Mathematics, Misconceptions, and Mental Blocks: A Thematic Analysis of Statistics Anxiety in University Psychology Students

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Abstract

Statistics anxiety is a persistent barrier for psychology undergraduates, yet little qualitative work has explored how it is experienced in higher education. This study employed semi-structured interviews with twelve psychology students from Scottish universities to examine the lived experiences of statistics anxiety. Using Reflexive Thematic Analysis, four overarching themes were formulated: (1) Negative Prior Experiences with Mathematics, (2) Misconceptions of Course Content, (3) Statistical Fragility, and (4) Student-Tutor Interaction. The findings show how early difficulties with mathematics and misaligned expectations about psychology as a discipline undermine fragile confidence when encountering statistical concepts, often resulting in hypervigilance and self-doubt. Tutor communication, class size, and assumptions about baseline competence further shaped students' experiences, intensifying anxiety. This research provides a nuanced investigation of how students conceptualise statistics in their psychology journey, and offers suggestions and recommendations for applied practice.

Statistical proficiency is an essential competency for higher education (HE) psychology students, encompassing the ability to perform, interpret, and critically evaluate statistical analyses. Despite its importance, no other aspect of the curriculum evokes as much anxiety and concern among students as statistics (Dykeman, 2011; Onwuegbuzie et al., 2010; Ruggeri et al., 2008). Statistics anxiety (SA) is defined as a negative emotional response, including both worry and apprehension, that arises when individuals encounter statistical content (Hanna et al., 2008; Paechter et al., 2017). While estimates of SA prevalence differ, it is generally acknowledged that a sizable proportion of social science students are affected. For instance, Abdalla (2023) reported that 71% of a sample comprising 142 social work and sociology students experienced SA, whereas Dodeen and Alharballeh (2024) found that 27% of 440 social science students demonstrated elevated SA levels. Although the precise prevalence of SA remains unclear, the evidence suggests that it affects a considerable proportion of students. Given that SA has been shown to negatively impact students' performance in statistics (Paechter et al., 2017; Trassi et al., 2022), understanding the underlying factors of SA is critical for promoting statistical literacy, and devising evidence-based strategies that can be implemented in applied practice.

SA encompasses various dimensions that make it particularly challenging (March et al., 2025). It includes fears related to the complexity of statistical concepts, the interpretation of data, and the application of statistical reasoning in real-world scenarios (e.g., during dissertation projects). Chew and Dillon (2014) argue that SA involves both cognitive and affective dimensions, indicating that students are not only anxious about dealing with numbers but also about the process of making sense of statistical information and applying it in meaningful ways. This broader scope makes SA a unique and complex challenge for students, requiring a multifaceted approach to both understand its effect, and devise strategies to adequately address it. While SA is closely related to mathematics anxiety (MA), the two are distinct constructs. MA generally refers to the fear and anxiety associated with performing mathematical or computational tasks such as numerical calculations and quantitative reasoning. SA, on the other hand, involves not only the fear of numbers but also anxiety related to understanding, interpreting, and applying statistical concepts (Paechter et al., 2017). Indeed, Paechter et al. (2017) demonstrated that, despite the considerable overlap between MA and SA, the two constructs also exhibit antagonistic

components. While MA was sometimes associated with increased effort and, in turn, better performance, SA was linked to procrastination, heightened worry during assessments, and ultimately poorer learning outcomes. Recognising this distinction is particularly important for applied practitioners (e.g., tutors and lecturers) as it indicates that strategies designed to reduce MA may not sufficiently alleviate the specific cognitive and behavioural barriers created by SA. At the same time, this distinction may offer grounds for optimism as proficiency in mathematics does not necessarily guarantee success in statistics, nor does difficulty with mathematics inevitably preclude it.

Statistics Anxiety Among Psychology Students

Statistics plays an indispensable role across the social sciences, where it is not only essential for analysing data but also for designing research, interpreting findings, and contributing to the development of theory (Maxim, 1999; Simchera, 2011). For students in social science disciplines, a solid understanding of statistics is critical to their academic success and their ability to engage with the research that underpins their field. While SA is a well-documented issue among social science students broadly, the burden of understanding and applying statistical concepts may be particularly heavy in psychology. As highlighted by Hunt et al. (2023), accreditation of psychology degrees in the United Kingdom by the British Psychological Society (BPS) require formal instruction in statistics and research methods. Consequently, statistical literacy is not merely a supplementary skill but a core component of academic competency in psychology degree programmes (The British Psychological Society, 2024).

Despite the critical importance of statistics in psychology, many students enter their studies with limited prior experience in mathematics and statistics. Unlike fields where students might have had more extensive exposure to quantitative methods before university, psychology often attracts students with diverse academic backgrounds, many of whom may have chosen the field in part because of its perceived emphasis on qualitative over quantitative research (Yu et al., 2020). In a 2008 survey of psychology students at a British institution, Ruggeri and colleagues found that only around half of students were aware that statistics would form a core component of the programme. Consequently, these students may be more vulnerable to SA due to their lack of foundational mathematical skills, and lack of foreknowledge of the emphasis placed on statistics.

Research on SA in the social sciences has highlighted that students often struggle with the abstract nature of statistical concepts, which can seem disconnected from the practical applications they are passionate about (Onwuegbuzie & Wilson, 2003). However, in psychology, this struggle is compounded by the sheer volume and complexity of statistical knowledge required. The need to understand not only basic statistical procedures but also to apply them in the context of experimental design, psychometric evaluation, and data interpretation places a unique burden on psychology students. This burden is often not as pronounced in other social science disciplines, where the focus may be more on the application of existing statistical tools rather than the deep understanding required in psychology.

Empirically Understanding Statistics Anxiety

SA is a multifaceted phenomenon that has been extensively studied within the realm of educational and applied pedagogy. Researchers have attempted to understand the cognitive, emotional, and behavioural components that underpin the phenomenon. For instance, Macher et al. (2013) emphasise the interplay between students' cognitive appraisals of their own abilities and the emotional responses they experience. When students perceive statistics as a threat to their academic self-concept or future success, they are more likely to experience anxiety, which can, in turn, lead to avoidance behaviours and decreased academic performance (Macher et al., 2013). Further, SA was found to foster persistent anxiety throughout exams, impairing cognitive focus and exacerbating performance issues.

A body of evidence has underscored the role that cognitive self-appraisal plays in developing and maintaining SA. For instance, self-efficacy, or the belief in one's ability to succeed in specific tasks, has been shown to be a significant predictor of SA across numerous disciplines (Koh & Zawi, 2014; Onwuegbuzie, 2000). Students with low self-efficacy in statistics are more likely to perceive the subject as challenging and overwhelming, which increases their anxiety levels (Hunt et al., 2023). Similarly, Ruggeri et al. (2008) also identified the perceptions of their cognitive competence, particularly in areas such as problem-solving and understanding statistical concepts, to be closely related to SA. Similarly, students' prior experiences with mathematics and statistics can shape their cognitive appraisals, leading to either increased confidence or heightened anxiety depending on the nature of these experiences (despite evidence highlighting these concepts as being distinct from one another).

Although SA can be conceptualised in a purely cognitive or internalised capacity, it is important to consider the outward, emotional manifestation of the phenomenon. Anxiety, fear, and worry are common emotional reactions to statistics, particularly among students who have previously struggled with mathematical concepts (for example, in school or pre-university education). These emotions can interfere with cognitive processing, making it difficult for students to concentrate, understand, and retain statistical information. This cognitive interference is particularly problematic during high-stakes assessments, where anxiety can impair performance, leading to a cycle of poor outcomes and increased anxiety (Cui et al., 2019).

Further quantitative research has categorised the factors contributing to SA into three broad categories: situational, dispositional, and environmental. Situational factors include elements such as the perceived difficulty of statistics, the high stakes often associated with statistics courses, and the fear of failure (Onwuegbuzie & Wilson, 2003). Dispositional factors involve personality traits such as perfectionism, low self-esteem, and a comparison with others. For instance, Malone and Bertsch (2016) found that neuroticism was positively associated with higher levels of test anxiety, especially in the context of statistics even when compared with non-statistical psychology content. Environmental factors, on the other hand, relate to the broader educational context, including the quality of instruction, the support available to students, and the overall classroom climate. These factors can either exacerbate SA, or can mitigate against it through strategies such as instructor immediacy (see, Williams, 2010).

Lived Experience of Statistics Anxiety

Although theoretical models and quantitative studies have yielded important insights into the cognitive and emotional dimensions of SA, the field has tended to underplay qualitative approaches. This imbalance risks overlooking how students themselves (especially in psychology) articulate and make sense of their anxiety, and how it shapes their approach to statistical education. Qualitative research is essential for capturing these lived experiences, offering perspectives that cannot be reduced to numerical scores. Ironically, the nuanced realities of students' difficulties with quantitative material may be best understood through a qualitative lens.

The qualitative literature on SA among psychology students (and social science students more broadly) is limited. From those studies that have been conducted, a prevalent attitude

is the level of dread, uncertainty, and confusion that statistics can cause (Schenkman, 2010; Swingler et al., 2021). In particular, Swingler et al. (2021) found that students identified mathematical concepts, choosing the appropriate inferential test, and also operating statistical software (e.g., SPSS) as specific sources of trepidation. Indeed, this is often accompanied by a perceived lack of mathematical competence that tended to have its roots in school or pre-university education (Schenkman, 2010). In a phenomenological investigation of American psychology students, Malik (2015) found that the inability to understand statistical terminology, coupled with both psychological symptoms of inadequacy and physiological manifestations such as panic, could result in disengagement from the learning activity entirely. This was specifically true of those students from a non-statistical or mathematically inclined background. Similarly, Morrow and Swingler (2014) found that this avoidant behaviour could result in procrastination, a lack of engagement with revision material, or even a reduction in lecture attendance.

The objective of the current study was to conduct a series of in-depth semi-structured interviews to understand the nuanced manifestations of SA. A qualitative approach is particularly well-suited to this inquiry, as it allows for an in-depth exploration of students lived experiences, shedding light on the nuanced ways in which SA is internalised, expressed, and managed. Given the distinct identity of psychology as a discipline that attracts students from diverse academic backgrounds (many of whom may hold misconceptions about its quantitative demands), a qualitative analysis can uncover insights that are inaccessible through traditional quantitative-based methods (i.e., surveys and questionnaires). The current study seeks to address this gap by exploring how undergraduate psychology students in a UK context experience, conceptualise, and respond to this. Importantly, not only does this allow for a deeper understanding of student experiences, but can also inform evidence-based interventions, pedagogical strategies, and teaching practices that can help address this prevalent issue.

Methods

Participants

A process of targeted convenience sampling using social media was employed to recruit participants to the current study. Participation in the study was open to undergraduate university students studying in Scotland as part of a single or joint honours psychology degree. To be eligible for participation, students must be in their second, third, or fourth year, and be undertaking a core research methods or statistics module as part of their

programme. First year students were excluded as specialised research modules are not typically introduced in Scottish psychology programmes during the foundation year. In addition, participants must have self-identified as feeling "unsure, stressed, worried, or anxious about learning and applying statistical concepts in (their) degree" (wording used in all advertisements and Participant Information Sheet).

In total, twelve participants were recruited to the study. This included nine women and three men, with an average age of 20.8 (SD = 1.5) years old. There were eight participants (66.7%) studying for either a BA or BSc Single Hons degree in Psychology. The remaining four participants were on a Joint Hons Degree programme. In total, participants were drawn from three separate Scottish HE institutions, allowing for diverse teaching styles and approaches.

The overall sample size has previously been deemed sufficient for research utilising thematic analysis through semi-structured interviews (Braun & Clarke, 2013; Fugard & Potts, 2015). A full overview of the demographic information can be found in Table 1.

Table 1

Demographic information

Participant	Gender	Academic Year	Degree	Age
Sophia	Female	2nd Year	Psychology	19
Betty	Female	2nd Year	Psychology	20
Kirsty	Female	2nd Year	Psychology + Marketing	21
Anna	Female	2nd Year	Psychology	20
Chloe	Female	2nd Year	Psychology + Journalism	22
Megan	Female	2nd Year	Psychology	19
Laura	Female	2nd Year	Psychology	20
Steven	Male	3rd Year	Psychology	21
Daniel	Male	3rd Year	Psychology + Counselling	22
Rachel	Female	3rd Year	Psychology	20
Emily	Female	4th Year	Psychology	22
James	Male	4th Year	Psychology + French	21

Data Collection and Transcription

Prior to data collection, ethical approval was sought and approved by the Departmental Ethics Committee. All interviews were conducted online via Zoom or Microsoft Teams. This approach allowed not only for greater geographical and participant diversity (Richard et al., 2018), but research has also demonstrated that the quality and richness of the data is not significantly impacted by conducting it online compared to in-person (Woodyatt et al., 2016).

Based on the guidelines proposed by Smith and Osborn (2003), semi-structured interviews were utilised. An interview schedule and associated prompts were created to guide the discussion. These questions were based on previously utilised quantitative scales that have explored the concept of SA such as the Statistics Anxiety Rating Scale (Cruise et al., 1985). Such questions were adapted to be open-ended, and more deeply probe the associated concepts and ideas. In addition, semi-structured interviews provide the additional benefit of allowing the interviewer to follow-up on interesting or novel insights that may not have been considered when initially devising the interview schedule (Louise & Alison, 1994). The full interview schedule can be found in Appendix 1.

Each interview was conducted by a member of the research team and lasted approximately 60 minutes. The audio recording of each interview was then transcribed verbatim and imported to NVivo for electronic analysis. In addition, each transcript was also printed to allow for manual annotation and coding in addition to a purely electronic approach.

Thematic Analysis

In this study, Reflexive Thematic Analysis (RTA) was employed as the primary method for analysing the semi-structured interviews. The analysis followed the guidelines proposed by Braun and Clarke (2019, 2021a, 2021b) and the worked example published by Byrne (2021). RTA was chosen for its flexibility and its alignment with qualitative research principles, allowing the researcher to develop themes directly from the data without relying on preconceived coding frameworks. This approach is particularly suited to exploring the diverse experiences of students with SA, enabling the researcher to engage deeply with the data and construct themes that accurately reflect participants' unique perspectives. In addition, RTA facilitated both an inductive and deductive approach to data analysis.

The process of analysis began with thorough familiarisation with the data, achieved through manual transcription and repeated reading. Following this, descriptive annotations were made to generate initial codes, capturing both explicit meanings and more latent, underlying concepts (Braun & Clarke, 2019). To manage and organise the large number of initial codes, NVivo 12 software was utilised, which facilitated the visualisation and grouping of related codes. However, recognising the potential for NVivo to skew analysis towards quantitative aspects, such as the frequency of code occurrences, a hybrid approach was adopted. This involved supplementing the analysis with a manual, physical manipulation of codes. Codes were printed, written down, and physically arranged on a notice board, allowing for a more immersive and iterative engagement with the data over an extended period. This approach ensured that the development of themes was guided by a holistic understanding of the data, rather than solely by the quantitative prevalence of a certain code.

In relation to reliability and validity, the reflexive nature of RTA recognises that themes are constructed by the researcher, which makes traditional measures of inter-rater reliability less relevant. RTA focuses on the researcher's subjective and interpretative role in the analysis process (Braun & Clarke, 2021b, 2021a). However, to strengthen the validity of the themes, they were discussed within the research group. These discussions ensured that the themes were coherent, well-founded, and accurately represented in the data. Although the reflexive approach reduces the emphasis on inter-rater reliability, these discussions provided a form of validity check, ensuring that the themes aligned with the collective understanding of the research team (Braun & Clarke, 2021). In addition, consistent with recommendations for transparency and openness in qualitative research (see, Branney et al., 2023; Kapiszewski & Karcher, 2021), a Thematic Map has been included in Appendix 2. This provides a snapshot of how the distilled codes were later used to generate overarching themes.

Findings and Discussion

By utilising RTA, four overarching themes were generated. A brief overview of each theme is included in Table 2 below.

Table 2

Overview and summary of formulated themes

Theme	Description
Negative Prior Experience with Mathematics	Early struggles with mathematics that create lasting feelings of inadequacy and anxiety in students.
Misconception of Course Content	Lack of awareness regarding the statistical components of their degree, leading to surprise and anxiety.
Statistical Fragility	Understanding of statistics was easily undermined, with constant fears of making mistakes and difficulties in interpreting or applying data.
Student/Tutor Interaction	The impact of unclear communication and lack of support from lecturers on increasing students' anxiety.

Theme 1: Negative Prior Experience with Mathematics

Many students entering HE in Psychology report a strong association between their negative prior experiences with mathematics and their current struggles with SA. Prior research has already substantiated the link between mathematical and SA in HE settings (e.g., Paechter et al., 2017). However, the current study expands upon such findings by examining the contextual factors and lived-experience that underpin these feelings. Students like Sophia, who struggled with maths during high school, often carry a sense of inadequacy into their HE, contributing to their difficulties with statistics. Sophia reflected on her high school experience by saying:

"I wasn't good at it at all [...] I wasn't confident, and I had to get extra help outside of school. Maths was just a constant struggle for me. I hated it. I still don't get it." - Sophia

For Sophia, the anxiety around mathematics is not merely a transient or fleeting attitude. Rather, it has an influence on the self-concept of the learner as one who cannot effectively or confidently engage with quantitative ideas. Daniel's narrative provides further insight into how the pressures of performing well in mathematics exams during school can leave a lasting impact on students. He mentioned:

"I think, for me, that (statistics anxiety) does come from sitting maths exams at school, and the pressure on having to do well, and then the self-doubt and all that. Then you come to university, and I need to do all that again to pass psychology." - Daniel

The literature supports these personal accounts, showing that early negative experiences in mathematics can have a lasting impact on student confidence and self-concept (Ashcraft, 2002). Studies have shown that students who had negative encounters with mathematics, such as struggling with exams or being subjected to high levels of pressure, tend to develop a heightened sense of anxiety when faced with statistics, a subject they perceive to be closely linked to their prior negative experiences (Gibeau et al., 2023). Although theoretically, mathematics and statistical anxiety have been conceptualised as related, yet distinct disciplines (Paechter et al., 2017), this differentiation is not always clear to students. For Sophia and Daniel, the exposure to any numerical or mathematical ideas immediately evokes a sense of anxiety that often stem from negative experiences prior to undertaking HE. As Hernández de la Hera et al. (2023) observe, this is partly due to students often being unable to differentiate between various types of mathematical content precisely because of deeply ingrained beliefs about their own abilities. Consequently, many students fail to make a clear distinction between different branches of mathematics, perceiving statistics as a continuation of the same difficulties they encountered earlier in life. This is particularly problematic when prior experiences have been marked by repeated failure or low confidence, as it means students often enter HE with an entrenched negative mindset towards any quantitative subject. This highlights the importance of understanding the *theoretical* distinction between mathematics and statistics as observed in empirical research, with the often-undifferentiated understanding as espoused by students in practice.

From a practical perspective, HE instructors will have little direct influence on applied mathematical teaching prior to university enrolment. However, that does not mean that they cannot affect change when students do encounter psychological statistics for the first time. Paechter et al. (2017) argue that it is not simply the negative experience itself but the context in which it occurs, such as unsupportive learning environments or inadequate remediation, that plays a crucial role in shaping future anxiety. Consequently, psychology instructors (and the social sciences more broadly) can still implement strategies to alleviate previous mathematical anxiety "seeping in" to statistics teaching. One particularly important step is to reframe statistics as distinct from the abstract, exam-driven mathematics many students encountered at school. Marshall and colleagues (2024) highlight that anxiety is often perpetuated because students assume statistics is simply a continuation of school mathematics, yet in psychology, statistics can be taught as a practical tool for making sense of human behaviour. By explicitly drawing this contrast in the classroom, instructors can

help students separate current learning from earlier negative experiences, reducing the likelihood that school-based anxieties will be reactivated.

Another key strategy is to provide early corrective experiences at the point of transition into HE. For instance, it has been argued that interventions are most effective when delivered early, before students' negative beliefs become further solidified in academic contexts (Jazayeri et al., 2024). For example, introductory workshops or bridge modules at the beginning of a degree can expose students to statistics in a supportive, applied, and low-stakes environment. Indeed, empirical evidence has suggested that such interventions can reduce the fear and nervousness associated with statistics learning (Huang, 2018), and can also improve self-efficacy and reduce negative attitudes (Hood & Neumann, 2013). Indeed, if such interventions can utilise novel methods of teaching, such as integrating gamification, humour, or multimodal approaches, it has the potential to make statistics less intimidating (Williams, 2015).

Theme 2: Misconception of Course Content

A recurring theme throughout the interviews was the apparent lack of awareness among psychology students about what their degree curriculum would entail. Specifically, many students were unaware that statistics would form such a large part of the programme, let alone a core component necessary for accreditation. Many of the students interviewed remarked that they envisaged their degree focusing on theory, people, and a qualitative understanding of behaviour, rather than numerical data. For instance, Steven, referring to his understanding of a Bachelor of *"Arts"* remarked:

"I didn't know how heavy it (statistics) was. I thought because I was choosing the BA (Bachelor of Arts) it would be less - sciency" – Steven.

This realisation took shape in three interconnected ways. First, many students admitted that they had underestimated how central statistics would be to their degree. Second, they were surprised by the sheer scale of statistical content, with some noting that they had not anticipated dedicated modules or the extent to which statistics would be embedded across assessments and coursework. Finally, several reflected that, had they known the true extent of statistics beforehand, they might have reconsidered their degree choice altogether:

"I had no idea how statistically heavy it was and how you would have to use all the statistics software. So, yeah. In all honesty it would have changed my mind of what course to take just because it's not my strong point. I wouldn't have picked psychology." – Betty

"No, I didn't actually know that when I came to university that psychology would be all stats. If I had known previously how psychology was, I might have looked at a different degree to be honest." – Laura

These attitudes reinforce the idea that misconceptions about course content not only fuel anxiety but also, for some, create a sense of mismatch between their expectations and their chosen degree path. It is therefore incumbent upon university prospectuses to clearly outline the degree structure and expectations, giving students a clear understanding of both the content of their degree, and the skills and attributes required. Although this might not fully alleviate the anxiety associated with a lack of self-efficacy, it will prepare students for the scale of statistics integration within their degree programme. Previous evidence (e.g., Brown et al., 2021) has demonstrated that transparent communication in relation to course content and organisation can mitigate student anxiety and uncertainty around expectations. Therefore, published prospectuses (i.e., either online or in written format) and Open Days can all be used as an opportunity to clearly articulate to students the expectations associated with pursuing a degree in Psychology. As a consequence, students are not *blindsided* after advancing past their foundation year by a sudden emphasis on research methods and associated statistical concepts.

Theme 3: Fragility and Hypervigilance

A prominent theme in the interviews was the fragility of students' confidence when engaging with statistics (highlighted by one student likening it to "walking on eggshells"). Unlike other subjects where errors may be more forgiving, students reported that in statistics even the smallest mistake felt catastrophic, undermining their entire sense of competence. This constant fear of "getting it wrong" was often paired with difficulties in interpreting statistical outputs, leaving students unsure whether their work was correct and exacerbating their anxiety. This reflects prior research highlighting the interplay between self-doubt and the technical demands of statistics as a distinctive driver of anxiety (Hanna et al., 2008; Onwuegbuzie & Wilson, 2003). For example, Daniel described the precariousness of statistical work in comparison to other areas of study:

"If you make one wee mistake the rest of your answers [are] all wrong. That's what I hate. You doubt yourself at every step." – Daniel.

Others emphasised the burden of second-guessing every step of their analysis, which contributed to a spiral of doubt. This can be conceptualised as a type of statistical *hypervigilance* where a negative feedback loop prevents progress in completing a specific task or sub-task associated with the analysis:

"I really question every single step that I'm taking – 'am I doing it right?' – because I don't get the same reassurance as in school. It makes me nervous to move on to the next thing." - Anna

When promoted for additional information, Anna continued:

"Like doing a t-test. Sometimes I run the analysis and then think – 'no, wait. Are my assumptions right? Like distributions and normality. Should I even be doing a t-test?' So I go back and check again. It's like I don't feel comfortable moving to the next step until I'm 100% sure I've done the right thing." - Anna

These narratives underscore that students' fragility is not solely about lacking technical ability, but also about their underlying sense of insecurity. The fear of errors creates a heightened sensitivity to every aspect of the statistical process, from deciding which test to use to reporting results in the correct format. As Williams (2013) notes, this fragile confidence can create a feedback loop where anxiety and self-doubt reinforce one another, leading students to perceive statistics as uniquely unforgiving compared to other domains of study.

This sense of fragility reflects what Marshall et al. (2024) describes as the lingering impact of school-based mathematics cultures where errors are framed as failure rather than learning opportunities. When such beliefs are carried into HE, students often experience statistics as a hostile environment where the consequences of small mistakes are amplified. Relatedly, students' confidence is often undermined when they approach quantitative work with a performance mindset, in which correctness is valued above exploration or understanding (Jazayeri et al., 2024). The interviews in this study illustrate how these perceptions manifest in practice, with participants repeatedly returning to earlier steps of an

analysis in order to guard against mistakes, a process that fuels hypervigilance and prevents progress.

From an applied perspective, teaching strategies should seek to directly challenge the assumption that statistics is uniquely unforgiving in nature. Marshall et al. (2024) argues that creating low-stakes opportunities for students to practise and make mistakes without penalty can provide positive replacement experiences that can potentially counteract previous negative ones. For example, those delivering statistics education in psychology could build error-based learning into tutorials or practical classes, showing common missteps and modelling the process of correction. This approach has already been found effective in Research Design classes in those students with higher levels of mathematics anxiety. Specifically, Núñez-Peña and Bono (2022) provided students with an overview of the most common *incorrect* answers, along with a detailed explanation of *why* these responses were incorrect. By framing incorrect answers as an opportunity for deep learning and explanation, both subjective and objective learning outcomes were improved among students who regularly attended these sessions. By fostering a classroom climate that frames errors as both expected and useful, psychology educators can begin to address the hypervigilance that currently characterises many students' engagement with statistics.

Theme 4: Student-Tutor Interaction

The interaction between student and tutor was consistently cited as an important factor related to SA. While difficulties with numbers and interpretation provided the backdrop for student anxiety, participants highlighted that the style of delivery, the clarity of communication, and the extent of support offered by tutors often determined whether this anxiety was heightened or mitigated. Within the interviews, students frequently described large group teaching, limited opportunity for dialogue, and lecturers' assumptions about prior knowledge as central to their struggles. The theme therefore conceptualises anxiety not only as an individual response to statistical content but as something shaped by the relational and communicative dimensions of the learning environment.

Betty captured this issue when reflecting on her experience of large statistics tutorials and practical classes:

"There wasn't really a lot of room for questions to be asked… it was in such a short space of time with so many people." – Betty

Her words reveal that it was not simply the logistical challenge of class size that mattered, but the resulting absence of space for dialogue and reassurance. This is important as previous research, such as that conducted by Pan and Tang (2005) highlight that a dialogue-rich environment is essential for fostering confidence among students, especially in statistics. This view cannot be divorced from the practical reality that limitations on space, teaching staff, and resources all place a burden on educators to realise the ideal of "instructor immediacy" (see, Williams, 2010). However, by integrating small group activities within tutorials, encouraging peer-to-peer explanation, or embedding opportunities for anonymous questions, this has the potential to foster a more open classroom environment (Onwuegbuzie & Wilson, 2003; Williams, 2013).

For other students, a key challenge was that teaching often began from an assumed baseline of competence, leaving them to interpret their confusion as evidence of personal inadequacy. Steven explained:

"I think they (tutors and lecturers) just assume that we have this base level of understanding that we actually don't have." – Steven

Steven's account illustrates the mismatch between lecturer expectations and students' actual starting points. Assumptions about prior quantitative knowledge can reinforce low self-efficacy, as students attribute their struggles to individual weakness rather than recognising that the instruction was not sufficiently scaffolded (Permana et al., 2016). Research has already demonstrated the negative impact of "assumed knowledge" on academic attainment in HE, prompting calls for better pedagogical support (see, King & Cattlin, 2015). This is imperative within psychology due to the diversity of academic backgrounds that ultimately enrol on degree programs. Unlike many "pure disciplines" that focus on fundamentals (e.g., Mathematics), it is unrealistic to assume homogeneity of baseline competency or expertise in psychology education. Consequently, tutors should not assume a robust working knowledge of statistics prior to enrolment. Rather, they should seek to provide needs-based scaffolded support, such as providing asynchronous resources to those that need them (see, Lin & Tang, 2017), whilst allowing more confident students to work independently.

Discussion and Conclusion

This study explored the lived experience of SA among psychology undergraduates. The findings indicate that SA can be conceptualised as a phenomenon produced through the interplay of prior mathematical experiences, expectations about the nature of psychology as a discipline, fragile confidence in practice, and the quality of interaction with tutors.

A key insight is how negative school-based experiences with mathematics intersect with misconceptions about psychology curricula. Many students assumed that by choosing psychology they would no longer need to engage with mathematical concepts. When these same students encountered statistics as a compulsory and central part of their degree, their anxiety was amplified through the association with past failure, struggle, and negative self-concept. This mismatch between prior expectation and curricular reality not only reactivated school-based anxieties but also deepened feelings of inadequacy, as students interpreted the presence of statistics as a barrier to succeeding in a subject they had chosen for its perceived focus on the *humanities*. This dynamic extends prior research linking mathematics and SA (e.g., Paechter et al., 2017; Trassi et al., 2022) by showing how expectations about disciplinary identity shape the reactivation of earlier negative experiences.

A prevalent attitude in the interviews was that students saw the analytical process as especially precarious. This sense of fragility often manifested in hypervigilance, with students repeatedly checking assumptions or re-running analyses out of fear that small mistakes would invalidate their work. Although the link between low self-efficacy and SA has been well-substantiated (see, Kaufmann et al., 2022), the current study identifies a unique qualitative dimension by illustrating how fragile self-concept, activated by prior experiences and course expectations, can fuel a spiral of doubt and compulsive checking. Indeed, this manifestation is exhibited through a negative feedback loop that prevents progress in the analysis process. Despite SA being traditionally associated with avoidance and procrastination (see, Morrow & Swingler, 2014), the current study evidences that "statistical hypervigilance" can also present an impediment to progress *despite* a willingness to engage with the content.

Finally, the association between classroom dynamics and student-tutor interaction shapes how SA is experienced. For students who carried negative prior experiences with mathematics into HE, the way tutors framed statistical content was an important factor in their attitudes. For example, students in the current study remarked that the assumption of prior knowledge or competence often perpetuated the feelings of low self-efficacy and

statistical self-concept (Paechter et al., 2017). This was further exacerbated by the dynamics of the learning environment, where large practical classes and limited instructor immediacy often stymied opportunities for reassurance and bespoke support. Consequently, it is important to recognise that the classroom dynamic is not merely another *dimension* of how SA is conceptualised by students. Rather, their time in the classroom is often where SA is explicitly *expressed* and brought to the fore. Therefore, it is important for educators to recognise that the in-person interaction between students and tutors is precisely where SA can be further solidified (e.g., through assumptions of prior knowledge or a lack of support), or potentially alleviated by incorporating such strategies that frame mistakes and uncertainty as an opportunity for learning (e.g., Núñez-Peña & Bono, 2022). Although educators must operate within the pragmatic and logistical boundaries of their institutions, even an explicit acknowledgement of statistic's potential for anxiety, uneasiness, and uncertainty can make students feel supported and listened to in the process.

One limitation of the current study is that participation was based on students' self-identification of experiencing "statistics anxiety" as described in the advertising material. As a result, there may have been substantial variation in actual levels of anxiety, which in future could be captured more objectively prior to interviews using a scale such as STARS (Cruise et al., 1985). Despite this, the "reflexive" component inherent in RTA is concerned with exploring the *lived experience* of those who perceive themselves as anxious, rather than quantifying severity in a diagnostic way. What mattered for this study was that students understood themselves as experiencing SA, since it is those perceptions and meanings that ultimately shape behaviours and attitudes (Braun & Clarke, 2021b). A second limitation is that this study interviewed students from multiple year groups at a single point in time. While this captured a broad range of perspectives and allowed students to reflect on prior experiences, it cannot trace how attitudes and anxieties evolve across the degree. SA is unlikely to be static, and students' perceptions may shift as they encounter new material, different teaching approaches, and varying assessment demands. A longitudinal design would provide a richer understanding of these dynamics by examining how initial anxieties persist, diminish, or transform over time, and whether particular pedagogical practices or milestones (such as dissertations) serve as turning points in students' confidence and engagement.

This study shows that SA among psychology undergraduates is shaped by the interplay of past experiences, disciplinary expectations, fragile confidence, and student–tutor interaction.

Recognising these connections highlights the need to move beyond viewing anxiety as an individual deficit and instead address it through curriculum design, clear communication, and supportive pedagogy. Future research should evaluate interventions that not only build competence but also reshape the identities and expectations that frame students' engagement with quantitative learning.

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Appendix 1

Statistics Anxiety Semi-Structured Interview Schedule

1. Opening question: Feelings about statistics

- *Question:* Could you describe how you feel about statistics, perhaps in three words?
- *Prompts:* Can you explain why you chose those words? Do you feel these words capture your general attitude, or only your feelings in certain contexts (e.g., exams, assignments)?

2. Prior experience of mathematics

- *Question:* Can you tell me about your experiences of mathematics at school?
- *Prompts:* What aspects did you find easy or enjoyable? What aspects did you find difficult or discouraging? Do you feel those experiences shaped your confidence with numbers today?

3. Transition into university psychology

- *Question:* Before starting your degree, did you know how much statistics would be involved in psychology?
- *Prompts:* Did this knowledge (or lack of it) influence your decision to study psychology? If you had known, do you think it would have changed your course choice?

4. Perceived importance of statistics in psychology

- *Question:* How important do you think statistics is within your psychology degree?
- *Prompts:* Do you see it as a useful skill for research or your future career? Does its importance affect the way you feel about it?

5. Sources of statistics anxiety

- *Question:* Why do you think statistics makes you feel anxious?
- *Prompts:* Is it the calculations, the interpretation, the software, or the exams that make you most anxious? Does your self-confidence or past experiences play a role?

6. Specific areas of difficulty

- *Question:* Are there particular elements of statistics that you find especially difficult?
- *Prompts:* For example, choosing the right test, using SPSS, interpreting outputs, or writing results sections. Can you describe a situation where you struggled most?

7. Coping strategies

- *Question:* What strategies do you use to cope with feelings of statistics anxiety?
- *Prompts:* Do you create your own notes or guides? Do you seek help from peers, tutors, or online resources? Do you avoid statistics tasks until necessary, or approach them gradually?

8. Suggested improvements to teaching

- *Question:* What could lecturers or universities do to help reduce students' anxiety about statistics?
- *Prompts:* Would smaller classes, more interactive tutorials, step-by-step guides, or additional workshops help? What difference would anonymous Q&A tools or introductory courses make?

9. Closing: Is there anything else you'd like to add about your experiences with statistics?

Appendix 2

Codes	Theme	Relationships/Notes
Placed in lower maths groups at school Teachers discouraged maths Failed or walked out of maths exams Fear of complex topics Not a "maths person" Self-doubt carried over into statistics	**Negative Prior Experience with Mathematics**	*Often chose Psychology precisely because it was not maths related → misconception*
Thought psychology was only about "mental illness" Did not expect maths/statistics in psychology Shocked at the level of statistics required Would have chosen a different degree if known Believed statistics was a "hidden" part of the degree Need for transparency in course information Didn't know it would be core component Separate statistics classes	**Misconception of Course Content**	*Many students felt they had left "maths behind" when enrolling on a Psychology course*
Able to follow step-by-step instructions but struggle with interpretation "I can hit all the buttons, but I don't understand what it means" Confidence undermined easily by mistakes Struggle distinguishing between similar tests Anxiety about interpreting outputs Knowledge not retained Reliance on creating own notes to cope Making one mistake ruins everything	**Statistical Fragility**	*Fragile knowledge and fear of errors were often intensified by Negative Prior Experiences with Mathematics. These difficulties were compounded by Student/Tutor Interaction, where lack of clear guidance left students more vulnerable to spirals of doubt.*
Difficult to ask lecturers for reassurance Lack of stats seminars in early years Seminars helpful but did not cover all areas Support sessions limited Feeling left on their own Desire for smaller, interactive classes Anonymous Q&A tools would reduce embarrassment Perception that lecturers assume too much baseline knowledge	**Student/Tutor Interaction**	*Inaccessible teaching amplified Statistical Fragility. It also reinforced Negative Prior Experiences with Mathematics, as poor support mirrored earlier discouragement.*