



Characterization and Alleviation of the Anxiety Experience for Doctoral Students

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SUMMARY: *Doctoral training requires students to carry out original research, publish their theses, write a dissertation and choose a career within the relatively short period of their studies, thus experiencing anxiety in daily academic life. Based on the disease narrative and theme analysis, this paper encodes the theme of the interview materials of 15 doctoral students who are experiencing or have experienced anxiety, including 6 with hospital diagnosis records and 9 who self-reported anxiety and have been affected in their study and life. The research construct a three-dimensional representation framework of "impaired social function, negative cognition and somatic symptoms", and explains the generation mechanism of anxiety through five aspects: institutional rigidity, accumulation of individual pressure, planning gap, lack of ability, and weakening of guidance interaction. The results showed that the cases of severe anxiety mainly included learning stagnation, submission avoidance, catastrophic expectations and sleep disorders; high-frequency pressure sources were publishing threshold, ability gap and tutor distance. As shown by the three-dimensional risk surface, a high level of stress caused by work and an overly restrictive institutional environment will lead to an increased anxiety risk; however, if one has good institutional support and self-strength, even in a stressful working environment, this risk will be reduced significantly. To alleviate the anxiety of doctoral students, multiple countermeasures need to be taken simultaneously, including improving personal resilience, strengthening the training system, increasing ability support, building an academic community, and enhancing the psychological service interface; early identification, process feedback and crisis referral should be linked. The research offers a visual evidence chain and an operable intervention framework for the management of doctoral students' mental health, as well as providing empirical support for colleges and universities to improve the evaluation system of doctoral training.*

KEYWORDS: *Doctoral students; Anxiety experience; Disease narrative; Academic pressure; Cultivation mechanism*

1 Introduction

The anxiety of doctoral students first appears in their studies at the university. The submission system has not replied to the letter in a long time; therefore, I cannot explain why the research has been stalled during the group meeting report, why the same papers have been repeatedly published in the same school, and why there are no achievements that can be counted towards

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graduation requirements in the school system node. These situations have reduced the time available for knowledge creation to a continuous count down. The learning objects in the doctoral stage have exceeded the requirements of the course. Students need to know how to join a research group, face problems in research, use different research methods, handle data, complete the thesis, and plan for their future lives. Any delay at any link will be viewed by students as a chain of risks to graduation, employment and family life. Anxiety in this situation is not a single emotional fluctuation; rather, it will affect all aspects of a student's experience of time, ability, relationships and physical health simultaneously.

Previous studies have shown that the mental health risks of doctoral students are also widespread in many countries and fields of study. The Nature Global Doctoral Survey report indicates that a considerable number of doctoral students have sought assistance due to anxiety or depression, and long-term work culture and academic uncertainty are frequently mentioned as sources of stress. Evans and others have also shown in their research on the mental health of graduate students that the risk of anxiety and depression for these students is relatively high compared to that in the general population [2]. Levecque and others have indicated, from the perspective of work organisation, that the relationship with a mentor, workload, a sense of control and organisational policies can all be reasons for psychological problems among doctoral students. These studies have shifted the focus of doctoral student anxiety from individual weakness to the conditions in their work and study at the institution.

The following are the systematic reviews and cross-border studies that have also provided support for this. Satinsky and others have found in their meta-analysis that anxiety, depression and suicidal ideation among doctoral students should be included in the government work plan for postgraduate education [4]. Hazell and others' national survey of doctoral students in the UK have also indicated that reasons for poor mental health include academic stress, a lack of support, and an unsupportive research environment. Recently, in a review of the mental health of doctoral students, it has been pointed out that related research is still limited by cross-sectional questionnaires, a lack of explanation for cultural differences, and no long-term follow-up of intervention effects [6]. Anxiety for Chinese doctoral students is closely linked to the degree-granting system, publication resources, family responsibilities and the job market. Bai et al. studied the reasons for anxiety among Chinese doctoral students and found that gender, age, marital stress and self-awareness are all linked to an increased risk of anxiety [7]. Xu et al. found that research pressure is correlated with depression in doctoral students, and this effect can be mediated by family economic support [8]. Quan and others have shown that due to the publication requirements of the Chinese doctoral program, many research papers need to be published before the thesis can be defended [9].

Research on the learning experience of doctoral students has gradually expanded from a focus on degree attainment to include aspects such as happiness, psychological capital, stage differences and intentions to leave. Cao and others have determined that psychological capital can affect the self-report of life quality among Chinese doctoral students by means of educational investment. Sverdlik and others have reported that the three elements of the doctoral life are completion progress, sense of achievement and health, respectively [11]. Schmidt and Hansson have pointed out in their review of previous research that the happiness of PhD students is related to their school life, relationships with teachers and friends, etc. Friedrich and others have explored the connection between daily life and mental health for doctoral students [13]. In addition, the risk of interruption in doctoral studies, emotional exhaustion and staged motivational changes have also been linked to anxiety and the intention to leave the academic system [14-16]. Based on the above studies, the anxiety experienced by doctoral students should not be viewed as an isolated emotional problem but rather as a result of the training system, academic life, and other circumstances in their lives.

The current studies have provided some support for understanding doctoral student anxiety, but three problems have not yet been solved. First of all, many studies have used scale scores or prevalence rates as the main indicators; although they can show the extent of risk, they are unable to describe the process by which anxiety occurs in doctoral students' learning behaviour, their physical responses, and their sense of self. Secondly, discussions of the sources of stress often list graduation, publication, employment, economy, relationships, etc., without explaining how these different pressures interact to enhance one another or how they manifest as anxiety after resource depletion. Thirdly, most of the recommendations for relief are single-point measures, such as psychological counselling, time management or optimisation of training systems; there is no all-encompassing framework to address these multiple problems at the level of individual adjustment, academic ability, mentor interaction and institutional evaluation simultaneously.

Anxiety in the context of doctoral training in China is also showing stronger time compression. Doctoral students generally have to handle courses, thesis proposals, mid-term examinations, thesis publications, thesis writing, pre-defense, and job hunting at the same time. Different tasks belong to different management stages, but they all require the same attention and resources from the student. The review cycle for core journals or high-level papers is unpredictable, and degree applications and recruitment windows have fixed deadlines; thus, regular time management by doctoral students cannot eliminate all risks. For students who are married, studying away from home, or taking on family caregiving responsibilities, postponing their education may also result in problems such as family income, partner division of labour and parent-child relations.

Based on the above deficiencies, this paper will combine disease narrative and thematic analysis to explore the representational structure, generative mechanism, and relief interface of anxiety experiences among about 15 doctoral students. This paper will address the following three problems: what are the main ways in which doctoral students' anxiety manifests in observable behaviours; how do institutional pressure, individual pressure, and deficiencies in academic resources jointly lead to anxiety; and which mitigation strategies have clearer responsibility divisions and implementation paths for training units and individual doctoral students. The main contributions of this paper are as follows: First, the interview materials of 15 doctoral students have been organised into programmable experience units; second, diagnostic anxiety has been separated from self-reported anxiety, and these two have been divided according to the level of social function impairment; third, a three-dimensional model of anxiety experience and a coupled model of stress resources have been constructed, and the anxiety structure is displayed using heat maps, three-dimensional surfaces and co-occurrence networks; finally, a relief framework composed of personal resilience, training system, capacity building, academic community and psychological services has been put forward to provide an operational basis for improving the quality of graduate education in universities.

The two senses of "anxiety experience" in this paper are as follows. First of all, anxiety refers to anxiety disorders in a medical sense, as well as persistent worries, avoidance, and physical discomfort that have not yet met the criteria for a clinical diagnosis but have already caused disturbances in doctoral studies and daily life. Secondly, experience is not the same as the subjective statement itself; it also includes how students explain their own circumstances under institutional pressure, how they alter their behaviour, how they keep a distance from mentors and peers, and how they express pressure that is difficult to convey directly through physical symptoms. Therefore, the interview materials need to be organised into an organised system of evidence for the following characterisation, causes, and solutions.

Therefore, this paper will explore the anxiety of doctoral students at the intersection of academic research, evaluation systems and their lives, and not only list the psychological

problems. This way can also help explain why some students can continue their behaviour under academic pressure after receiving feedback from teachers and working with classmates, while others are unable to adapt and develop long-term avoidance and physical symptoms. The difference in people is due to all sorts of reasons, including individual differences, how they address stress, resource acquisition and risk-sharing, etc. This will also move the focus of this paper from individual symptoms to the modifiable factors in cultivation.

2 Methods

2.1 Research object, material source, and sample organization

The primary source of data for this paper is semi-structured interviews, and the content analysed relates to the anxiety doctoral students experience in their academic work, learning interaction, comparison with peers, and life problems. The research subjects are 15 doctoral students who are currently experiencing or have experienced anxiety, among whom 6 have been diagnosed with anxiety neurosis or anxiety disorders by the hospital's psychiatric department, and 9 have not received a formal diagnosis but have clearly stated that their anxiety has affected normal study and life, sleep, social interaction, etc. Purposive convenience sampling was used for the sample, and the focus was on obtaining data about the different types of anxiety experienced by doctoral students in their studies; it did not aim to determine the general distribution of such anxiety. The case numbers in the interview materials are processed according to the "region gender serial number", and this article further uniformly anonymizes them as C01 to C15, keeping gender, anxiety identification methods, degree of social function impairment, and main sources of stress.

The inclusion conditions for the sample are as follows: first, the experience of anxiety must occur during the doctoral period and have a traceable connection with the thesis, the relationship with the supervisor, changes in degree status, family responsibilities or career choices; second, the interviewee needs to be able to provide a more detailed description of how the anxiety occurred, worsened, was relieved, or reappeared; and third, the interviewee must consent to using their story for academic analysis after anonymisation. Short-term exam stress, unexpected life events not related to doctoral studies, and materials that fail to provide key contextual details have not been included in the formal coding. Therefore, it will be easier to focus on the main issue and reduce the influence of the general narrative, thus making the sample more representative of anxiety experienced by doctoral students.

The research materials are semi-structured interview texts, interview memos, researcher process notes and case event summaries. The four kinds of questions in the interview are: first, the learning or life environment where the anxiety first appeared significantly; second, how anxiety affects the reading of literature, writing papers, submission, group work, interpersonal relationships and physical health; third, how pressures from the doctoral training system, interactions with mentors, peer comparison, family and economic responsibilities enter daily life; and finally, what self-regulation and help-seeking or avoidance behaviors have been used by individuals in the past. The interview text is first divided into event units according to natural semantics, and then the emotional responses, behavioural consequences, cognitive explanations and physical sensations within the same event are further divided into finer coding units, finally forming a case feature matrix that can be used for thematic analysis.

Low-structured questions are used in the interview to avoid having to ask the respondents directly about "anxiety symptoms" or "stressors" in the research. First, the researchers had the respondents describe the specific situation in which they felt anxious most recently, and then asked about the schoolwork they had been doing at that time, their communication with teachers

and classmates, their physical sensations, and what they had done afterward. If the interviewee voluntarily discloses information about hospital diagnoses, medications, consultations or other reasons for stopping and resumes in a private medical context, this will not be recorded in the thesis and will not be requested. For information on the name of the supervisor, the name of the college, the name of the journal, and the occupation of family members, it will be uniformly blurred during transcription.

The three divisions of the sample are based on the extent of social function impairment. Level I is severely impaired, showing symptoms such as academic stagnation, suspension, thoughts of leaving school, or a high risk of dropping out; there were a total of 3 cases. Level II is moderately impaired, with significant reductions in learning efficiency, problems with relationships, chronic insomnia, or frequent avoidance; a total of 7 cases. Level III was mildly impaired, manifesting as stage anxiety, occasional physical symptoms, and fluctuating self-regulated learning; there were a total of 5 cases. Only for internal comparison of the qualitative materials is this stratification used and it does not substitute for clinical diagnosis. Table 1 presents the organisation of the sample and text materials, and Figure 1 shows how the original interview materials were segmented, topic coded, matrixised and consistency tested before being used in the following analyses.

Organize the materials, then summarise each interview as a "chain of events". The event chain includes the trigger, duration, affected individuals, coping strategies and outcome directions of anxiety. For example, the event chain of a certain case may be "core paper rejection, continuous insomnia, avoidance of group meetings, taking leave from the supervisor, and delayed resubmission". The purpose of the event chain is to avoid encoding only the emotional words and ignoring how anxiety is shown in behaviour. Only when emotions, behaviour and circumstances can be linked in a reasonable way will they be included in the formal study.

Table 1: Sample Structure and Material Organisation Method

Item	Operational Definition	Quantity / Description
Valid cases	Doctoral students who were experiencing or had previously experienced anxiety	15 cases
Anxiety identification	Hospital-diagnosed anxiety / self-reported anxiety	6 cases / 9 cases
Gender structure	Used only for sample balance after anonymization	8 males and 7 females
Impairment level	Level I / Level II / Level III	3 cases / 7 cases / 5 cases
Main materials	Interview transcripts, interview memos, process notes, and case event summaries	186 event units were generated
Analytical purpose	Identification of anxiety manifestations, classification of stressors, and extraction of alleviation interfaces	Not used to estimate overall prevalence

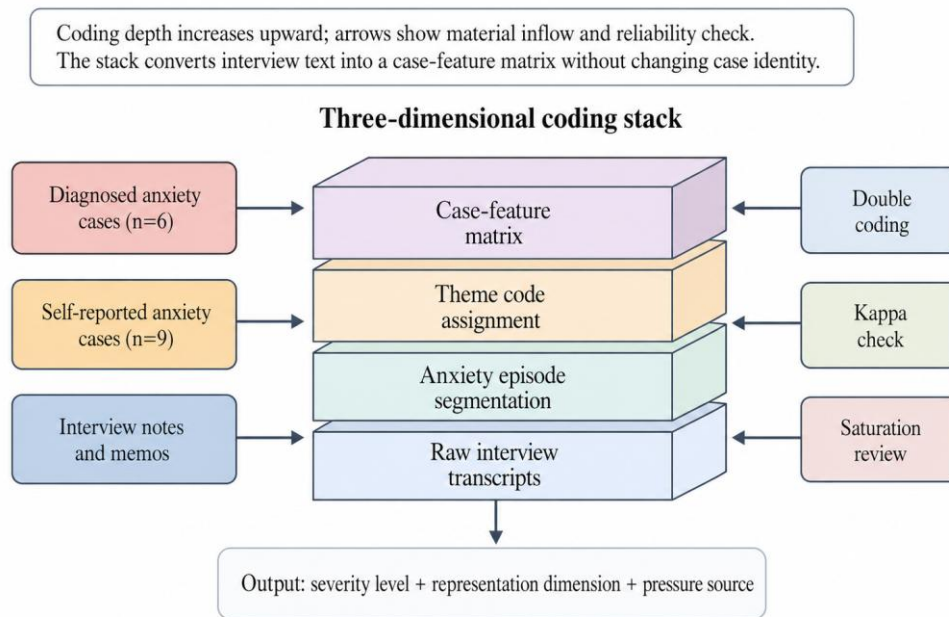


Figure 1: Research on the Mechanism of Material Organisation and Sample Construction

As shown in Figure 1, the three kinds of materials on the left are diagnostic anxiety, self-reported anxiety and interview memos; the central three-dimensional stacked structure shows an increase in encoding depth from the original text to the case feature matrix; and on the right are the consistency test, Kappa test and saturation review for boundary restriction. The output obtained is as follows: severity, characterization dimensions and sources of stress; these will be used in the following analysis of Figures 2-8.

2.2 VR Scenario Design and Immersive Instructional Intervention

The three steps in the coding process are open coding, classification according to main axes, and selective integration, and they are based on thematic analysis and systematic text analysis [17, 18]. In the open coding stage, pay attention to the particular experiences expressed by the interviewees, such as "unable to read literature", "afraid to open the submission system", "repeatedly thinking about graduation conditions after waking up in the early morning", and "headache when sitting at the workstation". The first step in the main-axis classification is to group similar experiences into one of three categories: social dysfunction, negative cognition and somatic symptoms. In the selective integration stage, the sources of stress, resource conditions and ways of coping have also been added to the same explanatory system to prevent reducing anxiety to merely emotions or a scale score.

The first codebook has been revised many times. First, frequent experiential words from the original text were selected for the study, including "stuck", "afraid to read the news", "blank mind", "feeling like you're done", "flustered" and "unable to sleep". Formulate more stable academic codes based on the above empirical findings. Stuck is a typical case: If the context suggests difficulty progressing with paper writing, learning will be inefficient; if it indicates fear of opening the submission system, enter the category of paper avoidance; and if 'I may never graduate' appears at the same time, add a catastrophic expectation code. This division will retain the richness of individual case stories and avoid unifying all the pressures under a single anxiety label.

The two people who would be used as peer reviewers for the code are selected here. Two coders read five interview texts together, created an initial codebook, and then coded all the

materials separately. After the first consistency test, the two sides discussed whether the "decline in learning efficiency" was included in the "impairment of social function", how to distinguish between "catastrophic expectations" and "general concerns", whether "rest shame" belonged to "negative cognition", and then adjusted the codebook to complete the second round of coding. Cohen's coefficient [19] was used to test for coding consistency, and the kappa value of the formal coding was 0.82; thus, it was deemed highly consistent. For the units in question, it will be necessary to go back to the interview context and determine the main direction of their adjustment. If the same statement has both a physical reaction and a cognitive explanation, multiple encodings are permitted.

To convert the qualitative materials into visual evidence, anxiety burden scores are constructed for each case in this paper. The Formula for Calculation is as follows:

$$A_i = \omega_f F_i + \omega_n N_i + \omega_p P_i \quad (1)$$

Dimension Assignment uses hierarchical judgment. If a certain representation only appears occasionally in an interview and does not affect subsequent behaviour, it is recorded as a low value; if the representation repeatedly occurs and alters the learning or communication arrangement, it is recorded as the median; and if the representation causes paper stagnation, prolonged insomnia, thoughts of taking a leave of absence, or other significant physical reactions, it is recorded as a high value. GAD-7 offers semantic references for scales on generalised anxiety, uncontrollable worry and functional impairment [20], but interviewees were not converted into clinical scale scores in this study. The reason for doing so is that this study will only examine how anxiety is expressed, experienced and organised in the context of doctoral studies, not as a replacement for medical examinations.

In the formula, A_i represents the comprehensive anxiety load of the i th case; F_i represents the intensity of social dysfunction, N_i represents the intensity of negative cognition, and P_i represents the intensity of somatic symptoms; ω_f , ω_n , and ω_p are the visual weights of the three dimensions, respectively. This article sets three weights to 1/3 to display the relative positions of different cases in three-dimensional space, not for clinical screening. All three types of indicators are standardized from 0 to 1, with higher values indicating denser, longer lasting, or more significant impact on learning and life experiences in the interview materials.

The topic co-occurrence relationship is represented by the normalized co-occurrence intensity of stressors and anxiety representations in this paper.

$$Q_{jk} = n_{jk}/N \quad (2)$$

In the formula, Q_{jk} represents the co-occurrence intensity of the j -th stressor and k -th anxiety representation in the sample; n_{jk} represents the number of instances where both appear simultaneously in the same case; N represents the total number of valid cases. This indicator is used to draw pressure source networks and heat maps, emphasizing the relative strength of thematic relationships. In order to avoid excessive inference caused by a small number of samples, all results are expressed in terms of "encoding strength" and "internal structure of the sample", and are not directly extrapolated as the overall proportion of doctoral students.

The Calculation of Coding Reliability is as follows:

$$\kappa = (p_o - p_e)/(1 - p_e) \quad (3)$$

In the formula, k represents the consistency of the corrected encoding; p_o represents the consistent proportion observed by two coders; P_{ue} represents the expected proportion that is randomly consistent. This statistic is used to test whether the codebook has repeatability. Based on the aforementioned three-dimensional load and co-occurrence matrix, this article generates three mutually verified output results: "case location, topic popularity, and pressure connection". Figure 2 presents the distribution of 15 cases in the three-dimensional space of social dysfunction, negative cognition, and somatic symptoms. Table 2 provides the main dimensions, secondary indicators, and judgment criteria.

The research in the stage of graphic conversion follows the sequence of "encoding first, then normalisation, and finally visualisation". Heatmap is used to show the average encoding strength of each group for the secondary indicators; a 3D scatter plot displays the three main dimension scores of each case; and a co-occurrence network shows the co-occurrence relationship between stressors and representation dimensions. In order to ensure the consistency of the hierarchical definitions in the figures with those in the main text, all Levels I, II, and III of the figures follow the definitions in Section 2.1; only colours are used to distinguish categories or intensities and are not assumed to have new interpretations. The numbers in the graph are the results of code analysis, and they will still change with different text and different definitions in the samples.

Transcription and Encoding of the text also need to handle citation boundaries specifically. Only short sentences that can support the theme judgment are kept in the main text, and long case narratives are not directly incorporated into the analysis to prevent the paper from becoming a collection of materials. For the colloquial expressions that the respondents used, the study aims to reduce the need for written processing without altering the meaning; as for objects such as "mentor", "fellow student", "journal", etc., only the relationship position is retained, and identifying clues are not preserved. It will be able to preserve the sense of situation in the anxiety experience and reduce the risk of individual exposure.

Table 2: Coding Dimensions, Secondary Indicators and Judgment Criteria

Main Dimension	Secondary Indicators	Judgment Criteria
Social functional impairment	Low learning efficiency, paper avoidance, interpersonal withdrawal, guilt about rest	Continuous decline in learning or social behavior that affects thesis writing, group meetings, peer interaction, or daily arrangements
Negative cognition	Self-doubt, catastrophic expectation, irritability and guilt	Interpreting temporary setbacks as personal incompetence, future failure, or irreversible loss
Somatic symptoms	Insomnia, palpitation or dizziness, loss of appetite or hair loss	Anxiety is experienced, expressed, or handled through bodily reactions and disrupts learning or daily rhythm
Stressors	Publication threshold, peer comparison, planning gap, ability gap, supervisory distance, family and financial pressure, career uncertainty	Factors explicitly identified in case narratives as the background or trigger of anxiety escalation
Support resources	Supervisor feedback, peer support, family understanding, methodological training, psychological services	Resources that reduce the intensity of stress interpretation, restore action capacity, or provide alternative coping pathways

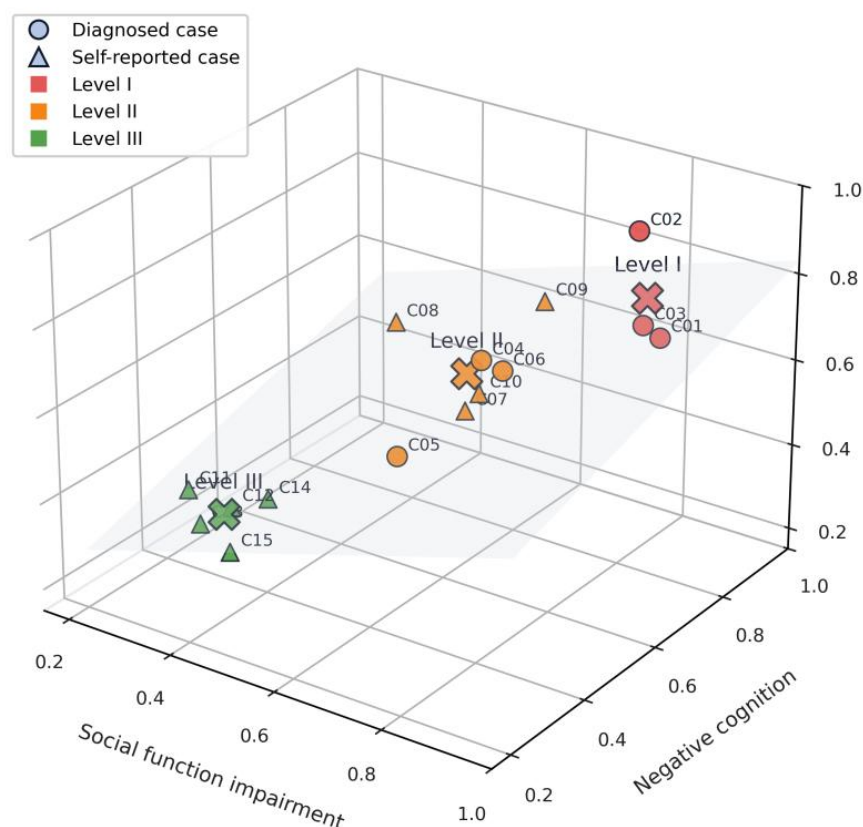


Figure 2: Three-Dimensional Encoding Space of Anxiety Experience

As shown in Figure 2, the Level I case is relatively close to the high-value end of the three-dimensional coordinates, indicating that severe anxiety often has social dysfunction, negative cognitions and somatic symptoms simultaneously; Level III cases are located in the low-value area and mainly show periodic fluctuations. The diagnosis case and the self-reported case are not fully separated, and there is an overlap between the status of clinical diagnosis and the extent of learning and life impairment; therefore, it needs to be judged in conjunction with narrative materials.

2.3 Coupling of pressure sources, verification protocols and interpretation boundaries

The cause of anxiety for doctoral students is generally a combination of several problems occurring at the same time. To explain how stress continuously increases, this paper introduces the work requirements resource theory and resource conservation theory [21, 22] as analytical frameworks. The paper threshold, duration of study and evaluation competition in the training system are external demands; students' own writing ability, method training, time management, family support and mentor feedback are available resources. If the demand for outside resources is high, there will be anxiety and other problems in daily life as a result.

Stressors are the reasons for the problems. The publishing threshold is the pressure that doctoral students feel when considering whether their paper has been accepted by top journals or achieved other notable results as a requirement for graduation; peer comparison refers to respondents comparing themselves to the publication progress of other PhD students in the same field, class, or institution for self-evaluation; planning gap is the failure to foresee the difficulty of doctoral studies in advance or during the early stages of enrollment; ability gap is

the lack of skills needed for other aspects of the program, such as reading and synthesizing research papers, designing research plans, processing data, writing academic papers, and responding to revisions or submissions; mentor distance refers to insufficient guidance or support from advisors, such as infrequent feedback, vague instructions, or reduced communication due to the hierarchical relationship; family economic pressure and career uncertainty correspond to the risks of high living expenses and uncertainty about future employment after graduation.

The pressure coupling risk can be expressed as the following function:

$$R_i = \sigma(\theta_0 + \theta_m M_i - \theta_h H_i) \quad (4)$$

In the formula, R_i represents the anxiety risk mapping value of the i -th case; σ represents the S-shaped normalization function; M_i represents the combined load of institutional requirements and personal pressure; H_i represents available support resources; θ_0 , θ_m , and θ_h represent mapping parameters. This function belongs to explanatory mapping, which is used to transform the repeated relationships of "increasing demands, decreasing resources, and increasing risks" in interview materials into interpretable graphics. Figure 3 presents the pathways of interaction between stressors, resource buffering, and anxiety fields.

The three kinds of model verification are as follows. First, carry out thematic saturation. After the 13th interview, the main themes have been stable, and C14 and C15 did not generate new primary themes. Only specific content was added, such as shame during rest, family caregiving responsibilities, and supervisor's administrative affairs, and feedback time was not extended. Second, test with a negative sample. Some cases of mild anxiety are also under the pressure of publishing papers, but due to stable feedback from supervisors, frequent peer discussions, or a clear personal plan, anxiety has not led to severe functional impairment. Therefore, stress may be of a certain intensity only after an individual's resources are diminished. Thirdly, carry out material recycling. Anonymize and organise the representative narratives, cross-check them sentence by sentence with the original text, remove any college or mentor designations and specific journal information that might reveal identity, and keep only experiential descriptions that can support theme judgment.

The distribution of the visualisation results is as follows: Figure 4 addresses the question 'Where is the anxiety most concentrated?', so a heatmap is used to show the differences in the intensity of each group at the secondary indicator level. Figure 5 answers the question of how institutional and individual pressures work together to increase risk, and thus a three-dimensional surface plot is used to show the interaction between the two continuous variables. Figure 6 shows which pressure sources are closely associated with which representations; therefore, a co-occurrence network is built. Figure 7 shows the pressure evolution at the doctoral level, so a multi-curve trajectory is employed. Figure 8 answers why relief requires the joint action of institutions and individuals, and thus response surface methodology is used. The position of the chart can maintain a uniform scale for methods, results and discussions.

The scope of application for this paper is as follows. First of all, the 15 cases can support mechanistic analysis and typological presentation, but they do not represent the general situation of doctoral students across the country. Second, there are different levels of clinical importance for diagnosed anxiety and self-reported anxiety. Both are placed in the same system for comparison of the effect of anxiety on learning, and no medical judgments are made. Again, the risk surface and response surface in the figure are based on encoding strength, theoretical relationships and internal sample normalisation results; their function is to help understand the mechanism and not to predict an individual's disease risk. Based on the above division, the following results will only be introduced for doctoral students' anxiety experiences in terms of representation, stress coupling and relief interface.

To reduce the problem of explanatory bias further, three limitations in the presentation of the results were added. First, all proportions and frequencies should be shown in the 15 cases to avoid writing sample frequency as the population occurrence rate. Secondly, content that may be related to gender, marriage and family responsibilities is only used when respondents actively link them with anxiety, and identity variables are not directly presented as causal conclusions. Thirdly, the relief strategy should be able to identify the corresponding pain points in the material or be mutually validated with existing research on mentor relationships, psychological capital, mindfulness training and peer support evidence. The conclusion reached from this has a sense of location and is not to be widely promoted.

The study has divided the reasons for the results into a "triggering factor" and a "maintenance factor" in its explanation. A failed submission, the defeat of one's group or family problems, etc., may all cause stress; but over time, what increases this stress is often a lack of follow-up on the situation, the inability to divide the work, and insufficient physical rest. The two can be used to avoid concentrating the intervention on a single-event appeasement and neglecting the restoration of the long-term cultivation environment.

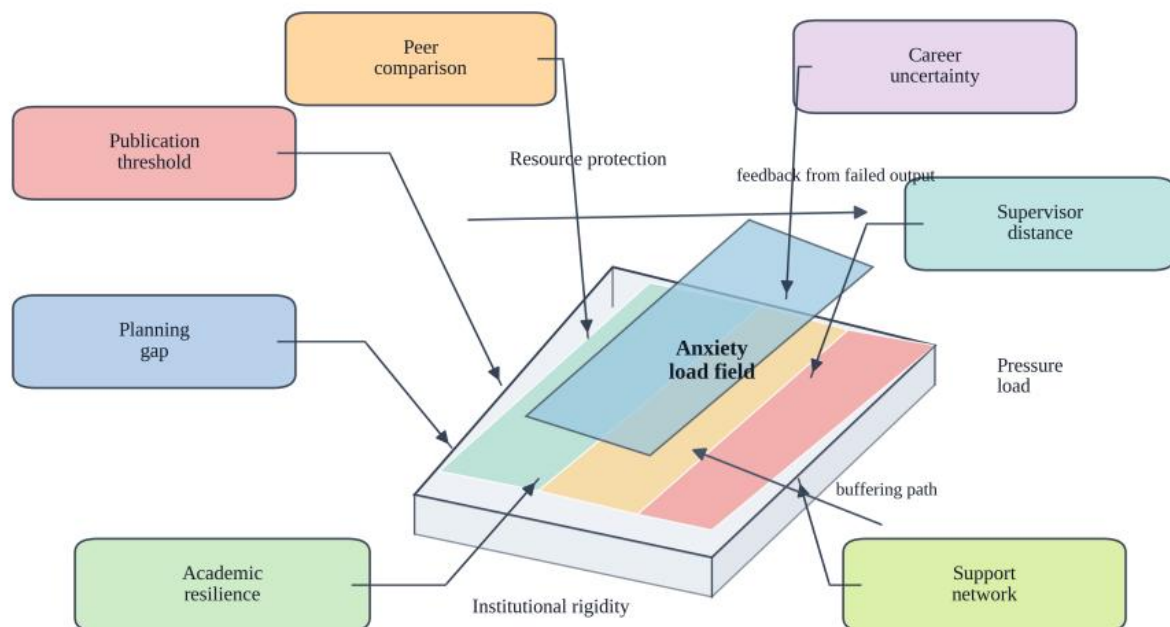


Figure 3: Stress-Resource Coupling Mechanism of Anxiety Among Doctoral Students

As shown in Figure 3, stressors such as the publication threshold, peer comparison, planning gap, distance from mentors, and career uncertainty are located on the periphery of the anxiety field, and academic resilience and support networks form a buffer path. As shown in the figure, the relative positions of stress load and resource conservation indicate that the strength of anxiety is determined by the fluctuations in the balance between stress input and resource availability, rather than by the specific cause of the anxiety.

3 Results and Discussion

3.1 Three dimensional representation and intensity stratification of anxiety experience

After completing the sample stratification and coding modelling, this section will first address

what form the anxiety of doctoral students takes empirically. Based on the interview materials, social dysfunction, negative cognition and somatic symptoms have all occurred in various degrees and their relationships are unclear and need to be further determined through charts. Figure 4 shows the normalised encoding intensity of different severity groups in 10 secondary representations, and Figure 2 places 15 cases in three-dimensional space to observe the correspondence between symptom combinations and intensity stratification.

As shown in Figure 4, the coding strengths of the Level I group for learning inefficiency, self-doubt, insomnia and catastrophic expectations were 0.91, 0.94, 0.93 and 0.87 respectively; these values were significantly higher than those of the Level II group (0.70, 0.71, 0.72 and 0.66) and also higher than those of the Level III group (0.38, 0.42, 0.46 and 0.34). Social dysfunction is the first external manifestation of severe cases, showing an inability to continue reading literature, interrupted paper-writing, avoidance of group activities, reduced exercise and socialisation. The respondents considered rest to be a "waste of time", but extended their learning time repeatedly without increasing output, thus creating a closed loop of "unable to learn or rest".

The moderate anxiety group had transitional features. The low efficiency intensity of learning for this group is 0.70, the avoidance of academic papers is 0.67, and insomnia is 0.72; all three are relatively high. However, physical indicators such as palpitations, dizziness and loss of appetite were not severe enough to fall into the severe group. Based on the interviews, the moderate group is often in a state of "still able to complete tasks but requires high-consumption maintenance". Students can be on time for the group meeting and demonstrate basic writing skills, but they may have to stay up late, reduce their social life, and feel guilty about their slow progress repeatedly. This group is most likely to be misjudged by mentors and colleges as "just under a lot of pressure", but its risk lies in the possibility of quickly turning into serious harm if it faces rejection, obstructed proposals, or family events repeatedly.

The Division of negative cognitions among the groups is also different. The self-doubt intensity of the Level I group is 0.94, and the catastrophic expectation is 0.87; thus, severe anxiety in this group involves both emotional tension and a reduction in self-efficacy and future-risk judgement. Paper rejection, a lack of guidance from supervisors and other reasons are often listed by respondents as the reasons they did not continue with their PhD studies. Therefore, they are less likely to seek assistance and will reduce their goals from "graduating on time and entering their preferred university" to "not having to drop out". Academic failures are thus generalised as a reduction in self-esteem, and anxiety has moved from pressure related to tasks to an identity crisis.

Somatic symptoms are relatively close to the feeling of anxiety. As shown in Figure 4, the intensity of insomnia for the Level I group was 0.93; palpitation or dizziness was 0.73; reduced appetite or hair loss was 0.69. The indices for the Level II group are 0.72, 0.50 and 0.48 respectively, and somatisation does not occur only in extreme cases. As shown in Figure 2, Level I cases are concentrated in the high-value areas of the three coordinate axes, and Level III cases are mainly located in the low- to medium-low areas. Three-dimensional space shows that social dysfunction, negative cognition and somatic symptoms often occur together; for instance, when students are unable to complete paper-and-pencil tasks for an extended period, they are likely to develop negative attributions; if sleep and physical health decline, learning efficiency will further drop, leading to anxiety in a self-reinforcing loop.

The Importance of the Mild Group should not be ignored. Most of the Level III group had scores below 0.50 in most indicators, but the shame of rest reached 0.45 and insomnia reached 0.46; therefore, anxiety had already started to affect doctoral students' perception of rest and health and was no longer in a state that seriously disturbed their study. If the cultivation system only uses suspension, dropout or severe insomnia as intervention signals, it will be late to

respond. As shown in Figures 2 and 4, the representation of anxiety has a continuous spectral feature without distinct breaks at the levels of mild, moderate and severe; only the intensity and combination change.

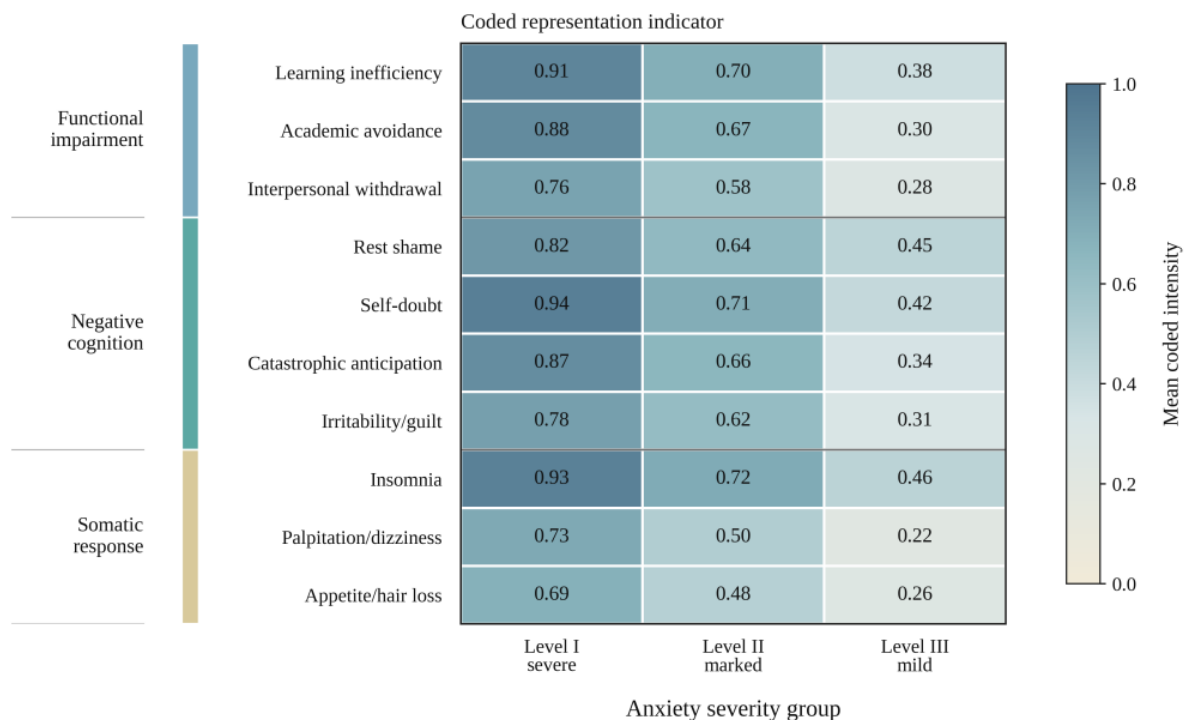


Figure 4: Encoding Heatmap of Anxiety Experience Representation Dimensions

As shown in Figure 4, learning inefficiency, self-doubt, insomnia and catastrophic thinking are all at a high level in the Level I group, suggesting that severe anxiety has affected action, cognition and sleep at the same time. The severity of the various factors in the Level III group is relatively low; insomnia, rest shame and mild self-doubt still occur, indicating that although it is mild, some support may still be required.

3.2 The pressure chain and coupling network generated by anxiety

Specify the form of the anxiety and then explain why it has appeared in this particular way. The seven kinds of stress sources in this paper are: institutional rigidity, peer comparison, planning gaps, ability gaps, mentor distance, family economic pressure, and career uncertainty. Based on the above, a risk surface and co-occurrence network are drawn. As shown in Figure 5, the change in anxiety risk under the combined effect of the institutional rigidity index and individual stress load is presented, and Figure 6 shows the strength of the connection between stressors and the three types of anxiety representation.

As shown in Figure 5, when both the institutional rigidity index and individual stress load are below 0.30, the anxiety risk is mainly in the range of 0.28 to 0.36; when both exceed 0.70 simultaneously, the surface rises rapidly, the risk value stays above 0.78, and is close to 1.00 in the intersection area of high institutional rigidity and high personal pressure. Therefore, it can be seen that the combination of graduation thesis requirements, journal publication expectations, family responsibilities, skill deficiencies and employment aspirations has led to a high-risk state of anxiety for doctoral students. The Level I cases on the surface are concentrated in the high-value area, and it can be seen that severe anxiety is often accompanied by a combination of "high institutional requirements, weak personal resources, and limited support feedback".

The reason the publishing threshold is located at the core of the internet is that it connects degree qualifications, employment competition and self-worth simultaneously. A long-term lack of core papers can alter students' sense of time, and waiting for review is regarded as a continuous loss of graduation time. The role of ability gap is closer to daily life, and most of the problems experienced by respondents are specific actions such as topic selection and refinement, literature review, method matching, and chart display. After the superposition of the two kinds of pressure, students are more likely to internalise the rules for external evaluation as personal flaws and thus develop negative cognition.

As shown in Figure 6, the publishing threshold is the most frequent type of pressure, with 13 cases, and it is closely associated with social dysfunction, negative cognitions and somatic symptoms. The 11 cases of the ability gap mainly include learning inefficiency, self-doubt and paper avoidance. There are 10 cases of a distant mentor; these include the supervisor's preoccupation with other duties resulting in long-delayed feedback, as well as students' apprehension about inconveniencing the mentor and reduced proactive communication. Peer comparison involves 9 cases and is relatively covert in its mode of operation; on the one hand, students need peer information to assess their own standing, and on the other hand, they may avoid communication due to the rapid development of their peers, thereby reducing the academic community to a competitive reference point.

Family economic pressure and career uncertainty each have 8 cases, and more of them are among married, older, or soon-to-be doctoral students. This kind of pressure will not immediately reduce the students' writing ability; however, they will feel that their time has been wasted. Now "delay" is not only an academic term, but also refers to a loss of income, neglect of family responsibilities, late marriage or childbirth, and career stagnation. There are 7 cases of a planning gap that occur at different times during the first year of doctoral studies, before and after the project proposal. Some students do not know how difficult original research and publishing core papers are before enrolling, and only realize after entering the doctoral program that the study methods during their master's studies are not conducive to producing doctoral-level works. From the above, it can be seen that the chain of anxiety generation is cumulative: institutional requirements set the lower bound for stress, ability and planning determine the upper limit of individual tolerance, and mentor and peer relationships determine the speed of resource supply.

Separation of teachers and comparison with classmates have jointly altered the support systems for graduate students. When the mentor provides less feedback, students have to seek information from their peers; if the peers are too advanced, students are more likely to reduce contact to protect their feelings. There is a conflict in supporting the internet: Students want to communicate but are also afraid that this communication will lead to more intense comparisons. The distance among mentors in a co-occurrence network is associated with poor social functions and negative cognitions, so a lack of interaction among teachers may lead to a reduced ability of students to communicate their research difficulties. If there is no timely feedback, the methods or reasons that need to be changed may be viewed by students as a lack of ability. This mistake will reduce one's willingness to revise the paper and increase expectations of delays and employment failure.

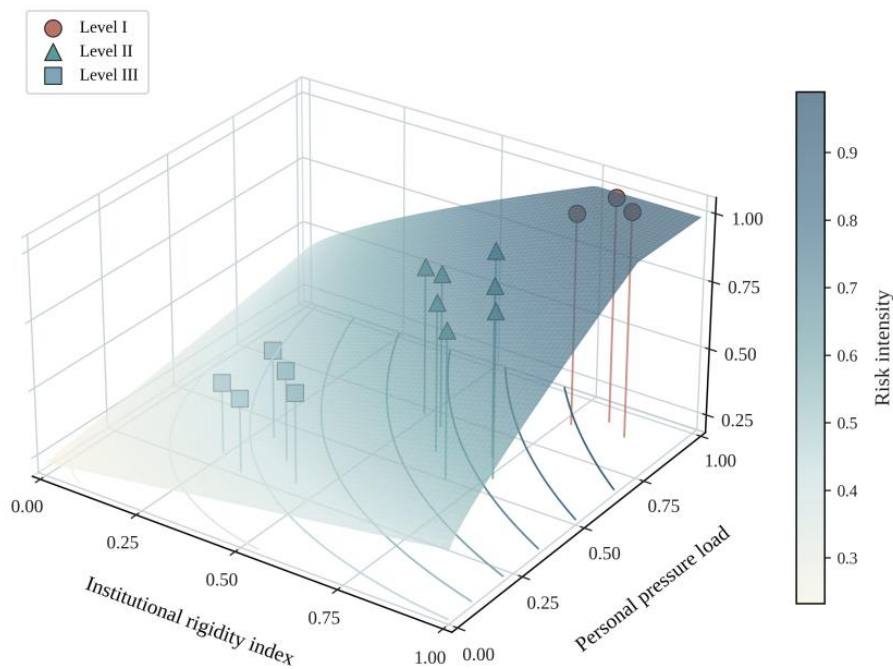


Figure 5: Three-dimensional surface of anxiety risk under institutional rigidity and individual stress load.

As shown in Figure 5, the risk surface is relatively high in the area at the back and on the right side, and the Level I cases are concentrated there. The contour lines at the bottom of the surface show that as long as one of the institutional rigidity and individual pressure load remains high, the risk will not drop to the low-value area; when both increase simultaneously, the risk of anxiety enters a rapid-amplification zone.

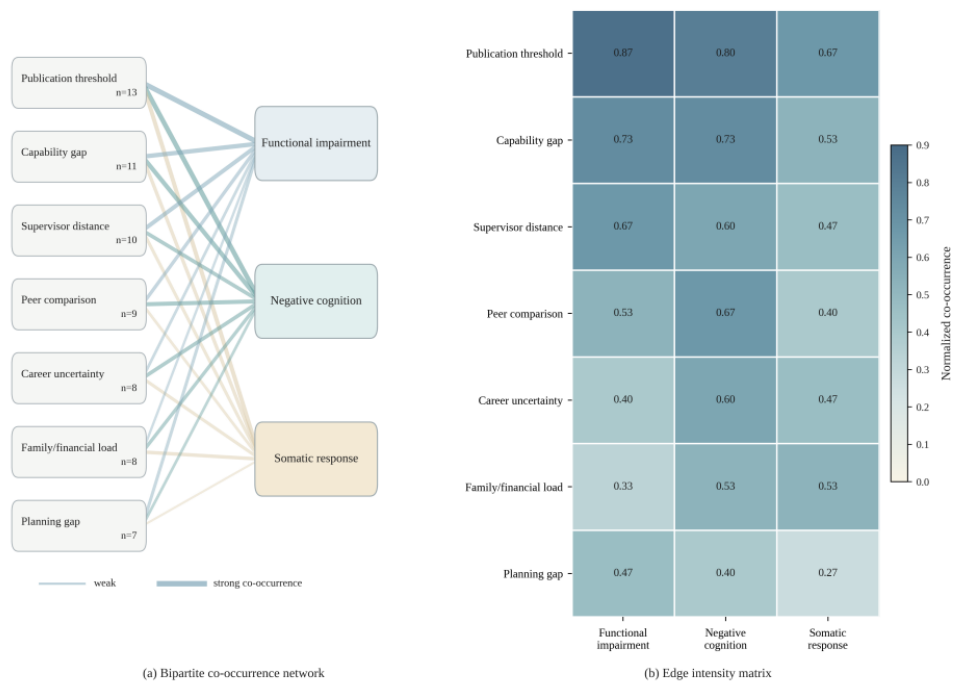


Figure 6: Co-occurring network of stressor and anxiety representation

As shown in Figure 6, the publishing threshold is in the upper left corner of the network and has multiple connections to the three types of representations; the ability gap and mentor distance are in the middle of the network and connect stressors and anxiety outcomes. A thick line indicates a relatively high degree of co-occurrence and is thus more likely to occur together in the same case. The network structure supports the explanation in this paper that 'institutional pressure is turned into anxiety representations by ability and relational resources'.

3.3 Module Ablation, Efficiency Analysis, Sources of Error, and Implications for Deployment

The first two parts have explained the traits and causes of anxiety, and this part will also cover when to use relief strategies. Stress relief by doctoral students should not be based on self-endurance alone, nor should it be solely the fault of the training unit. Figure 7 shows the changes in stress trajectory, mentor exposure and resource recovery from the learning stage; Figure 8 shows the size of risk reduction under the combined effect of institutional support strength and individual resilience strength; and Table 3 provides the responsibility interface that can be turned into training practice.

Figure 7 shows that the anxiety load gradually increases from 0.38 in the enrollment stage to 0.78 in the paper writing stage and reaches a high of 0.84 in the submission stage; at the same time, publishing pressure also rose from 0.22 to 0.90 and had a relatively steep increase. Recovery resources and mentor contacts have decreased from 0.54 and 0.62, respectively, to 0.28 and 0.38 in the course and submission periods. There is a noticeable resource compression zone during the writing and submission stage; students need the most intensive guidance and emotional support at this time, and they are also most likely to have reduced communication due to feedback on failures, waiting for peer reviews, and peer comparisons. Therefore, many people's anxiety is relatively high at the beginning of the paper and significantly lower before and after submission.

The mentor connection provides support for people in their lives. Previous studies have shown that a mentor-student relationship can affect the mental health of doctoral students [23]. Based on the materials in this paper, mentor support does not have to be frequent emotional support. At the same time, timely and specific feedback should be provided at the appropriate times to let students know whether there are any problems with the validity of the issue, whether the chosen method is suitable, whether the selected journal is reasonable, and how to respond to rejection comments. The more specific the feedback, the more likely to reduce anxiety caused by vague fears in students and allow them to feel in control. If the supervisor is absent for an extended period due to administrative work or other scientific research projects, the college should increase the frequency of guidance by utilising the supervisor group, joint meetings and outside experts.

Individual adjustment is still required, but the scope of its effect needs to be limited. Mindfulness training has been able to improve the psychological state and psychological capital of doctoral students [24], and some qualitative research has shown that peer support can reduce loneliness among these students [25]. However, according to the materials in this paper, individual adaptation is only more effective when the institutional and relational environment provides minimal support. If students are unable to know how many times they need to try again for graduation and receive no feedback, just telling them to stay positive or handle stress well will only increase their self-blame.

As shown in Figure 8, enhancing the resilience of individuals and strengthening institutional support alone will not solve the risk problem. When the intensity of institutional support is less than 0.30, even with high individual resilience of 0.80, the reduction in risk will only reach approximately 0.25-0.32; only when both institutional support and individual resilience are over

0.75 can a risk reduction of 0.52 or higher be achieved, and at that time, one will be closer to the 0.60 mark in the comprehensive support index. Therefore, it is necessary to provide institutions and academic support for psychological regulation training. If the publishing threshold for papers is not open, there will be a long-term lack of feedback from supervisors, and without training in methods, mindfulness training and time management will be unable to reduce stress independently.

Cognitive restructuring, behaviour regulation and meaning-making at the individual level need to be added to the daily training. Students can divide the stages of publishing their main papers into several sections, such as conducting a literature review, determining research questions, designing a research plan, collecting and analysing data, writing an initial version, and submitting for revision; thus, they will not feel excessive pressure from the final results of approval. At the level of training institutions, evaluation flexibility needs to be enhanced, the decisive weight given to the number of single papers for graduation qualifications should be reduced, and policy consulting reports, patents, project results, or high-quality datasets can be used as alternative results in relevant disciplines. The mentor should regularly offer feedback at various times to guide the student in completing the proposal, writing and submitting it, preparing for the defense, etc. At the level of the academic community, students can reduce the inclination to see their peers only as competitors through cross-grade reading groups, sharing of failed experiences, and anonymous peer evaluation mechanisms. Screening, referral and crisis intervention for psychological services should be included in the graduate training process to prevent intervention only after students have been severely affected by insomnia or taken a leave of absence.

Table 3 is the translation of the above strategies into responsible parties and evaluation signals. Effective relief needs to address the four interfaces of the system, ability, relationship and body simultaneously. The anxiety experienced by doctoral students cannot be addressed only in psychological counselling centres; various parts of life, such as their graduate schools, colleges, mentor groups, peer organisations and families, all play different roles in this. Only when the obstacles to publication, academic training, mentor feedback and psychological support work together can anxiety change from a continuous state of consumption to an identifiable, expressible and manageable one.

As shown in Table 3, the evaluation signal is relatively higher than the measure name. If, after implementing the relief measure, the students still cannot obtain specific modification opinions, are still unaware of the extension policy, and can only face rejection and the pressure of job searching alone, then the measure will likely remain at the formal level. At the same time, if students can divide up the work causing them anxiety into smaller steps, receive information from mentor groups or other young students' organisations, and obtain low-stress assistance at the school's mental health centre, then the anxiety will be perceived not as something "behind closed doors", but as an issue worth facing head-on.

From the perspective of governance, the lack of anxiety among doctoral students is due to their low sense of responsibility. Students believe that they are lacking in ability, supervisors believe that their stress resistance is insufficient, and the college thinks that psychological problems should be handled by the counselling centre, which is difficult to change the paper and evaluation system. According to the response surface and responsibility interface in this paper, only by reconnecting these dispersed responsibilities will the mitigation measures have a continuous effect. It will help normalise the system of governance at the college level.

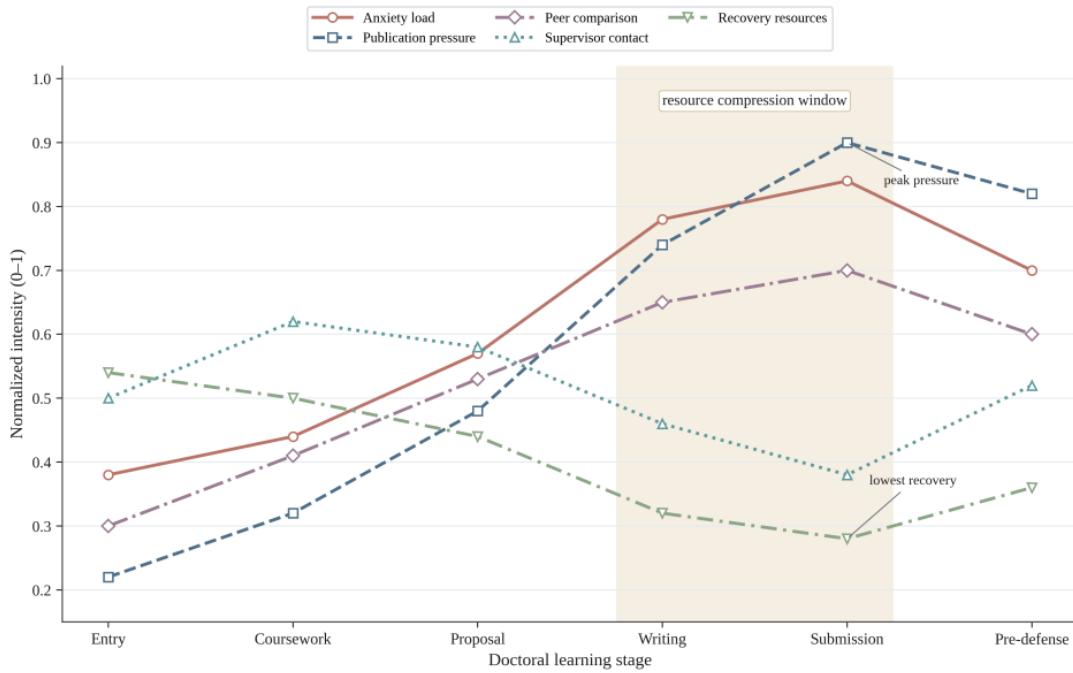


Figure 7: Stress, Exposure and Resource Recovery Trajectory during the Doctoral Learning Period

The Writing and Submission stages are identified as the areas with the highest compression in Figure 7. Anxiety load and publishing pressure are both high at this time, and simultaneously, mentor support and recovery resources decline; thus, it constitutes a situation of high demands, low feedback, and low recovery. At this time, the college, the mentor group and the psychological service system should start intervening proactively.

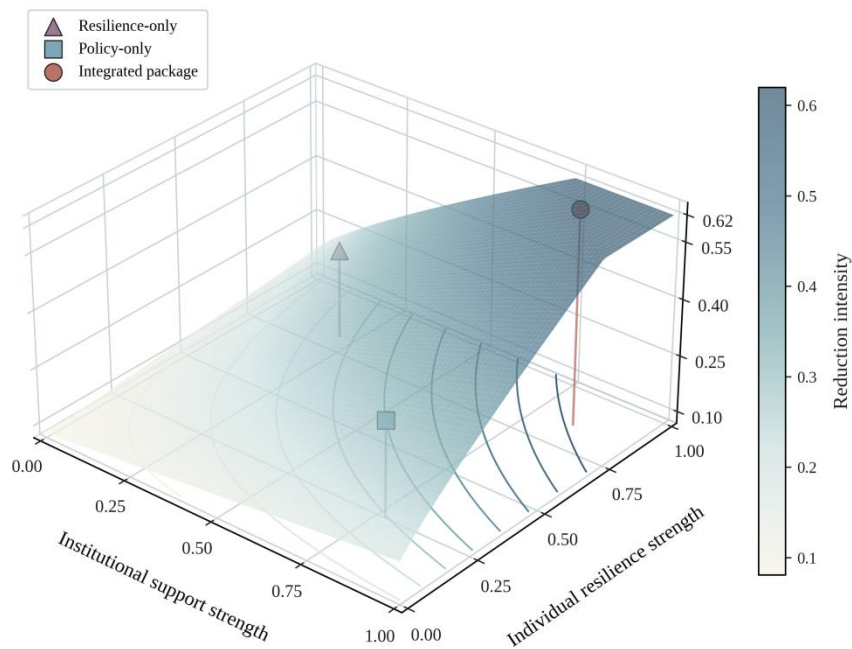


Figure 8: Risk Reduction Response Surface Under the Synergy of Institutional Support and Individual Resilience.

As shown in Figure 8, the peak of the risk-reduction response surface occurs when institutional support and individual resilience are both strengthened. Based on the region of the comprehensive support package, if transparent evaluation, stable guidance, method training and psychological resilience support can all be provided simultaneously, then the reduction in anxiety risk will be significantly higher than that of a single measure.

Table 3: Responsibility Interface and Evaluation Signals for Anxiety Relief among Doctoral Students

Alleviation Interface	Main Measures	Responsible Actors	Evaluation Signals
Personal resilience	Cognitive restructuring, phased task decomposition, exercise and sleep recovery, and active help-seeking when necessary	Doctoral students and psychological counseling centers	Recovery of learning engagement, improved sleep, and reduced avoidance behavior
Training system	Improving transparency in graduation evaluation, establishing recognition of alternative outputs, and supporting flexible study duration	Graduate school and colleges	Reduced stigma of extension, clearer appeal and review channels
Ability building	Workshops on academic writing, research methods, data analysis, and responses to manuscript review	Colleges, supervisor teams, and academic platforms	Higher draft completion rate, more effective revision cycles, and improved submission quality
Supervisory interaction	Fixed feedback at key stages, joint review by supervisor teams, and reduction of risk caused by reliance on a single supervisor	Supervisors and supervisor teams	Shorter feedback intervals and more specific problem lists
Academic community	Cross-year reading groups, sharing of failure experiences, peer review, and resource sharing	Colleges and postgraduate organizations	Increased peer support and reduced destructive comparison
Psychological services	Regular screening, risk referral, crisis intervention, and follow-up	University counseling centers and college-based student support systems	Timely identification and continuous follow-up of high-risk cases

4 Conclusion

This paper examines the theme coding and visual analysis of anxiety experiences among 15 doctoral students to build a chain of argumentation on anxiety performance, stress generation and relief pathways. The three results of the research are as follows.

(1) Firstly, doctoral students' anxiety is mainly manifested in three types of experiences: impaired social functioning, negative cognition, and somatic symptoms. Severe cases often present with learning stagnation, self denial, catastrophic expectations, and sleep disorders; Mild cases, although not severely damaging academic function, have also shown symptoms of rest shame and sleep fluctuations.

(2) Secondly, the generation of anxiety is related to the publication threshold, ability gap, mentor distance, peer comparison, family economic pressure, and career uncertainty; The publishing threshold and ability gap are most prominent in the sample, and anxiety is amplified through resource depletion.

(3) Third, the relief path needs to improve both individual resilience and institutional support. Single point psychological adjustment is insufficient to offset the pressure brought by rigid evaluation and insufficient resources. Due to limitations in sample size and cross-sectional interviews, this article is unable to evaluate the long-term effects of intervention measures. Subsequent research can expand the sample size, combine tracking data and multi school comparisons to examine the mechanisms of anxiety risk changes under different training systems, and further evaluate the actual effects of integrating mentor feedback, ability training, and psychological services.

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