MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 35 Issue 2, 2025, Pages: 1523-1528

Impact of Generative AI on Psychological Well-Being in Computer Engineering Education: A Study of Depression, Anxiety, and Stress Among Female B.Tech (Bachelor of Technology) Students

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Abstract - Advancements in generative artificial intelligence (AI) have transformed the landscape of computer engineering, raising questions about skill relevance and employment stability for emerging professionals. This interdisciplinary investigation examines the occurrence and contributing factors to common psychological issues—namely depression, anxiety, and stress—among female students pursuing B.Tech in Computer Science and Engineering in Ernakulam, Kerala. Drawing on a mixed-methods approach, the study highlights how fears of AI-induced job displacement, often called "AI anxiety," intersect with socioeconomic elements to influence mental health. Data from 150 participants indicate moderate levels of these conditions, with significant links to family income, household structure, and AI-related concerns. Qualitative insights reveal additional pressures from academics, social media, and interpersonal dynamics. The findings advocate for curriculum adjustments in engineering programs to address these stressors, promoting resilience and adaptive skills in an AI-dominated field. This work bridges computer engineering with psychosocial research, offering implications for educational policy and student support systems.

Keywords- AI anxiety, mental health, computer engineering students, depression, anxiety, stress, generative AI

1.Introduction

The swift evolution of artificial intelligence, especially generative models such as large language models, has reshaped educational and professional domains in computer engineering. While these technologies promise efficiency and innovation, they also introduce uncertainties, including potential automation of tasks traditionally handled by human engineers. This has led to heightened worries among students about their future roles in the industry, a concept increasingly recognized as "AI anxiety." Such concerns are particularly acute for female undergraduates in computer science and engineering, who may face compounded challenges from societal expectations and gender-specific pressures.

Mental health challenges like depression, anxiety, and stress are on the rise in higher education, with engineering students experiencing unique strains due to rigorous technical demands. Depression, in this context, refers to a persistent state of low mood accompanied by functional impairments, beyond mere transient sadness. This research focuses on female B.Tech (Bachelor of Technology) students in the software engineering track in Ernakulam, exploring how AI-driven disruptions contribute to these issues alongside other psychosocial elements.

The objectives include evaluating the extent of depression, anxiety, and stress; examining differences based on socioeconomic backgrounds; and identifying key influencing factors, with emphasis on AI-related fears of job loss and skill redundancy.

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2. Literature Review

The mental health of college students has garnered increasing attention, particularly as technological advancements introduce novel stressors. Studies globally indicate a rising prevalence of psychological distress, including depression, anxiety, and stress, among higher education students, with female students often facing unique pressures from academic, social, and personal domains [3, 8]. In India, research on engineering students has reported significant mental health challenges. For instance, a study in Pune using the PHQ-9 questionnaire found that 70.9% of 110 engineering students experienced depression, with 48.2% reporting mild and 22.7% moderate symptoms [3]. Predictors included interpersonal conflicts (3.1 times higher likelihood of depression) and lack of economic support (2.5 times greater odds) [3]. Similarly, a study in Bangalore noted 78.7% of students away from home experiencing depression, while a multi-state analysis across nine Indian states reported 33.6% with moderate-to-severe depression [3, 8]. Among Computer Science and Engineering students in Manipal, academic pressure was a significant correlate of depression [8].

The rapid rise of generative artificial intelligence (AI) has introduced "technostress" and "AI anxiety," particularly among students and professionals in technical fields. These terms describe emotional strain from interacting with AI systems and fears of job displacement due to automation [4, 5]. A study of 62 software professionals highlighted frustration from AI tools like large language models (LLMs) when they produced incorrect outputs or failed to meet expectations, contributing to stress and potential burnout [4]. Research on information science students and professionals found that older individuals and those with lower educational attainment reported higher AI anxiety, suggesting that educational interventions could mitigate these fears [5]. In developing contexts like India, where engineering is often a pathway to socioeconomic mobility, AI-driven disruptions amplify concerns about skill obsolescence [6].

Socioeconomic factors significantly influence mental health outcomes. A meta-analysis confirmed that low income and financial strain increase the risk of depression and stress, as these conditions heighten familial expectations for academic success [9]. Family structure also plays a role, with only children experiencing greater loneliness and pressure due to concentrated parental expectations, particularly when parental relationships are strained [10]. Additionally, low mental health literacy among families in Kerala creates barriers to help-seeking, with stigma and negative attitudes toward mental illness prevalent among young adults [13]. Digital stressors, such as excessive social media use, further exacerbate mental health issues by fostering unhealthy comparisons and unrealistic standards, leading to feelings of inadequacy, especially among young women [11].

This review synthesizes these findings, positioning AI anxiety as a critical, emerging stressor in computer engineering education, compounded by socioeconomic and familial factors.

3. Methodology

The present study adopted a sequential explanatory mixed-methods design to investigate the prevalence and underlying contributing social factors of common mental disorders (CMDs) such as depression, anxiety, and stress among 150 female B.Tech Computer Science and Engineering students from Ernakulam, selected via purposive sampling across academic years. City. This two-phase approach allowed for triangulation of data—statistical trends from the survey were contextualized through personal narratives.

Quantitative data were gathered using standardized scales for depression, anxiety, and stress (DAS - 42), with questionnaire on socio-demographic details included family structure, residence, parental occupation, and income alongside questions on AI anxieties.

Statistical analyses employed descriptive metrics (means, standard deviations), chi-square tests for associations, and Pearson correlations for relationships between variables. Qualitative data from in-depth interviews with a subset of participants were thematically analyzed to uncover underlying themes.

Ethical standards were upheld, with informed consent obtained and anonymity ensured, in line with international guidelines. This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki (World Medical Association, 2013) (14). Informed consent was obtained from all individual participants before their inclusion in the study. Each participant was provided with a clear explanation of the study's purpose, procedures, voluntary nature of participation, confidentiality measures, and their right to withdraw at any time without penalty.

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4.Results

4.1 Participant Demographics

The cohort comprised 150 female undergraduate (Bachelor of Technology) students, with distribution across academic years as follows: 25.3% (n=38) in the first year, 36.0% (n=54) in the second year, and 38.7% (n=58) in the third year. Regarding family structure, 17.3% (n=26) were from single-child households, while 82.7% (n=124) had multiple children. Residential locality was balanced, with 54.0% (n=81) from urban areas and 46.0% (n=69) from rural areas. Parental occupations were evenly distributed: 34.0% (n=51) in government roles, 33.3% (n=50) in the private sector, and 32.7% (n=49) in agriculture or other fields. Monthly family income varied, with 21.3% (n=32) below ₹10,000, 37.3% (n=56) between ₹10,000–₹25,000, and 41.3% (n=62) above ₹25,000.

4.2 Mental Health Metrics

Descriptive statistics for depression revealed a mean score of 8.80 (SE = 0.36, SD = 4.41), indicative of moderate depressive symptoms. The 95% confidence interval was 8.09 to 9.51, with a median of 8.00 and a 5% trimmed mean of 8.64, suggesting minimal outlier influence. Scores ranged from 1 to 20, with an interquartile range of 7.00. The distribution showed mild positive skewness (0.48, SE = 0.20) and platykurtic kurtosis (-0.44, SE = 0.39), implying a relatively normal spread with fewer extremes.

For anxiety, the mean was 8.29 (SE = 0.40, SD = 4.86), reflecting moderate levels. The 95% confidence interval ranged from 7.51 to 9.08, with a median of 8.00 and a trimmed mean of 8.21. Scores varied from 0 to 18, interquartile range 7.25, with slight positive skewness (0.30, SE = 0.20) and negative kurtosis (-0.72, SE = 0.39), indicating a flatter distribution.

Stress scores had the highest mean at 9.59 (SE = 0.47, SD = 5.73). The 95% confidence interval was 8.66 to 10.51, median 9.50, trimmed mean 9.46. Scores ranged from 0 to 24, interquartile range 9.00, with mild positive skewness (0.22, SE = 0.20) and platykurtic kurtosis (-0.76, SE = 0.39), suggesting pronounced variability.

Prevalence rates were calculated as follows: depression symptoms in 34.0% (n=51), anxiety in 31.3% (n=47), and stress in 42.7% (n=64). These rates align with broader studies showing significant mental health burdens among students, with stress being the most prevalent.

4.3 Associations with Demographics

Chi-square tests assessed associations between mental health outcomes and demographic variables. No significant association was found between residential locality (urban vs. rural) and depression ($\chi^2 = 0.72$, df=1, p=0.395), anxiety ($\chi^2 = 0.05$, df=1, p=0.827), or stress ($\chi^2 = 0.03$, df=1, p=0.853). Similarly, parental occupation (agriculture/other, government, private) showed no significant links: depression ($\chi^2 = 3.34$, df=2, p=0.188), anxiety ($\chi^2 = 1.06$, df=2, p=0.588), stress ($\chi^2 = 0.08$, df=2, p=0.959).

However, family income demonstrated significant associations with depression ($\chi^2 = 8.72$, df=2, p=0.013) and stress ($\chi^2 = 9.31$, df=2, p=0.009), with higher symptoms in lower income brackets (e.g., 53.1% of those below ₹10,000 reported depression symptoms compared to 25.8% above ₹25,000). Anxiety showed no significance ($\chi^2 = 0.94$, df=2, p=0.625).

Table 1: Association between family type and mental health status

Mental Health Variable	Type of Family	No	Yes	Chi-square Value	p-value	Significance
Depression	More than one child	90	34			
	Single child	9	17	6.248	0.012	Significant
	Total	99	51			
Anxiety	More than one child	85	39			
	Single child	8	18	7.892	0.005	Significant
	Total	93	57			
Stress	More than one child	73	51			
	Single child	13	13	0.691	0.406	Not Significant
	Total	86	64			

Family type (single-child vs. multi-child) was significantly associated with depression ($\chi^2 = 6.25$, df=1, p=0.012) and anxiety ($\chi^2 = 7.89$, df=1, p=0.005), with single-child participants showing higher rates (65.4% for depression, 69.2% for anxiety), but not stress ($\chi^2 = 0.69$, df=1, p=0.406).

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Being an only child can intensify these parental pressures, as there are no siblings to share the emotional burden or familial expectations. The unique demands placed on a single child was accurately captured in one respondent's experience: *"Both my parents are employed, and we have a very smooth and healthy bond. Yet, I feel lonely and misunderstood. I am an only child, and they wanted me to be a doctor. When I joined for B.tech degree, needless to say, they were very disappointed at first. They often mention this in front of relatives, which makes me feel ashamed. I can't share my depressive thoughts with them; they clearly don't understand the concept of mental health*." In short, when all of a family's hopes rest on one child, it can become an incredibly lonely and heavy burden to carry. This pressure to meet those expectations often leads to shame and seclusion, making it much harder for the student to ask for help.

4.4 AI Anxiety Correlations

Table 2: Correlation between Mental Health and AI-Related Career Anxiety Among Female Engineering Students

Variable	1	2	3	4	5
1. Depression	-				
2. Anxiety	0.78**	-			
3. Stress	0.72**	0.75**	-		
4. Fear of AI Layoffs	0.52**	0.48**	0.51**	-	
5. AI Anxiety	0.49**	0.53**	0.47**	0.68**	-

Pearson correlations indicated strong positive interrelationships among depression, anxiety, and stress: depression-anxiety ($r=0.78$, $p<0.001$), depression-stress ($r=0.72$, $p<0.001$), anxiety-stress ($r=0.75$, $p<0.001$). Moderate positive correlations linked these to fear of AI layoffs: depression ($r=0.52$, $p<0.001$), anxiety ($r=0.48$, $p<0.001$), stress ($r=0.50$, $p<0.001$). Similarly for general AI anxiety: depression ($r=0.49$, $p<0.001$), anxiety ($r=0.53$, $p<0.001$), stress ($r=0.47$, $p<0.001$). The two AI variables were highly correlated ($r=0.68$, $p<0.001$), suggesting a cohesive construct of technological insecurity.

4.5 Parental Knowledge

Among symptomatic students, parental awareness was low: 1/51 (1.96%) for depression, 3/47 (6.38%) for anxiety, and 0/64 (0%) for stress, highlighting a significant literacy gap.

Table 3: Parental Awareness of Mental Health Issues Among Students with Depression, Anxiety, and Stress.

Conditi	Prevale e among pondents	Percent (%)	Pare s with ental ealth eracy (n)	Pare s with ental ealth eracy (%)
Depress	51	34%	1	~2%
Anxiety	47	31.3%	3	~6.4
Stress	64	42.7%	0	0%

The above table highlights a profound and critical gap in parental awareness, which likely contributes to stigma, a lack of support, and underreporting of mental health issues among students. The findings show that among 51 students who exhibited depressive scores in DAS, only 1 respondent had parents who understood depression as a clinical health issue. Similarly, only 3 respondents among 47 students with anxiety had parents who understood the concept of Common Mental Disorders (CMDs) and none of the 64 students identified with stress symptomatology had parents who understood the concept of Common Mental Disorders.

Very few parents understood common mental disorders as real clinical issues. This is a serious problem that requires urgent attention from both policymakers and healthcare providers. Studies have found that, despite relatively high literacy and good public health systems, young adults in Kerala frequently reported negative attitudes and significant stigma towards mental illness as major barriers to seeking help. The fear is deeply rooted in fear of social judgement within their families and communities (13).

4.6 Qualitative Themes

Thematic analysis identified key domains: academics (performance anxiety, e.g., "Fear of failure under parental expectations"), digital stressors (social media burnout, e.g., "Instagram comparisons cause inadequacy"), self/body image (low esteem, e.g., "Weight jokes erode confidence"), AI-related anxiety (job fears, e.g., "ChatGPT makes my coding obsolete"), family relationships (discord, e.g., "Parental fights drain me"), and romantic/peer influences (breakups, e.g., "Feeling invisible in class"). Academic and AI themes were most frequent, underscoring technology's role in contemporary distress. This indicates that while interpersonal and identity-based struggles remain

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relevant, contemporary engineering students are increasingly distressed by future-oriented, technology-mediated fears—particularly the perceived threat of AI rendering their skills and careers obsolete. This pattern underscores a shift in student mental health concerns from traditional psychosocial stressors toward existential and economic anxieties rooted in technological disruption.

5. Discussion

The findings illuminate the multifaceted psychological challenges faced by female computer engineering students in an era of rapid AI advancement. Moderate levels of depression (mean=8.80), anxiety (mean=8.29), and stress (mean=9.59) were observed, with prevalence rates of 34.0%, 31.3%, and 42.7% respectively—these align with national trends in India, where studies report 33.6%-78.7% depression among students, often linked to academic and economic pressures [3, 8]. The strong intercorrelations among these conditions ($r=0.72$-0.78, $p<0.001$) suggest they form a syndemic cluster, consistent with literature on common mental disorders where one symptom exacerbates others, potentially leading to burnout [4].

Notably, AI anxiety emerged as a significant contributor, with moderate correlations to all mental health dimensions ($r=0.47$-0.53, $p<0.001$). This "technostress" reflects fears of job displacement in software engineering, where generative AI like LLMs automate coding tasks, eroding perceived skill value. Qualitative narratives, such as "What if AI takes all the jobs? I feel guilty and terrified," echo recent global concerns; for instance, research indicates AI interactions cause frustration and burnout among professionals, with demographic factors like education level influencing anxiety [4, 5]. In India, where engineering symbolizes mobility, these fears are amplified by familial investments, as seen in lower-income groups showing higher depression and stress ($p=0.013$ and $p=0.009$). This socioeconomic link corroborates meta-analyses linking poverty to elevated mental risks (odds ratios up to 2.5) due to financial strain and expectations [9]. Rather than leaving students to navigate these anxieties in isolation—often through sensationalized media headlines or fragmented online discourse—engineering programs must proactively equip them with a nuanced understanding of AI's capabilities, limitations, and evolving role in the workforce. Such modules should go beyond technical training in prompt engineering or AI tool usage; Curriculum should also encourage students to think critically about how AI affects jobs and society, learn from past examples of how new technologies changed work, and explore future careers where human skills—like judgment, ethics, creativity, and emotional intelligence—still matter and cannot be replaced by AI. Equally important is the cultivation of career resilience—the capacity to adapt, re-skill, and maintain self-efficacy amid uncertainty. This can be accomplished through scenario-based workshops, industry mentorship programs, and reflective exercises that help students reframe AI not as a threat to their identity but as a collaborator in a redefined professional landscape. By embedding these components into the curriculum, institutions can change anxiety into agency, empowering students to see themselves not as obsolete labor but as adaptive, future-ready professionals.It was also found family type further modulates vulnerability, with single-child status associated with higher depression and anxiety ($p=0.012$ and $p=0.005$), likely from concentrated pressure and loneliness, as supported by studies on only children [10]. The absence of sibling support may intensify isolation, especially amid parental discord themes. Digital stressors, including social media, compound this, fostering comparisons that align with evidence of temporal links between platform use and depression. Social media apps like Instagram, which constantly showcase perfected images and idealized lifestyles, can negatively impact a young woman's self-perception. By promoting often unrealistic standards of beauty and success, they can lead to feelings of inadequacy, comparison, and a distorted sense of self-worth.

Parental awareness gaps (0-6.4%) perpetuate stigma, mirroring Kerala's high literacy yet persistent mental health barriers. While demographics like residence and occupation showed no associations ($p>0.05$), this suggests contextual factors like AI and income dominate over structural ones in this cohort.

Broader implications draw from 2024-2025 research: AI can exacerbate mental health via digital fatigue and reduced interactions but also mitigate it through personalized support [4, 6]. For engineering students, over-reliance on AI tools risks accuracy issues and dependency, heightening anxiety [5]. However, positive applications—like AI for early detection or resilience training—could transform curricula [4, 6]. Institutions must integrate AI literacy to reframe threats as opportunities, reducing technostress. This study highlights the need for targeted interventions, such as workshops addressing AI biases and ethical use, to foster agency amid uncertainty. Limitations include the cross-sectional design, limiting causality, and focus on one region/gender, suggesting generalizability needs further exploration. Future longitudinal studies could track AI's evolving impact.

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6.Conclusions

In conclusion, this study underscores the substantial psychological toll of generative AI on female computer engineering students, manifesting as elevated depression, anxiety, and stress linked to fears of professional obsolescence. Significant associations with socioeconomic factors and AI concerns ($p<0.001$ for correlations) emphasize the urgency of addressing "AI anxiety" in educational frameworks. By embedding AI education, mental health support, and resilience-building into curricula, institutions can empower students to navigate technological disruptions adaptively. Policymakers should prioritize parental awareness programs and accessible counseling in Kerala, where stigma persists despite literacy. Ultimately, while AI poses risks like job uncertainty and digital strain, its potential for personalized mental health tools offers a pathway to mitigate these challenges, fostering a balanced, future-ready workforce in computer engineering. Thus the findings of the study highlight a serious need to improve mental health resources for college students in Kerala. Early intervention and tailored support systems to combat rising rates of psychological distress and depression are needed. A comprehensive strategy to support student mental health should begin with the appointment of a dedicated counsellor possessing an MSW or MSc Psychology qualification, providing a professional foundation for care. To ensure students feel safe, the environment must actively encourage them to express their worries freely and without judgment. Furthermore, conducting compulsory workshops for both students and parents on a bi-annual basis can help change negative attitudes about mental health and build a shared understanding.

7.Funding

No external funding was received.

8.Competing Interests

None declared.

9.References

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