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PSYCHOMETRIC VALIDATION AND CULTURAL ADAPTATION OF INSTRUMENTS FOR THE DETECTION OF DEPRESSION, ANXIETY, AND STRESS IN UNIVERSITY STUDENTS OF SYSTEMS ENGINEERING

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Abstract
Mental health among university students is a growing global concern, intensified by the COVID-19 pandemic, which has caused a significant increase in anxiety, depression, and stress, affecting well-being and academic performance. This context highlights the need for reliable psychometric tools for early detection, emphasizing the DASS-21 Scale and the PHQ-9, both culturally adapted and validated in various Latin American countries. The study includes a quantitative and qualitative analysis of the validity, reliability, and adaptations of these instruments in health sciences students in Mexico, Colombia, and Chile, confirming their effectiveness for assessing negative emotional symptoms. Additionally, it reviews institutional and pedagogical interventions implemented post-pandemic, covering promotion, prevention, clinical care, and educational adjustments to improve mental health at universities. Although universities have advanced in both in-person and digital psychological services, limitations remain in resources, coverage, and teacher training. The importance of comprehensive, multidisciplinary, and culturally sensitive programs involving the entire university community and social actors to address these issues is emphasized. In conclusion, the ongoing validation of instruments such as DASS-21 and PHQ-9 is crucial for the effective detection of emotional disorders. It is recommended to strengthen psychological resources, promote mental health training for faculty and staff, and consolidate the structural integration of emotional well-being in higher education to favor comprehensive student development and overcome barriers such as stigma and institutional unpreparedness.
Keywords: Mental health, DASS-21, PHQ-9, Depression, University students.

INTRODUCTION

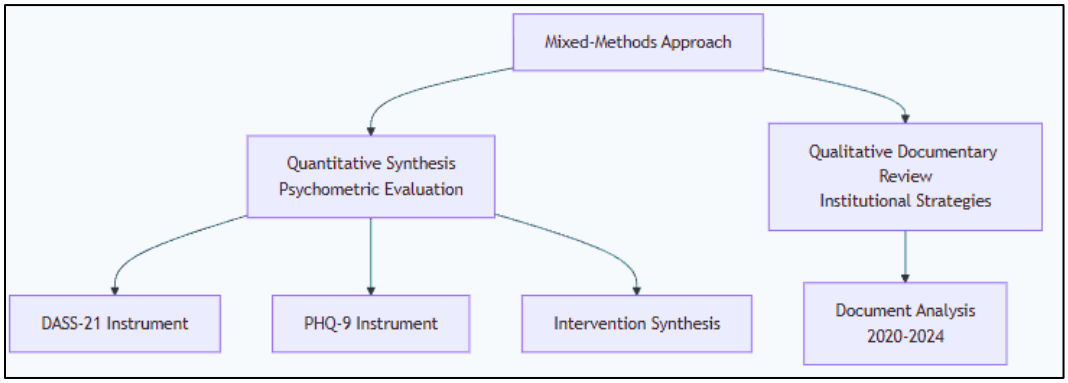
The mental health of university students is a growing global concern, which has been sharply exacerbated by the COVID-19 pandemic (Martínez et al., 2021; Mac-Ginty et al., 2021). The university stage is a critical period marked by significant life transitions including completing education, entering the workforce, and forming social relationships (INJUV, 2013). During this time, many students face heightened emotional sensitivity to stress, increasing the risk of anxiety and depression (Fox et al., 2010). The pandemic's confinement measures, academic challenges, and shifts to online learning have significantly raised levels of anxiety, depression, and stress among students (Cao et al., 2020; Odriozola-González et al., 2020; Sahu, 2020; Tufiño & Acevedo, 2024; Mayo Parra et al., 2024). For example, in Spain, nearly 50% of students reported symptoms of depression and anxiety post-pandemic, with many contemplating suicide, while in Ecuador, 85% of medical students experienced mild emotional disorders and 61% reported anxiety or panic attacks (Tufiño & Acevedo, 2024). Across Latin America, these mental health challenges have profound psychosocial impacts (Mayo Parra et al., 2024). Given this context, there is an urgent need for validated, reliable tools to enable early detection of symptoms and timely intervention within university settings (Zapata-Ospina et al., 2021). Prior to COVID-19, mental health disorders—especially depression, anxiety, and suicide—were already significant causes of disability in the Americas (World Health Organization, 2020). It is estimated that up to 20% of university students suffer from mental health issues including anxiety, mood disorders, and substance use (Auerbach et al., 2016; Gastelú Soto & Hurtado Deudor, 2022). Universities have responded by implementing support strategies addressing students' psychosocial vulnerabilities. Early symptom detection is critical not only for individual well-being but also due to its impact on academic achievement and overall development (Salinas-Muñoz et al., 2024; Cassiani-Miranda

et al., 2018). Reliable psychometric instruments, such as the Depression, Anxiety, and Stress Scale (DASS-21) (Salinas-Muñoz et al., 2024), have emerged for simultaneous assessment of these negative emotional states. Although originally developed by Lovibond & Lovibond (1995), the abbreviated form has shown adequate psychometric properties in diverse populations, including Latin American university students in the U.S. (Daza et al., 2002) and Spain (Román et al., 2014), as well as during the COVID-19 lockdown in Mexico (Salinas-Rodríguez et al., 2023). However, validation studies in specific groups, such as health sciences students in Mexico, remain scarce (Salinas-Muñoz et al., 2024). Similarly, the Patient Health Questionnaire (PHQ-9), derived from PRIME-MD, is a brief, effective tool for depression screening in clinical and community settings (Kroenke, Spitzer, & Williams, 2001; Cassiani-Miranda et al., 2018). Cultural and linguistic adaptation is essential to ensure its accuracy in diverse Spanish-speaking populations (Calderón et al., 2012). This article aims to synthesize and analyze evidence on the psychometric properties of DASS-21 and PHQ-9, alongside reviewing institutional intervention strategies designed to improve university students' mental health, particularly within health sciences contexts and the challenges posed by the pandemic. Additionally, it discusses post-pandemic institutional strategies and educational narratives addressing this growing mental health challenge.

METHODOLOGY

This study integrates a mixed-methods approach, combining a synthesis of quantitative, cross-sectional, and descriptive research focused on the psychometric evaluation of mental health instruments, alongside a qualitative documentary review of strategies and institutional discourses concerning university mental health in the post-pandemic context, Figure 1.

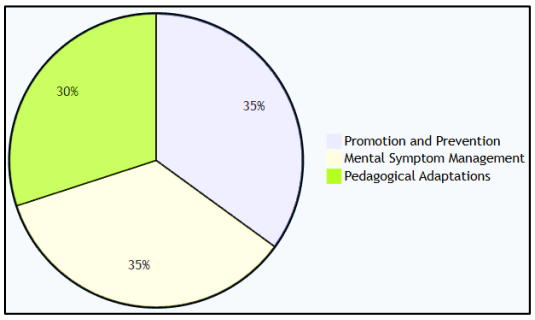
Figure 1. Flowchart of the Integrated Mixed-Methods Approach



Source: Author's own elaboration.

For the psychometric evaluation of the Depression Anxiety Stress Scale (DASS-21), we analyzed data from a sample of 135 health sciences students in Veracruz, Mexico. The instrument, comprising three subscales—depression, anxiety, and stress—was administered and evaluated using exploratory and confirmatory factor analyses, structural equation modeling, and multiple reliability indices (Salinas-Muñoz et al., 2024; Lovibond & Lovibond, 1995). Additionally, cutoff points relevant to youth populations in Chile were incorporated through receiver operating characteristic (ROC) curve analyses (Román et al., 2016). Regarding the Patient Health Questionnaire (PHQ-9), a cross-sectional study with students from Cartagena, Colombia, was included. This investigation assessed face validity using the Content Validity Ratio (CVR) and performed idiomatic adjustments informed by expert consultations and focus groups to ensure cultural relevance and linguistic clarity (Cassiani-Miranda et al., 2018). Further, criterion validity was evaluated by contrasting PHQ-9 outcomes with those of the Mini-International Neuropsychiatric Interview among primary care users in Bucaramanga, Colombia (Cassiani-Miranda et al., 2021). To examine mental health interventions, a systematic review synthesis was carried out by Zapata-Ospina et al. (2021), encompassing 12 scientific articles and 11 web-based resources identified through extensive searches in databases including PubMed, EMBASE, and BIREME, without restrictions on language or publication date. Inclusion criteria emphasized actionable measures targeting mental health promotion, symptom prevention, and adaptive pedagogical strategies tailored for university students. This synthesis organized findings into three primary categories: (1) promotion and prevention, (2) mental symptom management, and (3) pedagogical adaptations (Zapata-Ospina et al., 2021), Figure 2.

Figure 2. Synthesis Framework for Student Mental Health Interventions.



Source: Author's own elaboration.

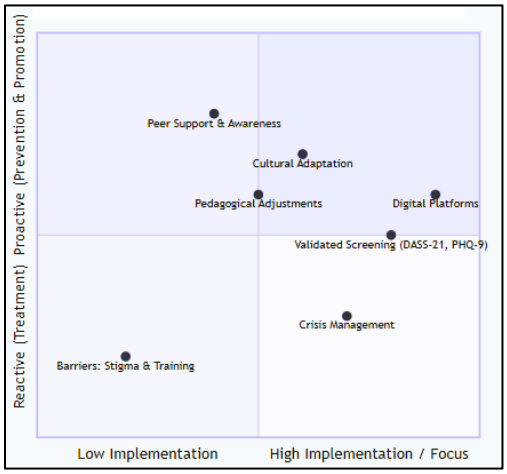
Concurrently, the qualitative documentary review involved a systematic search of literature, reports, and institutional documents published between 2020 and 2024 in databases such as Scopus, Scielo, PubMed, and Google Scholar. Search terms targeted university mental health, institutional strategies, and post-pandemic emotional well-being (Cevallos Terán et al., 2025). Selected documents underwent critical appraisal and thematic categorization into institutional strategies, educational discourses, and emerging challenges or opportunities. Triangulation of data sources enhanced the robustness and validity of the analysis. This comprehensive approach integrates psychometric assessment with contextual institutional insights, facilitating a multidimensional understanding of university mental health challenges and responses in the aftermath of the COVID-19 pandemic.

Comparative Analysis

The study by Salinas-Muñoz et al. (2024) in health sciences students in Veracruz, Mexico, confirmed that the DASS-21 is a reliable instrument with robust internal and criterion validity. Confirmatory factor analysis supported a clear three-factor structure (depression, anxiety, and stress) explaining 59.9% of the variance, with factor loadings exceeding 0.30 and outstanding fit indices in the structural equation model (CMIN/DF = 1.868; CFI = 1.00; RMSEA = 0.000; TLI = 1.02; NFI = 0.98; PNFI = 0.86; RFI = 0.98; IFI = 1.02; RNI = 1.02; SRMR = 0.050; GFI = 0.992) (Salinas-Muñoz et al., 2024). Reliability estimates, through Cronbach's alpha and McDonald's omega, significantly exceeded the 0.70 threshold for each subscale (Depression: ω=0.904, α=0.903; Anxiety: ω=0.879, α=0.872; Stress: ω=0.839, α=0.830), confirming strong internal consistency consistent with previous validations in Chile (Román et al., 2014) and Portugal. In Chile, Román et al. (2016) established sensitive and specific cutoff points for the DASS-21 among youth aged 15 to 24 years, validating its screening utility. Additional research from Mexico and Peru displayed variations in the factorial structure and proposed item reductions, underscoring the importance of culturally tailored adaptations (Salinas-Rodríguez et al., 2023; Arntz et al., 2022). Conversely, the PHQ-9 demonstrated adequate face validity and cultural adaptation with health sciences students in Cartagena, Colombia, achieved through a rigorous process of expert judgment and idiomatic adjustments—such as replacing "Deprimido" (Depressed) with "Triste" (Sad) and reformulating sleep and appetite items—to ensure clarity and relevance in the Spanish-speaking context (Cassiani-Miranda et al., 2018; Calderón et al., 2012). The Colombian primary care validation reported excellent diagnostic performance with sensitivity and specificity at a cutoff of ≥7, high internal reliability, and convergent validity with other measures (Cassiani-Miranda et al., 2021). It is noteworthy that stigma may bias responses, and optimal cutoff scores could vary by socioeconomic factors (Campo-Arias et al., 2014). Mental health challenges among university students have intensified amid the COVID-19 pandemic, with a pronounced impact on female students and notable prevalence rates in Chile (Román et al., 2016; Álamo et al., 2020; Gastelú Soto & Hurtado Deudor, 2022). Addressing this, structured, multidisciplinary, and culturally sensitive interventions have been advocated. These programs focus on promotion and prevention (digital psychoeducation, peer support, social spaces, routine screenings), symptom management (consulting centers, crisis protocols), and pedagogical adjustments (clear communication, tutoring, flexibility in content and evaluation) (Zapata-Ospina et al., 2021; Ibáñez-Vizoso et al., 2020; Jowsey et al., 2020; Sahu, 2020; Rastegar Kazerooni et al., 2020; Furst et al., 2020). At the institutional level, universities have diversified psychological services and strengthened digital platforms to maintain access during social distancing, exemplified by initiatives such as "Salud Mental UNAM" and mindfulness workshops at the UBA (Cevallos Terán et al., 2025). They have also promoted mental health awareness days and personalized tutoring, despite ongoing challenges in resource availability and staff specialization, especially within large public institutions (Cedeño et al., 2025). Educational discourse has gradually prioritized emotional well-being by incorporating self-care promotion, resilience-building, and socio-emotional skill development into curricula and encouraging student-led initiatives for destigmatization and flexible pedagogical practices sensitive to emotional needs (Zapata-Ospina et al., 2021; PUCP, 2023). Nevertheless, this integration remains incipient, hindered by limited awareness and insufficient teacher training to adequately support mental health within educational environments (Cevallos Terán et al., 2025). In

summary, as illustrated in the visual summary of key themes, Figure 3, the effective support of university student mental health rests on three interconnected pillars: the use of validated screening tools for early identification, the implementation of proactive and reactive institutional interventions, and the crucial cultural and pedagogical adaptations to ensure their relevance. The analysis confirms that instruments like the DASS-21 and PHQ-9 are fundamental to the first pillar, providing reliable data to inform the others. While universities have made progress in diversifying services and promoting well-being—moving towards more proactive promotion—significant barriers related to resources, stigma, and training persist, hindering the full implementation of a comprehensive support system (Salinas-Muñoz et al., 2024; Cassiani-Miranda et al., 2021; Cevallos Terán et al., 2025).

Figure 3. Conceptual Mapping of Strategies and Barriers in University Student Mental Health.



Source: Author's own elaboration.

CONCLUSIONS

The analyzed studies confirm that the DASS-21 Scale is a valid and reliable instrument to evaluate depression, anxiety, and stress states in health sciences university students in Mexico, corroborating its three-dimensional structure and demonstrating robust psychometric properties such as high internal consistency and criterion validity, making it useful for both epidemiological studies and the implementation of comprehensive university health programs (Salinas-Muñoz et al., 2024). Complementarily, the face validation of the PHQ-9 highlights the crucial importance of cultural and linguistic adaptation of instruments for their proper application in specific populations (Cassiani-Miranda et al., 2018). Mental health among university students has emerged as an unavoidable priority, especially in crisis contexts like pandemics, where universities have responded with significant advances, including the implementation of online psychological support services and the creation of educational spaces centered on emotional well-being (Cevallos Terán et al., 2025). These initiatives have enabled a faster and more accessible response to student needs, although they face important limitations due to insufficient resources and specialized personnel (Cedeño et al., 2025). The progressive integration of mental health into educational discourses reflects greater awareness of its impact on academic performance and student quality of life (Zapata-Ospina et al., 2021). However, implementation is still uneven and lacks, in many institutions, a systematic approach that contemplates its full inclusion in curricula and university life (Cevallos Terán et al., 2025). Challenges also persist, such as stigma toward emotional health and the lack of adequate teacher training to recognize and address these needs (Cevallos Terán et al., 2025). Therefore, it is essential that universities develop comprehensive and structured programs covering promotion, prevention, and mental symptom care through psychoeducation, peer support, and active screening, as well as promote flexible pedagogical adaptations that reduce stress and anxiety (Zapata-Ospina et al., 2021). These programs should emerge from a multidisciplinary and culturally sensitive perspective, integrating teachers, administrative staff, mental health professionals, and students, as well as coordinating with social and governmental actors to comprehensively address basic and mental health needs (Salinas-Muñoz et al., 2024; Zapata-Ospina et al., 2021). The constant validation and cultural adaptation of instruments like DASS-21 and PHQ-9 are essential for early and accurate detection of emotional disorders in university contexts (Salinas-Muñoz et al., 2024; Cassiani-Miranda et al., 2021). Additionally, universities are recommended to increase investment in psychological care resources, expanding specialized personnel and offering a combination of in-person and virtual services according to the diversity of student needs (Cevallos Terán et al., 2025). Finally, to promote a more inclusive and understanding university culture, continuing mental health training programs for teachers and administrative personnel should be implemented. Structured integration of mental health into academic programs and extracurricular activities will contribute to emotional well-being as an essential part of students' comprehensive development (Cevallos

Terán et al., 2025). It is also suggested to conduct longitudinal studies to evaluate scale invariance according to gender and cultural contexts, test-retest reliability, and intervention effectiveness, thus strengthening the empirical basis for university mental health actions (Salinas-Muñoz et al., 2024; Zapata-Ospina et al., 2021). To enhance the impact and clarity of these conclusions for high-impact international journals, it is recommended to apply a more concise and precise language that highlights the significance of these findings succinctly. Avoid repetition and ensure each sentence delivers new information or emphasis. Present key data related to psychometric validation and intervention efficacy clearly, possibly employing structured paragraphs for each main theme: validation of instruments, mental health challenges and institutional responses, and future research directions.

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