network analysis to investigate the complex interrelations among five theoretically and empirically salient constructs within academic cognition and emotion: academic social anxiety, anticipatory anxiety, academic workload stress (as interrelated subdimensions of social anxiety), false memory, and psychological resilience. These constructs have been repeatedly implicated in the literature as critical determinants of students' emotion regulation and cognitive performance in high-stakes educational contexts.

Participants

The sample comprised 184 second-year undergraduate students (162 females, 22 males; $M_{GPA} = 2.497$, $SD = 0.707$; GPA range = 1.00 - 4.70 on a 5-point scale) enrolled in scientific majors, including mathematics, physics, chemistry, biology, and general science, within the Faculty of Education at Suez Canal University. Although students were recruited from the same year of study, their ages ranged from 19 to 21 years due to variations in pre- and during-university educational trajectories and admission pathways.

These academic disciplines were purposively selected based on their elevated cognitive demands and performance-driven assessment structures, which are known to amplify academic anxiety and stress (cf. [Moussa & Elnerash, 2025](#)). Participants were recruited using convenience sampling from core theoretical courses to ensure accessibility and diversity in academic achievement. The inclusion of academic, social, and anticipatory anxiety reflects their

documented roles in impairing engagement and executive functioning under evaluative pressure.

Instruments

The **Psychological Resilience scale** was designed by the authors, and it consists of a single-item instrument designed to assess university students' perceived capacity for enduring academic challenges through patience and perseverance. The item - "To what extent do you feel psychologically resilient (in terms of patience and academic perseverance)?"—captures a core aspect of resilience relevant to higher education, where students frequently encounter stressors that demand sustained effort, emotional regulation, and long-term goal orientation. Responses are recorded on a 10-point Likert-type scale ranging from 1 (*very low resilience*) to 10 (*very high resilience*), allowing participants to intuitively self-evaluate their academic resilience without cognitive overload.

The Social Anxiety Indicators Scale (SAIS)

It is developed as a theoretically grounded and contextually specific psychometric instrument to systematically assess social anxiety as it manifests within academic evaluative contexts. The SAIS addresses a longstanding gap between clinical measures of social anxiety and educational assessments of test-related stress by integrating dimensions uniquely pertinent to the educational domain, including oral presentations, high-stakes examinations, peer evaluation, and instructor scrutiny. The 15-item scale (see Appendix 1) was constructed through rigorous content analysis of established instruments, namely, the Social Anxiety Scale for Adolescents (SAS-A; [La Greca & Lopez, 1998](#)), the Brief Fear of Negative Evaluation Scale—Revised (BFNE-R; [Carleton et al., 2006](#)), the Cognitive Test Anxiety Scale (CTAS; [Cassady & Johnson, 2002](#)), and the short forms of the Social Interaction Anxiety Scale and Social Phobia Scale ([Fergus et al., 2014](#)) (see Table 1). Items were adapted to reflect cognitive-affective dimensions, including anticipatory anxiety, fear of negative evaluation, and socially mediated performance distress, all within the temporal and interpersonal pressures inherent to academic contexts. Content domains span evaluative feedback, academic workload stress, peer comparison, and classroom performance exposure.

In the present sample, the exploratory factor analysis (EFA) showed a three-factor structure emerged, comprising Academic Social Anxiety, Academic Workload Stress, and Anticipatory Anxiety, demonstrating structural alignment with contemporary multidimensional models of

educational anxiety (e.g., [Putwain & Daly, 2014](#)) and interactional models of social anxiety ([Fergus et al., 2014](#)). The results of the EFA performed by principal component analysis and promax rotated axis, which provide strong support for the construct validity of the SAIS, indicating the three-factor structure aligned with the theoretical dimensions of Academic Social Anxiety, Academic Workload Stress, and Anticipatory Anxiety. The overall Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was exceptionally high at 0.908, with individual item MSA values ranging from 0.860 to 0.945, confirming the suitability of the data for factor analysis. Bartlett’s Test of Sphericity equaled a highly significant result ($\chi^2 = 1225.022$, $df = 105$, $p < .001$), indicating suitable correlations among items for factor extraction. The rotated solution explained approximately 59.5% of the total variance, with Component 1 (Anticipatory Anxiety) accounting for 23.4%, Component 2 (Academic Social Anxiety) for 21.8%, and Component 3 (Academic Workload Stress) for 14.2%, indicating meaningful and interpretable latent dimensions.

Table 1.
Content analysis of Social Anxiety structures in previous studies

Study / Author(s)	Subscales	Construction Method	General Factor Structure	Sample Characteristics	Measurement Tool/ Scale	Psychometric Properties	Major/ Discipline
La Greca & Lopez (1998, revised post-2000)	Fear of Negative Evaluation, Social Avoidance in New/General Situations	Empirical-theoretical basis	Three-factor model	Adolescents	Social Anxiety Scale for Adolescents (SAS-A)	$\alpha > .85$; CFA supported	Developmental Psychology
Cassady & Johnson (2002)	Cognitive worry, emotionality	Theoretical model adapted from test anxiety literature	Two-factor (worry/emotionality)	Undergraduate students	Cognitive Test Anxiety Scale (CTAS)	$\alpha > .90$; CFA supported	Educational Psychology
Putwain & Daly (2014)	Test anxiety, Learning anxiety, Future-oriented anxiety	Theoretical refinement of test anxiety	Three-factor model	Secondary students (UK)	Multidimensional Academic Anxiety Scale (MAAS)	$\alpha > .80$; factorial invariance tested	Educational Psychology
Carleton et al.(2006)	Fear of Negative Evaluation	Revised version of BFNE	Unidimensional	General and community samples	Brief Fear of Negative Evaluation Scale– Revised (BFNE-R)	$\alpha > .90$, confirmed construct validity (CFA)	Clinical Psychology
Fergus et	Social	Compariso	Unidimens	Undergraduate	Short-form	$\alpha > .85$,	Clinical



al. (2014)	Interaction Anxiety	n of two short-form versions	ional	samples	versions of SIAS and SPS	good convergent validity	Psychology
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False Memory Scale (FMS)

To assess individual differences in proneness to memory distortion in academic contexts, the present study employed the False Memory Scale (FMS) – a 15-item (see Appendix 2), theory-driven self-report instrument designed to capture the frequency and subjective characteristics of distorted autobiographical memories. The scale's development was informed by established cognitive mechanisms that contribute to false memory formation, including source monitoring errors ([Johnson et al., 1993](#)), suggestibility ([Loftus, 2005](#)), temporal misattributions, and the conflation of imagined and experienced events ([Thomas & Loftus, 2002](#)). Unlike paradigms reliant on behavioral induction (e.g., the Deese–Roediger–McDermott paradigm; [Roediger & McDermott, 1995](#)) or neurocognitive indices (see Table 2), the FMS aligns with the self-perception and metacognitive frameworks prominent in educational psychology. Its self-report format enables the investigation of internal beliefs and appraisals regarding memory fidelity, factors often overlooked in experimental studies ([Bernstein et al., 2005](#); [Cody et al., 2015](#)).

Items were phrased to reflect everyday memory distortions rather than laboratory-induced errors, enhancing ecological validity and relevance to educational and psychological functioning. Participants responded using a 5-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*), with total scores ranging from 15 to 75. Higher scores indicate greater susceptibility to false memory experiences in daily life.

In the present sample, the FMS exhibited excellent internal consistency (Cronbach's $\alpha = .918$) and a broad range of individual differences ($M = 37.32$, $SD = 12.31$), demonstrating robust psychometric adequacy. These findings support the scale's utility in modeling person-level variability in memory distortion within academic environments.

The FMS was assumed to be a unidimensional latent construct reflecting general false memory susceptibility. The strong internal coherence among items provides empirical support for this general factor model. This approach mirrors findings from prior self-report tools that have identified a single latent trait underlying suggestibility, source confusion, and belief distortions (e.g., [Mazzoni et al., 2001](#)). Furthermore, the adoption of a general factor structure facilitates its integration into network models of cognition and emotion, which require continuous,



psychometrically sound indicators. This parsimonious structure enhances interpretability while maintaining fidelity to theoretical models of cognitive vulnerability.

To evaluate the structural validity of the False Memory Scale, a confirmatory factor analysis was conducted to test a unidimensional model representing a general latent factor of false memory susceptibility. The model demonstrated an acceptable fit to the data: $\chi^2(90) = 167.399, p < .001$, with incremental fit indices exceeding the recommended thresholds (CFI = 0.936; TLI = 0.925; IFI = 0.936; NNFI = 0.925), and an RMSEA of 0.068 (90% CI = 0.052–0.084; $p = .033$), suggesting a reasonable approximation to the population covariance matrix. The SRMR was also within acceptable limits (0.049), further supporting model adequacy. Moreover, all 15 items loaded significantly onto the latent factor (standardized loadings ranging from 0.548 to 0.760, $P_s < .001$), indicating that the items coherently capture a common underlying construct. High factor loadings for key indicators (e.g., $f_{12} = 0.760, f_{15} = 0.755, f_5 = 0.741$) provide the presence of a good general tendency to memory distortion.

Table 2
Content analysis of false memory structures in previous studies.

Study/ Author(s)	False Memory Subscales	Construction Method	General Factor Structure	Sample Characteristics	Measurement Tool / Scale	Psychometric Properties	Major / Discipline
Roediger & McDermott (1995)	Critical Lure Recall, Recognition	Experimental DRM lists	No formal factor model; behavioural performance focus	University students (n ≈ 30)	Deese-Roediger-McDermott paradigm	Not reported; replicated widely	Cognitive Psychology
Clancy et al. (2000)	False Recall, False Recognition, Confidence	Post-hoc subscale extraction	No factor structure; group comparisons	Adults with/without trauma	Modified DRM paradigm	Valid through group differentiation	Clinical Psychology
Zhu et al. (2010)	Visual vs. Auditory False Memory	Experimental manipulation by modality	Multimodal structure: Visual vs. Auditory	Chinese undergraduates	Visual-Auditory DRM paradigm	CFA supported; cross-modal consistency	Cognitive Neuroscience
Bernstein et al. (2005)	Suggestibility, Confidence, Source Monitoring	Theoretical mapping & scale development	Three-factor model: Suggestibility, Confidence, Source	General adult sample	Experimental & self-report tasks	$\alpha > .75$; good test-retest reliability	Personality Psychology
Mazzoni et al. (2001)	Belief in False Events, Imagination Inflation	Scenario-driven item clustering	Single belief-imagination inflation factor	College students	Imagination inflation paradigm	PCA used; convergent validity strong	Social Psychology
Howe et al. (2011)	Emotional vs. Neutral False Memory	Emotionally valenced stimuli	Two-factor: Emotional vs. Neutral	Children and adults	Emotional DRM	CFA supported; distinct	Emotion & Memory Research

Procedure

Data collection was conducted entirely online. Prior to administering the self-report instruments, all potential participants received an email invitation to attend a synchronous orientation session via a secure video-conferencing platform. The session explained the study's objective of modeling structural relationships among academic emotions, memory processes, and resilience without any intervention. Following the orientation, participants who chose to proceed accessed a secure online survey platform. The questionnaire battery contained the Social Anxiety Indicators Scale (SAIS), the False Memory Scale (FMS), and a single-item Psychological Resilience measure, presented in a fixed order. Completion time averaged approximately 15–20 minutes. No compensation or course credit was offered. The final analytical sample comprised 184 respondents with no missing values.

Data Analysis

Data were analyzed using JASP version 19.3. A Gaussian Graphical Model (GGM) was specified to model the partial correlation structures among the five theoretically grounded constructs: academic social anxiety, anticipatory anxiety, academic workload stress, psychological resilience, and false memory. The network structure was estimated using the EBICglasso algorithm, which integrates the graphical least absolute shrinkage and selection operator (glasso) with the Extended Bayesian Information Criterion (EBIC). The default tuning parameter ($\gamma = 0.5$) was retained to achieve an optimal trade-off between model sparsity and fidelity to the observed data, thereby minimizing spurious associations while preserving theoretically meaningful links. Four centrality indices- strength, closeness, betweenness, and expected influence- were computed to quantify each node's relative prominence and integrative function within the network. Prior to network estimation, preliminary screening confirmed that the distributions of all study variables conformed to univariate normality assumptions, with skewness and kurtosis indices falling within the conventional ± 2 thresholds ([Abdelrahman et al., 2025](#); [Moussa & Amer, 2025](#)). The dataset was complete, with no missing values, thus obviating the need for imputation.

Ethical Considerations

This non-interventional, cross-sectional study used anonymous surveys on normal-range academic anxiety, false memory, and resilience, posing no risks beyond daily academic life. Formal IRB approval was not sought, consistent with exempt research guidelines, but the study adhered to the Declaration of Helsinki and APA ethics. A mandatory online orientation preemptively informed participants, and active electronic informed consent was obtained. No identifiers (IPs, student IDs) were collected. Data were password-protected, de-identified, and reported only collectively. Participants could withdraw before analysis. All ethical safeguards (consent, anonymity, voluntariness, transparency, data security) were fully documented.

Results

Preliminary analysis

Before implementing network modeling, it is methodologically imperative to evaluate the descriptive properties of the data to confirm adherence to the statistical assumptions and to ensure sufficient variability for detecting conditional dependencies among psychological constructs. In the present study, 184 university students completed validated measures of five theoretically salient constructs: psychological resilience, anticipatory anxiety, academic social anxiety, academic workload stress, and false memory.

Descriptive analyses revealed adequate dispersion across all variables, as reflected in their standard deviations: psychological resilience ($SD = 2.372$), anticipatory anxiety ($SD = 4.792$), academic social anxiety ($SD = 5.003$), academic workload stress ($SD = 2.537$), and false memory ($SD = 12.307$). Notably, the pronounced variability observed in false memory underscores a wide interindividual distribution of cognitive distortion tendencies, ranging from negligible to highly elevated. This degree of variance is especially advantageous for network analysis, which relies on heterogeneity to detect meaningful edge weights and conditional dependencies among nodes.

The distributional properties of the data were further examined via skewness and kurtosis metrics. All variables fell within acceptable psychometric thresholds for approximate normality, with skewness ranging from -0.803 (academic workload stress) to 0.543 (false memory), and kurtosis ranging from -0.663 to 0.456 . These values suggest minimal deviation from a Gaussian

distribution, reducing the likelihood of estimation bias in partial correlation networks, which are known to be sensitive to extreme values and non-normality.

Centrality and Influence of Variables

The network analysis yielded a moderately sparse configuration, consisting of five psychological constructs (nodes) linked by eight non-zero edges out of a possible ten, resulting in a sparsity index of 0.20. This structure reflects a balance between complexity and parsimony, suggesting that while the constructs – academic social anxiety, false memory, academic workload stress, psychological resilience, and anticipatory anxiety – are meaningfully interconnected, the network avoids overfitting by excluding negligible or spurious associations. Such moderate sparsity is theoretically advantageous, as it delineates the most diagnostically and functionally relevant pathways, thereby enhancing both the robustness and interpretability of the observed relationships within the cognitive-affective domain.

Table 3
Centrality indices and influences of variables

Variable	Network			
	Betweenness	Closeness	Strength	Expected influence
Academic Social Anxiety	0.707	1.218	1.265	0.211
False memory	-0.707	-1.067	-1.223	-0.506
Academic Workload Stress	-0.707	-0.341	-0.055	0.609
Psychological Resilience	-0.707	-0.694	-0.665	-1.438
Anticipatory Anxiety	1.414	0.883	0.678	1.123

Centrality analyses, spanning betweenness, closeness, strength, and expected influence, offer a nuanced lens into the structural prominence of each node within the cognitive-affective network (see Table 3). Notably, anticipatory anxiety emerged as the dominant hub, exhibiting the highest magnitude across all centrality indices: betweenness (1.414), closeness (0.883), strength (0.678), and expected influence (1.123). This convergence across metrics identifies anticipatory anxiety as a pivotal bridging construct, structurally positioned to mediate and disseminate influence throughout the network. Its elevated betweenness centrality highlights its role as a critical conduit linking academic stressors and socio-evaluative threat to memory

distortions and adaptive functioning. These findings underscore anticipatory anxiety not merely as a symptom, but as a central organizing mechanism within the cognitive-emotional architecture of academic vulnerability.

Academic social anxiety also demonstrates pronounced centrality, with positive betweenness (0.707), closeness (1.218), and strength (1.265), though its expected influence (0.211) is comparatively moderate. This suggests that while academic social anxiety is highly accessible and well-connected within the network, it may serve as a stable and proximal factor influencing immediate emotional and cognitive responses, rather than acting as a dominant driver of systemic psychological shifts. Its strong links to workload stress and anticipatory anxiety further underscore its embeddedness in academic emotional dynamics.

In contrast, false memory, psychological resilience, and academic workload stress exhibit negative betweenness values (-0.707), indicating less involvement in bridging different network components. False memory notably occupies a peripheral position, as reflected by negative closeness (-1.067), strength (-1.223), and expected influence (-0.506), implying it is less integrated and less influential within the overall network topology. This peripheral placement may reflect its role as an outcome or secondary phenomenon, rather than a primary causal factor, in the complex interplay of academic stress and anxiety.

Psychological resilience shares a similar peripheral network profile, with negative closeness (-0.694), strength (-0.665), and a markedly negative expected influence (-1.438). These findings are consistent with its conceptualization as a protective factor that operates somewhat independently from immediate stress and anxiety processes or modulates them via indirect mechanisms not fully captured by direct network edges. Its negative expected influence underscores its potential buffering capacity, mitigating the adverse effects of anxiety and workload stress on cognitive and emotional functioning.

Academic workload stress presents an intriguing profile: it exhibits minimal strength (-0.055) and negative closeness (-0.341), yet a positive expected influence (0.609). This suggests that while workload stress is not highly interconnected or centrally accessible, it nonetheless exerts a meaningful influence on the network, potentially through targeted, context-specific pathways, such as intensifying anticipatory anxiety or exacerbating academic social anxiety. This nuanced role highlights the complexity of academic stress as a construct with selective but impactful effects.

Taken together, the network model elucidates the intricate interrelations among anxiety, stress, resilience, and memory within academic contexts. The prominent centrality of anticipatory anxiety highlights it as a critical leverage point for interventions aimed at disrupting maladaptive cognitive-emotional cycles. Meanwhile, the peripheral yet potentially modulatory roles of false memory and psychological resilience emphasize the importance of considering both direct and indirect pathways in advancing our understanding of academic psychological health. These findings offer a refined conceptual framework for supporting student mental well-being and cognitive accuracy, suggesting strategic targets for future research and clinical practice.

Network Centrality per variable

The present analysis (see Figure 2) investigates the centrality indices - Betweenness, Closeness, Strength, and Expected Influence- of five critical psychological constructs affecting university students: Academic Social Anxiety, False Memory, Academic Workload Stress, Psychological Resilience, and Anticipatory Anxiety. This network approach offers an advanced methodological lens for uncovering the dynamic interplay and hierarchical structure of these variables, thus providing crucial insights for evidence-based intervention and policy development in higher education.

Betweenness centrality highlights the intermediary influence a node exerts over the flow of information within the network. In this regard, *Academic Social Anxiety* and *Academic Workload Stress* emerged as dominant bridging constructs. Their elevated betweenness suggests they serve as pivotal conduits linking other psychological factors, potentially amplifying or diffusing stress-related processes across the network. From an educational standpoint, this implies that interventions targeting these two constructs may disrupt maladaptive pathways, thereby exerting system-wide therapeutic benefits. Specifically, programs that reduce academic social anxiety, such as social-emotional skills training and public speaking workshops, may concurrently alleviate anticipatory anxiety and minimize the emergence of false memory errors induced by cognitive overload.

Closeness centrality, representing the average proximity of a construct to all others in the network, was highest for *Academic Social Anxiety* and *False Memory*. These constructs occupy proximal positions that enable rapid transference of psychological effects, both direct and indirect. False memories' central location may be indicative of their susceptibility to emotional and cognitive disturbances, such as those induced by academic stress or social anxiety,

resulting in distorted learning outcomes and compromised academic performance. Therefore, educators must consider the cognitive and emotional demands placed on students, particularly during high-stakes assessments, to mitigate the risk of memory inaccuracies that stem from stress-induced encoding deficits.

In terms of strength centrality, *Academic Social Anxiety* again exhibited the most robust network connectivity, followed closely by *False Memory* and *Academic Workload Stress*. High strength implies a construct's direct influence on other variables, positioning it as a powerful determinant of psychological functioning. The salience of academic social anxiety across all centrality indices reaffirms its role as a core psychological vulnerability in university populations. Consequently, institutional policies should prioritize early identification and management of this anxiety type. For example, implementing cognitive-behavioral interventions, structured peer mentoring, and supportive instructional design can directly buffer their influence on students' academic engagement and emotional regulation.

Notably, Expected Influence, which incorporates both the strength and direction of associations, revealed a unique pattern. While *Academic Social Anxiety* and *False Memory* remained central, *Psychological Resilience* and *Anticipatory Anxiety* demonstrated meaningful influence despite their relatively lower betweenness and strength. This finding suggests that resilience functions as a compensatory mechanism within the psychological ecosystem of students, potentially dampening the adverse effects of academic pressure and social evaluative threat. Enhancing resilience through strengths-based interventions, mindfulness training, and positive psychology curricula may therefore yield considerable indirect benefits, fostering academic persistence and emotional well-being. Likewise, anticipatory anxiety, though often treated as a secondary symptom, may play a foundational role in students' preparatory behaviors and affective regulation, warranting focused attention in pedagogical strategies and counseling services.

In sum, this network analysis elucidates the central and peripheral mechanisms underlying university students' psychological functioning. *Academic Social Anxiety* emerges as a structurally and functionally dominant node, demanding prioritized intervention. However, the strategic placement of constructs like *False Memory*, *Academic Workload Stress*, and *Psychological Resilience* reveals a broader system of interdependencies that educational institutions must address. Embedding this network-informed framework into curriculum design, assessment policy, and student support systems offers a pathway to optimize psychological

resilience, cognitive integrity, and academic achievement across diverse higher education settings.

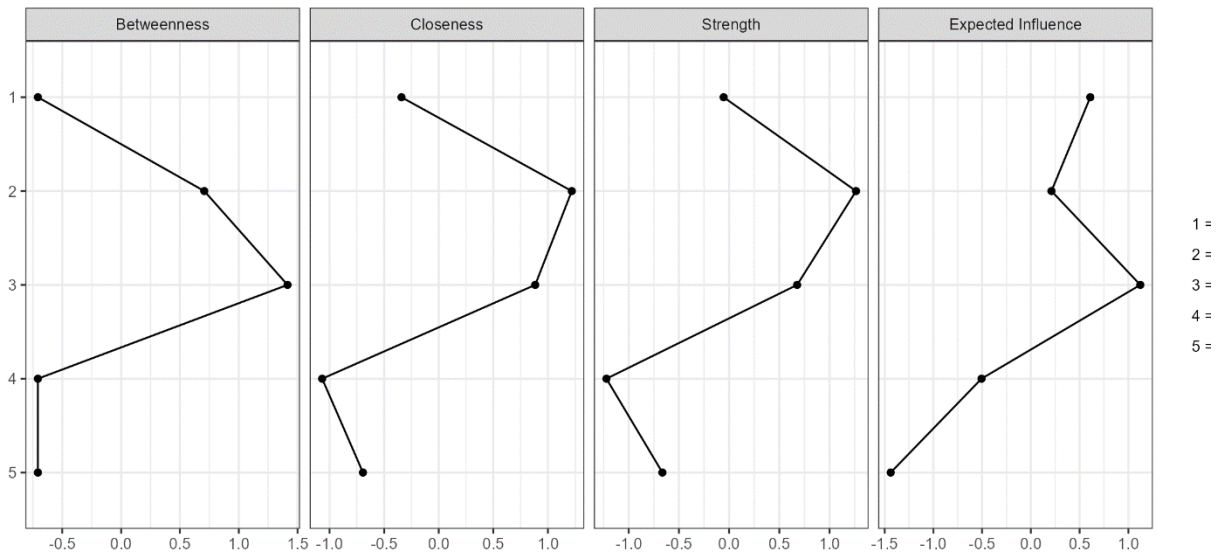


Figure 2. Centrality Plot of the study variables

Visual network analysis

The psychological network model (Figure 3) reveals a complex system of emotional and cognitive variables shaping university students' academic experiences, with Anticipatory Anxiety emerging as the most central and influential node. Its strongest connection, a positive edge with Academic Social Anxiety, suggests that fear of future failure or negative evaluation amplifies students' social apprehensions in educational settings, a pattern consistent with expectancy-value theory and research on performance anxiety as [Wade et al. \(2025\)](#) referred. This bidirectional link may create a self-reinforcing loop that drains academic self-efficacy and weakens engagement, peer interaction, and well-being. Academic Social Anxiety, in turn, shows a notable negative connection with Psychological Resilience, indicating that resilient students are better equipped to handle evaluative pressure without becoming paralyzed by self-doubt. Rather than a fixed trait, resilience here acts as a dynamic buffer against stress and anxiety, underscoring the value of integrating resilience training and emotion regulation programs into university curricula. Academic Workload Stress, while less central, maintains several moderate connections, particularly with anxiety and resilience, suggesting that heavy academic demands can trigger stress responses that disrupt both emotional stability and cognitive function. False Memory occupies a peripheral but meaningful position, weakly linked to Anticipatory Anxiety.

This tentative connection hints that high emotional arousal and cognitive overload may interfere with memory accuracy, a concern in knowledge-intensive academic settings, where distorted recall can undermine performance and lead to flawed learning. Taken together, the model points to the need for a holistic approach to student mental health: one that targets core drivers like anticipatory and social anxiety, strengthens resilience, and addresses workload through thoughtful pedagogical and institutional changes.

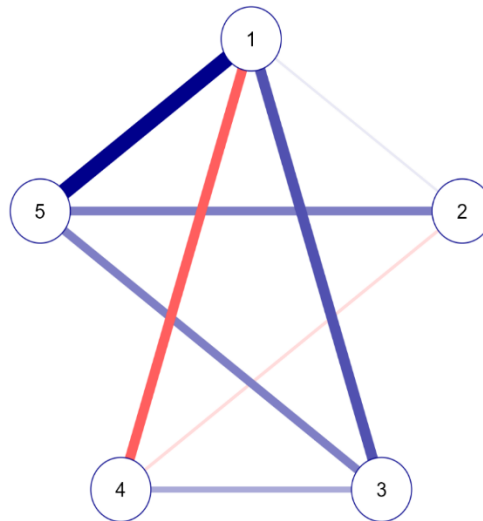


Figure 3. Network analysis of study variables.

Notes. 1= Academic Social Anxiety, 2= False memory, 3= Academic Workload Stress, 4= Psychological Resilience, 5 = Anticipatory Anxiety, and the Nodes no. 1, 3, and 5 are the social anxiety subscales in academic contexts, the red line= negative edges (partial correlations) between two nodes, and the blue line= positive correlations.

Discussion

The network results capture the interplay between anxiety, memory, stress, and resilience in academic settings, resonating with contemporary cognitive-emotional memory theories. The results show that anxiety and stress are upstream influences increasing susceptibility to false memories, while resilience mitigates these effects. The peripheral yet significant role of false memories aligns with the reconstructive nature of episodic memory, as highlighted by [Poncet et al. \(2024\)](#). Here, memory appears as a malleable construct, susceptible to interference and distortion during encoding and retrieval, especially under emotional stress. The negative centrality of false memory implies it is primarily shaped by prior emotional states, notably

anxiety and stress, rather than serving as a root cause. This finding aligns with research suggesting that false memories result from complex interactions between cognitive and affective processes, rather than simple retrieval failures ([Erceg et al., 2025](#)).

The emotional modulation of memory, particularly by negative affective states such as disgust and anxiety ([Matson et al., 2025](#); [Dodier et al., 2022](#)), further explains false memory's link to academic social anxiety and anticipatory anxiety. These affective states function as cognitive-affective filters, modulating the encoding and retrieval of memory traces by either stabilizing or distorting their content, particularly under conditions of heightened arousal or cognitive demand, such as evaluative academic settings or socially threatening environments. The fact that false memory has lower closeness and strength centrality highlights its susceptibility to contextual emotional influences rather than being a core psychological vulnerability itself.

Anticipatory anxiety's prominent centrality is theoretically coherent with expectancy-value and cognitive appraisal models of anxiety ([Wade et al., 2025](#)). As a forward-looking, preparatory state, it functions as a critical nexus connecting academic stressors and social anxiety, potentially amplifying maladaptive cognitive-emotional cycles that culminate in compromised memory accuracy and resilience depletion. Its high betweenness centrality confirms its mediatory role, suggesting that interventions reducing anticipatory anxiety may disrupt the cascading effects of stress on memory distortion and emotional dysregulation. Academic social anxiety's strong connectivity and accessibility underscore its foundational role in the academic emotional ecosystem. It is intricately linked to workload stress and anticipatory anxiety, reinforcing the idea that social evaluative fears exacerbate academic stress and influence cognitive outcomes ([Cody et al., 2015](#)). However, its moderate expected influence relative to anticipatory anxiety suggests it may act more as a proximal, situational factor, intensifying immediate distress without fully driving systemic psychological shifts.

Psychological resilience's peripheral yet protective position matches its conceptual role as a compensatory and buffering factor ([Putri et al., 2025](#); [Leo et al., 2025](#)). While not directly central to anxiety and stress processes, resilience mitigates their impact, preserving cognitive and emotional functioning.

Finally, academic workload stress's mixed profile, low connectivity but positive expected influence, suggests it operates through selective pathways, perhaps intensifying anticipatory anxiety or social anxiety rather than broadly influencing the network. This nuance emphasizes

the importance of targeted stress management strategies focusing on specific academic demands and their cognitive-emotional sequelae.

Limitations and future research suggestions

Despite the novel insights offered by this network approach, several limitations should be acknowledged. First, the cross-sectional design precludes inferences about directional or causal relationships among the identified nodes. While anticipatory anxiety emerged as the most central construct, the observed associations remain correlational; longitudinal network analyses are necessary to examine how the structure and centrality of these variables evolve over academic semesters and whether changes in anticipatory anxiety precede shifts in false memory susceptibility or resilience. Second, the sample was restricted to second-year students in scientific majors from a single Egyptian university, which limits generalizability to other academic disciplines, year levels, or cultural contexts. Future research should replicate the network structure in diverse samples, including humanities students, and postgraduate populations. Third, the use of a single-item measure for psychological resilience, while justified by parsimony and participant burden considerations, may not capture the multidimensional nature of resilience (e.g., social support, adaptive coping, emotional regulation). Future studies should employ validated multi-item resilience scales to examine whether a more nuanced measurement alters the node's centrality or expected influence within the network. Fourth, the False Memory Scale, though psychometrically sound, relies on self-reported memory distortions rather than behavioral or experimental paradigms (e.g., DRM procedure). Future research should integrate objective memory tasks to corroborate self-report findings and examine whether performance-based false memory indices occupy different network positions. Finally, the network was restricted to five nodes. Future research should expand the model to include additional theoretically relevant constructs, such as metacognitive beliefs, and academic self-efficacy, to examine whether false memory remains peripheral or becomes more central when competing variables are introduced.

Practical Implications

Given false memories' role as a downstream consequence of elevated anticipatory anxiety and academic social anxiety, practical interventions should prioritize reducing emotional arousal and cognitive overload during critical academic tasks to safeguard memory accuracy. Educational institutions should implement evidence-based stress reduction programs that include

mindfulness training, anxiety management workshops, and metacognitive strategies to enhance students' awareness of their cognitive processes and emotional states. These interventions can help students recognize and regulate anticipatory anxiety before it escalates to impair memory encoding and retrieval. Furthermore, assessment designs must be re-evaluated to minimize high-stakes pressure, favoring formative, low-stakes, or collaborative evaluations that reduce the risk of anxiety-induced cognitive disruptions. Incorporating breaks, pacing, and flexible deadlines can also alleviate workload stress, which indirectly contributes to memory distortions. Strengthening psychological resilience through strengths-based programs and emotional intelligence development is critical, as resilience buffers the adverse effects of stress and supports adaptive coping strategies that prevent the cognitive fragmentation leading to false memories. Additionally, training educators to recognize signs of anxiety and cognitive strain enables timely support and referrals, fostering an academic environment that promotes both emotional well-being and cognitive fidelity. Collectively, these targeted strategies aim to interrupt the pathways from anxiety and stress to false memory, enhancing both mental health and academic performance.

Conclusion

Within the limits of cross-sectional network analysis, false memory emerges not as a core driver of academic psychological functioning but as a peripheral cognitive consequence—a sensitive indicator of how anticipatory anxiety and emotional dysregulation penetrate and distort learning processes. Its modest association with anticipatory anxiety suggests that heightened arousal and cognitive load increase susceptibility to memory errors, while psychological resilience exerts a countervailing, protective influence despite its similarly peripheral network position. These findings position false memory as a downstream marker of cognitive-affective strain rather than a causal mechanism; however, longitudinal research is needed to determine whether this relationship unfolds directionally over time and whether interventions targeting anticipatory anxiety yield measurable improvements in memory accuracy within educational contexts.



Funding/Financial Support

The authors have no funding to report

Other Support/Acknowledgement

The authors have no support to report

Competing Interests

The authors have declared that no competing interests exist.



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Appendix

Social Anxiety Indicators

1. I feel anxious when the final exam schedule is announced.
2. I experience anxiety when the professor asks me to answer a question in front of my classmates.
3. I often worry about the possibility of failing, even when I am well-prepared.
4. I feel distressed when I submit an academic assignment late, even if the delay is minor.
5. I become tense when giving an oral presentation in front of my classmates.
6. I experience intrusive thoughts when I receive the exam paper for a difficult subject.
7. I feel anxious at the beginning of each new semester due to my expectations about the courses.
8. I worry about receiving a low grade in courses that require extensive written work.
9. I find it difficult to concentrate during a lecture when I feel the professor might call on me to participate.
10. I frequently think about the consequences of academic failure on my future career.
11. I feel extreme pressure when multiple assignments and tests are scheduled in the same week.
12. I feel deeply embarrassed when I make a mistake while explaining an idea during a class discussion.
13. I suffer from insomnia on the night before exams due to excessive thinking.
14. I feel anxious when my grades are compared with those of my classmates.
15. I become tense when I receive critical feedback on my research papers or projects.

False Memory Scale

1. Sometimes I remember details of things that didn't happen to me.
2. I sometimes believe memories others tell me about myself, even if I'm not sure they're true.
3. I might mix up what happened with what I later heard or imagined.
4. I sometimes add wrong details when I talk about my past.
5. It's hard for me to tell the difference between real memories and ones influenced by others.
6. I sometimes remember things differently from how they happened.
7. I think some of my memories might not be fully correct.
8. I sometimes believe wrong things about my past because I've heard them many times.
9. I sometimes mix my friends' memories with my own without realizing it.
10. I remember old events in ways that feel different from how they were.
11. I sometimes confuse events that happened at different times or places.
12. I sometimes add extra details when I tell others about my past, without meaning to.
13. I believe memories can change or become unclear over time.
14. I sometimes believe stories about my past even without strong proof.
15. I sometimes doubt my memories, even though they seem real to me.



About the Authors

Mahmoud Ali Moussa is an Associate Professor of Educational Psychology at the Faculty of Education, Suez Canal University, Egypt.

Omar Atallah Al-Adamat works at the Ministry of Education in Al-Mafraq, Jordan.

Naoual Abdessalam Adghar is affiliated with the Faculté des Lettres et des Sciences Humaines, Université Sidi Mohamed Ben Abdellah, Fès, Morocco.

Corresponding Author's Contact Address

Mahmoud Ali Moussa

Faculty of Education, Suez Canal University

Egypt

E-mail: mahmoud_muhanna@edu.suez.edu.eg