Article

Are Reports of Memory Failures in an Understudied Population of First-Year Female Students Related to Self-Confidence or Anxiety?

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ABSTRACT: *The first year of college requires adjustments that are often described as cognitively and emotionally demanding, thereby potentially fostering symptoms of anxiety. It is particularly demanding for young female students (age range: 18-25) from a society emerging from patriarchy. Among this understudied population, the prevalence of symptoms of generalized anxiety disorder (GAD) is largely unknown. The present study examined the distribution of such symptoms, as well as the degree to which students subjectively perceived them as impairing academic and home activities and relationships (i.e., impact estimates). Then, students' reports of prospective memory (PM) and retrospective memory (RM) slips were surveyed to determine the extent to which they could be differentially predicted by self-efficacy and GAD. Both prospective and retrospective memory slips increased with GAD symptomatology but were unrelated to either general or academic self-efficacy. These findings suggest that the mental health of first-year female students who are navigating the uncharted territory of personal agency needs to be assessed before enrollment. Suggestions of potentially effective interventions focusing on symptoms of anxiety, such as worrying, are offered.*

INTRODUCTION

Memory, upon which a host of other skills rest, is an important underlying component of performance in university courses. Memory, however, is not a unitary skill but can be organized into subskills, such as prospective memory (PM) and retrospective memory (RM). The former refers to the activity of remembering to execute intentions at the right time in the future (Rummel & McDaniel, 2019). Forgetting to submit an assignment by its deadline is an example of a PM slip. In contrast, RM refers to the activity of recollecting information and skills acquired in the past. Failing to remember the instructions of an assignment discussed in class the day before is an example of an RM slip.

The brain structures mediating both types of memory processes closely overlap (Addis et al., 2007). Not surprisingly, both rely on working memory (Harris & Cumming, 2003), the limited-capacity mental workspace where information stored in long-term memory or gathered from the surrounding environment is processed for the execution of an ongoing task (McBride & Workman, 2017). Specifically, working memory is the workspace where information is monitored and transformed to meet the demands of activities in the present. The functioning of working memory can be disrupted by worries, a typical symptom of anxiety, including clinical manifestations, such as generalized anxiety disorder (GAD). Worry specifically restricts working memory capacity by introducing thoughts whose uncontrollable recurrences compete with task-relevant processes (Moran, 2016).

Distractions fostered by worrying are accompanied by poorer performance across a wide variety of tasks, including academic tasks that heavily rely on prospective and retrospective remembering. Both types of remembering require that information be encoded, held for some time, and eventually retrieved. Thus, disruptions of encoding and retrieval processes can potentially impair both memory processes. For instance, the successful execution of an intention depends on the extent to which active monitoring preserves attentional focus (i.e., activation level in working memory). Similarly, the resting activation level of information in long-term memory determines how easily it can be moved to working memory for processing. According to Eysenck and Calvo's processing efficiency framework (1992), PM is particularly sensitive to increases in working memory load, which arise when the resources necessary for the completion of an ongoing task are shared with the task of monitoring the timing of the execution of an intention (Meier & Zimmermann, 2015). As a result, PM and RM tend to be differentially sensitive to working memory load (Harris & Cumming, 2003).

Another source of working memory load is anxiety, which refers to physiological, affective, and cognitive responses to an imagined and often unknown threat. Symptoms encompass tension, distress, worrying, and difficulties in sustaining attention (Moran, 2016). Undergraduate students, especially women, have not been immune to such symptoms (Alkhaldi & Bista, 2025; Rastogi et al., 2025). Evidence exists that undergraduate students' anxiety negatively affects PM. For instance, Bowman et al. (2019) found decreased PM performance in college students with high levels of trait anxiety. Arnold et al.

(2015) reported that PM performance decreased as state anxiety increased. Not surprisingly, 33.6% of female undergraduate students in the US have reported impairments in academic performance arising from elevated levels of anxiety (American College Health Association, 2024). If only students who experienced anxiety are considered, reports of academic performance impairments among female undergraduate students increase to 48.9%. Reports of anxiety impacting academic performance are not surprising given the high cognitive demands that undergraduate curricula place upon students. While anxiety has been relatively well documented in undergraduate students, there is a lack of thorough research on understudied populations, such as female students of a society emerging from patriarchy. A prototypical example of such a society is Saudi Arabia. To develop a sustainable, internationally viable economy (Parveen, 2022), women have been granted educational and professional opportunities, once largely restricted to men. Women, especially those who are enrolled in higher education programs, are viewed as leading contributors to the envisioned economic engine. They are no longer relegated to the home or represent a neglected, low-expectation workforce. Despite the persistence of archaic gender stereotypes that portray professional endeavors as largely unsuitable to women (Al-bakr et al., 2017), female enrollment in higher education has risen considerably. Even academic majors traditionally viewed as leading to male occupations (e.g., computer science and engineering) have experienced an increasing number of female learners (Islam, 2017; 2019; Kayan-Fadlelmula et al., 2022).

For female students from a society emerging from patriarchy, the pressure to succeed is considerable. Failures are reminders of the restrictions they once encountered in all aspects of life and of the ensuing lack of agency they suffered. These students not only face the high cognitive demands of undergraduate curricula but also experience the deleterious effects of archaic gender stereotypes that relegate women to the home (Al-Bakr et al., 2017). Unknown is the extent to which symptoms of anxiety, even at subclinical levels, are subjectively experienced as debilitating academic performance. Also unknown is how anxiety may be experienced as impairing memory processes, including RM and PM tasks.

Of course, dispositions exist that can counteract the purported impact of anxiety on academic performance. Self-efficacy is one of these dispositions (Honicke & Broadbent, 2016; Luszczynska et al., 2005; Mejri et al., 2026). It refers to students' beliefs in their abilities to overcome current obstacles and challenges to carry out the task at hand. Such beliefs may be generalized, cutting across domains and settings (i.e., general self-efficacy), or specific to a domain (e.g., academic self-efficacy; Choi, 2004; Honicke & Broadbent, 2016).

OUR STUDY

In this research, we examined the relationship between self-reports of memory failures and self-efficacy or anxiety symptoms in an understudied population of young female students (age range: 18-25; Society for Adolescent Health and Medicine, 2017). Their society is changing rapidly from an economic system

based on fossil fuels and governed by patriarchy to one that is diversified in its sources and, by necessity, aspiring to gender equity (Moshashai et al., 2020). As expectations for women have changed from exclusively homebound to desirable members of the workforce, a variety of academic programs and careers have become accessible to women (Pilotti et al., 2021a). Currently, young women enrolled in undergraduate programs are expected to be active members of the new economy, and thus, they are under intense pressure to not only complete academic programs but also excel to gain access to valued occupations and secure financial independence. For many other undergraduate students, the first year requires adaptation to the novel environment of academia and its demands, making female undergraduate students especially sensitive to anxiety symptomatology (Gao et al., 2020). The novel academic environment, coupled with the societal changes that surround their quotidian lives, may make their experiences not unlike those of international students attending their first year of university studies in a foreign country. In this context, several questions were asked. Each research question generated a hypothesis largely guided by the findings of the extant literature.

Research Questions and Hypotheses

Q1a-b   Do first-year female students report symptoms of anxiety, especially worrying?

Q2   Are anxiety symptoms viewed as impacting daily activities, such as academic performance?

Q3   Do female students report PM and RM failures equally?

Q4   Do anxiety symptoms or self-efficacy account for self-reported memory slips?

Evidence exists, mostly from the Global North, that female undergraduate students are prone to anxiety (American College Health Association, 2024; Alkhaldi & Bista, 2025; Rastogi et al., 2025). Evidence also exists that symptoms of GAD are particularly pronounced in undergraduate female students (Byrd-Bredbenner et al., 2020). Generalized anxiety disorder is characterized by disproportionate worries and fears about nonspecific events, situations, or objects, which are experienced most days (Bartolo et al., 2017). Those who suffer from the disorder exhibit not only excessive worrying but also difficulties concentrating and remembering, sleep problems, and restlessness. According to Spitzer et al. (2006), a score of 10 on the GAD-7 scale, a popular screening measure of GAD (Han et al., 2025), should be considered the cutoff point for identifying clinical occurrences of GAD. Based on evidence from the Global North, we hypothesized that the selected sample of female students would experience both subclinical and clinical levels of anxiety (H1a). We also predicted that reports of worries would increase with the overall severity of anxiety as measured by the GAD-7 (H1b).

According to Eysenck and Calvo's processing efficiency theory (1992), the impact of anxiety on task performance depends on working memory resources. At low levels, anxiety can enhance performance on a primary task (e.g., a final

exam) when the anticipation of adverse outcomes leads the student to allocate resources preferentially to the task. However, anxiety may interfere with a host of capacity-demanding cognitive operations when distracting, out-of-control thoughts (worries) limit the resources available to the primary task. Thus, we predicted that for the selected sample of female students, symptoms of anxiety (especially worrying) would be seen as primarily impacting academic activities (H2).

As noted earlier, the selected sample of women is under considerable pressure to excel academically (Song, 2019), which adds to the demands of navigating unfamiliar, still male-dominated environments. Their quotidian experiences are not much different from those of international students who need to adapt to an alien ecosystem at a foreign university (Lefdahl-Davis & Perrone-McGovern, 2015). For all these women, preferentially allocating processing resources to a primary task might leave little or no resources available for a secondary task, such as remembering to execute intentions. Thus, we predicted that female students would report more PM failures than RM failures (H3).

However, particular dispositions can minimize the struggle to adapt. Students' self-efficacy refers to beliefs about their ability to adopt the right course of action to achieve performance goals when facing difficult circumstances, either in everyday life (general self-efficacy) or more particularly in university tasks (academic self-efficacy). Evidence exists that self-efficacy and anxiety are negatively correlated (Simonetti et al., 2021). Among individuals suffering from GAD, self-efficacy specifically declines with increased worries (Vîslă et al., 2023). In the selected sample of female students, consistent academic demands and external pressure to succeed may contribute to psychological distress (e.g., anxiety) and increase the importance of personal resources, such as self-efficacy. Thus, we predicted that GAD, including worrying, would be linked to increased reports of memory failures, whereas self-efficacy, either general or specific to academic endeavors, would be linked to decreased reports of memory failures (H4). We expected this pattern to be more pronounced with PM than RM failures due to the former's greater sensitivity to scarce resources in working memory.

METHOD

Participants

Through purposive sampling, 598 first-year female students were selected from written communication courses of the general education curriculum. Ages ranged from 18 to 25. According to the definition of the Society for Adolescent Health and Medicine (2017), participants could be defined as young adults. The sample of participants included 54% STEM students (i.e., Engineering, Computer Science, and Architecture) and 46% non-STEM students (i.e., Business, Law, and Design), all of whom had English as their second language. Arabic was their native language.

The university from which participants were recruited is a medium-sized higher education institution located in the Eastern Province of Saudi Arabia. The university follows a US curriculum taught in English through student-centered pedagogy (Eltoum & Abdelsalam, 2025). Thus, the precondition for the participants' university enrollment was a minimum overall score of 6 on the International English Language Testing System (IELTS). At the time of the study, male and female first-year students attended classes on separate campuses.

Materials and Procedure

During the span of two semesters, students were recruited from different sections of the selected written communication courses. Participants were given four questionnaires to complete: the Prospective and Retrospective Memory Questionnaire (PRMQ; Crawford et al., 2003; Smith et al., 2000), the General Self-Efficacy (GSE) questionnaire (Chen et al., 2001), the General Academic Self-Efficacy (GASE) scale (Lindstrøm & Sharma, 2011; Nielsen et al., 2017), and the Generalized Anxiety Disorder (GAD-7) scale (Spitzer et al., 2006).

An assessment of memory concerns was gathered through PRMQ, which contained 16 statements of memory failures. Students rated each statement on a 5-point Likert scale from 'never' (1) to 'very often' (5). Statements referred to PM or RM failures, which could involve either short-term or long-term information and self-cued or environmentally cued retrieval (Smith et al., 2000). Crawford et al. (2003), however, reported that the statements of the PRMQ should be considered as representing only the dimensions of PM and RM. Thus, in this paper, these dimensions were measured. The reliability of the PM scale was $\alpha = 0.82$, whereas the reliability of the RM scale was $\alpha = 0.79$.

Information about participants' self-efficacy was gathered through GSE (Chen et al., 2001), which contained 8 generic statements of confidence in one's abilities. Instead, GASE (Lindstrøm & Sharma, 2011; Nielsen et al., 2017) contained 5 statements of confidence in one's academic abilities without any reference to a particular discipline. For each questionnaire, students rated every statement for the degree to which it applied to them. A 5-point scale from 'strongly disagree' (1) to 'strongly agree' (5) was utilized for ratings. The reliability of GSE was $\alpha = 0.97$, whereas that of GASE was $\alpha = 0.87$

Information about anxiety was collected through the GAD-7 (Spitzer et al., 2006), which contained 7 items describing symptoms of anxiety. Each item had to be rated on a frequency scale from 'not at all' (0) to 'nearly every day' (3). The scale was specifically selected for two items describing the cognitive dimension of anxiety (i.e., worrying): 'not being able to stop or control worrying' and 'worrying too much about different things'. In addition, the scale required respondents to indicate the extent to which their self-reported anxiety symptoms interfered with academic and home responsibilities as well as interactions with others. Estimates of impact were to be produced on a scale describing the extent to which activities in these areas were made difficult. The scale ranged from 'not at all difficult' (0) to 'extremely difficult' (3). The reliability of the GAD-7 was 0.90. The reliability of its impact scale was 0.79.

Before administration, the face validity of the PRMQ, GSE, GASE, and GAD was assessed with a separate group of 17 students from the same subject pool. Students were specifically asked to rate how well they understood each statement. A 5-point scale from 'not at all understandable' (0) to 'very understandable' (4) was used. All statements received a score of 3 or 4 (Allen et al., 2023). Debriefing sessions were used to better understand the quantitative results. The coding reliability approach was utilized to organize students' comments into themes (Clarke & Braun, 2017).

The study was conducted under the purview of the Deanship of Research of the hosting institution. Approval (PMU-DoR-2023-2024-17) relied on the study's compliance with the guidelines of the Office for Human Research Protections of the U.S. Department of Health and Human Services. Informed consent was obtained from all participants. Any potentially identifying information was deleted after the data sources were matched. As a result, identifying information was not present in the data set submitted to statistical analyses.

RESULTS

Descriptive and inferential statistics were organized by the questions they answered and the hypotheses they tested. The significance level was set to 0.05.

Did Students Report GAD?

According to Spitzer et al. (2006), the GAD-7 yields 4 levels of symptom severity, each with its range of total scores: minimal (0-4), mild (5-9), moderate (10-14), and severe (15-21). Table 1 illustrates the descriptive statistics of reported symptoms of worrying (GAD items 2 and 3) as well as the purported impact of GAD on everyday activities organized by severity levels.

As predicted by H1a, both subclinical and clinical levels of anxiety were experienced by the selected sample of female students. Reports of worrying increased from the nonclinical levels (0-9) to the clinical levels (10-21) [$F(1, 596)$ = 972.16, MSE = 0.326, $p < 0.001$, $partial\ \eta^2$ = 0.620]. H1b was supported.

Table 1: GAD Severity Levels and Impact Scores (Mean, *M*, and Standard Deviation, *SD*)

GAD	Range	Incidence	Worrying		Acad. Resp.		Home Resp.		Interact.	
			M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Minimal	0-4	23% (n = 137)	0.46	(0.37)	0.39	(0.49)	0.21	(0.44)	0.23	0.43
Mild	5-9	34% (n = 206)	1.16	(0.40)	0.76	(0.61)	0.46	(0.64)	0.37	0.53
Moderate	10-14	23% (n = 138)	1.99	(0.56)	1.07	(0.64)	0.66	(0.73)	0.67	0.69
Severe	15-21	20% (n = 117)	2.77	(0.42)	1.82	(0.77)	1.38	(0.96)	1.03	0.92

Was GAD Viewed as Impacting Daily Activities?

A Pearson correlation coefficient was computed between participants' mean GAD or reported worrying and perceived impact on daily activities. Correlation coefficients were translated into coefficients of determination to describe the percentage of variance in either GAD or worrying that accounted for perceived impact on a particular domain of students' daily lives (see Table 2).

Table 2: Relationship between GAD or Worrying and Impact Scores

	Academic resp.		Home Resp.		Interactions	
	R	*CoD*	*R*	*CoD*	*R*	*CoD*
GAD	0.64	41%	0.51	26%	0.45	20%
Worrying	0.55	30%	0.42	18%	0.38	14%

Note: Worrying included GAD-7 items 2 and 3.

Fisher's *r*-to-*z* transformation was utilized to determine whether differences existed in the strength of the relationship between GAD and the estimated impact on daily activities. The estimated impact of GAD on academic responsibilities was greater than that on home responsibilities, which in turn was greater than that on social interactions [$zs \geq 1.86$, $p \leq 0.032$]. The same analysis performed on worrying also yielded a greater perceived impact of worrying on academic responsibilities than on home responsibilities [$z = 3.93$, $p < 0.001$]. However, no differences existed in the estimated impact of worrying between home responsibilities and social interactions [$z = 1.3$, *ns*]. H2 was supported.

Did Reports of PM and RM Failures Differ?

Table 3 illustrates the descriptive statistics of GAD, GSE, and GASE, as well as self-reported PM and RM slips. Students reported more PM than RM slips [$F(1, 597) = 157.28$, $MSE = 0.111$, $p < 0.001$, partial $\eta^2 = 0.209$]. H3 was supported.

Table 3: Descriptive Statistics (Mean, *M*, and Standard Deviation, *SD*) of Key Variables

Variables	Range	*M*	*SD*
GAD	0-3	1.32	0.79
Worrying	0-3	1.50	0.93
GSE	1-5	2.86	1.35
GASE	1-5	4.01	0.81
PM	1-5	2.80	0.73
RM	1-5	2.55	0.69

Note: Worrying included GAD-7 items 2 and 3.

Could GAD or Self-Efficacy Account for Self-Reported Memory Slips?

Linear regression analyses were carried out on mean PM or RM scores as outcome variables and mean GAD, GSE, and GASE as predictors. Only GAD was shown to significantly contribute to both types of memory (see Table 4). Namely, GAD increased with reports of PM and RM slips. Linear regression analyses substituting GAD with mean worrying scores yielded the same pattern of outcomes [PM's $R = 0.24$; RM's $R = 0.21$]. The contribution of anxiety to reports of memory failures supported H4. However, the null findings regarding the contribution of self-efficacy beliefs to memory failures did not support H4.

Interestingly, general and academic self-efficacy were only minimally related [$r_s = + 0.19$, $n = 598$, $p < 0.001$], suggesting that students' evaluations of generic abilities and abilities specific to academic endeavors relied on different sources of information. Furthermore, ratings of their generic abilities were much lower than those about academic tasks [$F(1, 597) = 383.16$, $MSE = 1.035$, $p < 0.001$, *partial* $\eta^2 = 0.391$]. Comments collected during debriefings clarified these findings. Students associated general self-efficacy with abilities demanded by the 'real world' to be encountered after graduation. Academic self-efficacy was linked to their cognitive abilities at present. Students were uncertain about the former but not about the latter, as they maintained that the demands of tests and assignments were known variables, whereas the demands of a future career were largely unknown.

Table 4: Regression Analyses with GAD, GSE, and GASE as Predictors and PM or RM as Outcome Variables

PM	b	SE b	Beta	p	Part
Constant	+2.831	0.197			
GAD	+0.182	0.041	+0.197	>.001	+0.18
GSE	-0.043	0.022	-0.080	ns	-0.08
GASE	-0.038	0.039	-0.042	ns	-0.04
RM	b	SE b	Beta	p	Part
Constant	2.617	.189			
GAD	.141	.039	.162	>.001	+0.14
GSE	-.034	.021	-.066	ns	-0.06
GASE	-.038	.038	-.045	ns	-0.04

Note: PM's $R = 0.25$; RM's $R = 0.21$; tolerance ≥ 0.79.

DISCUSSION

The results of the present study can be summarized in two points. First, first-year female students reported GAD symptoms that were perceived as impacting different facets of their lives, with the greatest impact being reported for academic activities. Worrying had a similar impact, albeit students did not distinguish between home responsibilities and social interactions when estimating the impact

of worrying. In debriefing sessions, students freely reported that they worried about their academic success because they saw it as capable of shaping employment opportunities. They worried less about their responsibilities toward immediate and extended family members because both were more predictable than academic responsibilities. Students reported social relationships, inside and outside their extended families, as linked to the social support needed to succeed in life. Thus, all domains of impact were linked to concerns about an uncertain future. Uncertainty avoidance, a typical aspect of Saudi Arabian culture (Pilotti et al., 2021b), was the dominant feature of these young women's concerns.

Second, in agreement with Haas et al. (2020), students reported more PM than RM slips. Furthermore, GAD, including worrying, accounted for both PM and RM slips. Instead, when measuring actual performance, Harris and Cumming (2003) found increased anxiety to be linked to declines in PM but failed to uncover any declines in RM. These conflicting results may reflect the challenges inherent to the metamemory task of assessing actual memory performance. Furthermore, in our study, neither general nor academic-specific self-efficacy accounted for memory slips. This finding contrasts with that of Khan (2015), who reported a negative relationship in participants whose ages ranged from 18 to 75 years. The reason for the absence of a relationship may be attributed to the generality of students' self-confidence ratings, which did not focus on memory in particular.

The present field study has limitations that may be addressed in future research. For instance, memory slips were self-reported rather than objectively measured. Thus, they reflected students' awareness of memory errors. In such errors, no clear distinction was made between errors of omission and errors of commission. Furthermore, the sample of participants was limited to first-year female students. Of course, in the selected sample, other disturbances besides anxiety and memory failures may be at play, such as depression (Acharya et al., 2018; Zeng et al., 2022). Nevertheless, our study offers a window into an understudied population of young women who appear to have confidence in their current academic abilities more than in their future abilities to succeed in a job market still dominated by men. Their symptomatology may foretell problems ahead. These young women are at the start of their educational journey. Academic demands may increase, and confidence may decrease as graduation day approaches and their fears of the 'real world' become more concrete. As such, symptoms of anxiety, such as worrying, and their impact on functioning may not go away.

Students' concerns about PM and RM failures should not be discounted. At the very minimum, PM and RM reports are linked to time management, which is critical to academic success (Macan et al., 2010). Both PM and RM processes, through their reliance on working memory, contribute to a variety of cognitive tasks underlying academic performance (Bayanfar & RajaeeManesh, 2022; Swanson & Alloway, 2012). Thus, training focused on reducing worrying may be beneficial to their future goal attainment. As self-efficacy beliefs in this population of women seem to be disconnected from anxiety symptoms, the cognitive restructuring techniques suggested by Minahan (2019) may be particularly helpful if it focuses on rumination. Reframing negative thoughts

about one's quotidian life is one of these techniques. Similarly, training that targets how students approach novel tasks (either as a threat or a challenge; Johnston et al., 2023) may be beneficial.

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