



OPEN ACCESS

EDITED BY

ZhiMin Xiao,
University of Essex, United Kingdom

REVIEWED BY

Rei Akaishi,
RIKEN Center for Brain Science (CBS), Japan
Yousif AbdulRaheem,
University of Baghdad, Iraq

*CORRESPONDENCE

Riyadi Riyadi
✉ riyadi23e@student.unhas.ac.id

RECEIVED 08 July 2025

ACCEPTED 23 September 2025

PUBLISHED 06 October 2025

CITATION

Riyadi R, Fatimah JM and Hasrulah H (2025)
Smartphone-mediated communication and
mental health: the moderating role of social
support among university students in
Makassar, Indonesia.
Front. Hum. Dyn. 7:1658154.
doi: 10.3389/fhumd.2025.1658154

COPYRIGHT

© 2025 Riyadi, Fatimah and Hasrulah. This is
an open-access article distributed under the
terms of the [Creative Commons Attribution
License \(CC BY\)](#). The use, distribution or
reproduction in other forums is permitted,
provided the original author(s) and the
copyright owner(s) are credited and that the
original publication in this journal is cited, in
accordance with accepted academic
practice. No use, distribution or reproduction
is permitted which does not comply with
these terms.

Smartphone-mediated communication and mental health: the moderating role of social support among university students in Makassar, Indonesia

Riyadi Riyadi*, Jeanny Maria Fatimah and Hasrullah Hasrulah

Department of Communication Science, Faculty of Social and Political Sciences, Hasanuddin University, Makassar, Indonesia

Introduction: This study examines the relationship between smartphone use and mental health among undergraduate students in Makassar, Indonesia, with particular attention to the moderating role of social support. The investigation is grounded in the Stress-Buffering Hypothesis and Uses and Gratifications Theory within the collectivistic cultural context of Indonesia.

Methods: A stratified random sample of 400 undergraduate students from three universities in Makassar was surveyed. Standardized instruments were employed, including the Smartphone Use Scale, the Depression Anxiety Stress Scale (DASS-21), and the Multidimensional Scale of Perceived Social Support. Correlation and moderation analyses were conducted to test the study hypotheses.

Results: Findings reveal that general smartphone use showed only a weak positive correlation with psychological distress ($r = 0.12, p < 0.05$). In contrast, compulsive smartphone use demonstrated a stronger association with symptoms of depression, anxiety, and stress ($r = 0.28, p < 0.001$). Social support displayed a robust negative correlation with distress ($r = -0.34, p < 0.001$) and significantly moderated the negative effects of smartphone use on mental health ($\beta = -0.09, p < 0.05$).

Discussion: The results provide tentative support for extending existing theoretical frameworks into smartphone-mediated interactions among students in collectivistic contexts. Although the moderation effect of social support was modest and should be interpreted with caution, the findings highlight the practical importance of enhancing peer and community-based interventions to reduce risks associated with compulsive smartphone use. Limitations include the restriction of the sample to undergraduate students in Makassar, indicating the need for future research across different regions and age groups in Indonesia.

KEYWORDS

smartphone use, mental health, social support, undergraduate students, Makassar

1 Introduction

1.1 Digital context and related issues

The digital revolution has profoundly transformed the way individuals build and maintain social relationships. Among the various digital technologies, smartphones have emerged as a primary medium for interpersonal communication among university students. National statistics show that individuals aged 15–24—an age group largely overlapping with the university population—report the highest smartphone ownership in Indonesia, reaching 92.14% (Badan Pusat Statistik, 2024). University students are frequently

described as “digital natives,” a concept originally introduced to characterize generations who have grown up immersed in digital technologies (Prensky, 2001). Systematic reviews also confirm that smartphone use is particularly intensive among university students, with high prevalence of problematic use in this group (Candussi et al., 2023; Sánchez-Fernández and Borda-Mas, 2023). The centrality of smartphones became even more evident during the COVID-19 pandemic, when students relied heavily on these devices to sustain social connections and engage in online learning amid restrictions on face-to-face interaction (Rahiem, 2021; Merchán Tamayo et al., 2024).

While digital connectivity was crucial for sustaining academic engagement and psychological wellbeing during the pandemic, concerns have grown regarding its long-term consequences. Empirical evidence provides a mixed picture. On one hand, smartphones provide access to emotional networks, mental health resources, and peer support, thereby promoting wellbeing (Naslund et al., 2016; Stawarz et al., 2019). On the contrary, when smartphone use becomes excessive—particularly under compulsive patterns—it has been repeatedly linked to depression, anxiety, and stress, a phenomenon commonly termed Problematic Smartphone Use (PSU). This condition is typically characterized by compulsive behavior, weakened self-regulation, and heightened psychological distress (Dai et al., 2021; Elamin et al., 2024).

1.2 The role of social support and the cultural context of Makassar

An increasing number of studies highlight the critical role of social support as a contextual factor that shapes both the quality and consequences of smartphone-mediated interactions (Feeney and Collins, 2015; Gooding et al., 2023). The Stress-Buffering Hypothesis (Cohen and Wills, 1985) suggests that social support can lessen the adverse effects of stress by providing emotional comfort, instrumental help, and informational resources. While this framework has been extensively validated in offline contexts, its application to digital environments—particularly in relation to smartphone-mediated communication—remains underexplored.

This issue is particularly salient in collectivistic societies such as Indonesia, where social relationships are embedded in cultural values like *gotong royong* (mutual cooperation) and *kekeluargaan* (familial closeness). Research on cultural adaptation of digital interventions shows that collectivistic values significantly shape patterns of digital engagement, particularly in terms of user acceptability and stigma reduction (Spanhel et al., 2021; Naderbagi et al., 2024).

In such contexts, social support may function as a double-edged sword: it provides essential psychological resources while simultaneously generating implicit pressure to remain constantly available, particularly in family or campus-based group chats (Veissière and Stendel, 2018; Bai et al., 2024). These dynamics are often overlooked in Western-centric models of digital health.

Makassar provides a unique and meaningful setting for this study. As a major educational hub in Eastern Indonesia, the city attracts a diverse student population while preserving strong communal traditions. These values are embedded not only in campus life but also in broader social interactions, making Makassar an ideal context for examining how cultural norms influence the linkage between smartphone usage, mental wellbeing, and supportive networks.

1.3 Research objective and contribution

To address these gaps, this research examines how smartphone use is connected to mental health outcomes among university students in Makassar, emphasizing the potential moderating function of social support. The central research question is: *Does social support moderate the relationship between smartphone use and mental health outcomes among university students in Makassar?*

This study contributes theoretically by extending the Stress-Buffering Hypothesis into digitally mediated and collectivistic cultural milieus, adding nuance to literature dominated by Western samples. Practically, findings can inform culturally attuned interventions by university administrators, mental health practitioners, and policymakers aiming to promote digital wellbeing. Grounding the analysis in Makassar's socio-cultural context, the study enriches our understanding of how smartphone use, mental health, and social support intersect and offers contextually grounded recommendations for higher education institutions in Indonesia.

2 Literature review and theoretical framework

2.1 Smartphone usage patterns among university students

Smartphones have transformed from basic communication devices into indispensable tools for academic, social, and personal activities. Among university students, they are used not only for calls and messages but also for social media, online classes, and information access (Yus, 2022). While these devices enhance connectivity and provide educational benefits, excessive use has been linked to sleep problems, lower productivity, and impaired face-to-face interactions (Kwon et al., 2013; Kim et al., 2015).

Problematic smartphone use (PSU) is increasingly recognized as a behavioral concern. Global prevalence among university students ranges between 12.5% and 63.6% (Haug et al., 2015; Lopez-Fernandez, 2017; Lachmann et al., 2018; Tateno et al., 2019; Sohn et al., 2021; Okasha et al., 2022). In Indonesia, smartphone penetration has surged in the past decade, with students representing one of the most active user groups (Badan Pusat Statistik, 2020). This makes them particularly vulnerable to both the advantages and risks of intensive smartphone engagement.

2.2 Mental health in the university student population

University life represents a transitional stage characterized by academic pressure, social adaptation, and demands for autonomy. These stressors often contribute to increased vulnerability to depression, anxiety, and stress (Braithwaite et al., 2010; Hunt and Eisenberg, 2010). When combined with high levels of digital exposure, students' risk of experiencing psychological distress is magnified (Ogunmodede et al., 2023). Studies in diverse contexts confirm that compulsive smartphone use is significantly associated with depressive symptoms, anxiety, and reduced wellbeing (Lei et al., 2020; Liu, 2023; Elamin et al., 2024).

Studies in diverse contexts confirm that compulsive smartphone use is significantly associated with depressive symptoms, anxiety, and reduced wellbeing. For example, PSU has been shown to predict higher levels of psychological distress among students in both Asian and Middle Eastern contexts (Dai et al., 2021; Elamin et al., 2024). In Indonesia, student mental health has become a pressing concern as digital platforms frequently intersect with academic and social stressors. Yet empirical research exploring the nuanced relationship between smartphone use and mental health in collectivistic societies remains limited.

2.3 The role of social support in mental health

Social support is widely acknowledged as a modifying factor for psychological wellbeing, altering the impact of stressors through emotional, instrumental, and informational resources. The Stress-Buffering Hypothesis (Cohen and Wills, 1985) posits that supportive networks reduce the impact of stressors by providing these resources. These provisions enhance resilience, promote adaptive coping, and foster belonging (Cutrona and Russell, 1987).

Previous studies demonstrate that strong social support networks are associated with lower levels of distress and depressive symptoms among university students (Thoits, 2011; Kong and You, 2013). In collectivistic societies such as Indonesia, where values of *gotong royong* (mutual cooperation) and *kekeluargaan* (familial closeness) are central, social support is culturally embedded and often taken for granted as a communal resource. Recent evidence on the cultural adaptation of digital mental health interventions shows that collectivistic values strongly shape how individuals engage with support systems, including in online contexts (Spanhel et al., 2021). However, cultural norms may also reinforce expectations for constant availability, which could inadvertently contribute to compulsive smartphone use (Veissière and Stendel, 2018). This dual role underscores the need for context-sensitive examinations of social support in digital environments.

2.4 Smartphone-mediated communication and mental health

The relationship between smartphone-mediated communication and mental health is ambivalent. Smartphones can reduce loneliness and strengthen peer support networks (Herrero et al., 2019; Johnson-Esparza et al., 2021). However, problematic smartphone use has been consistently associated with poor sleep quality, anxiety, and heightened distress among students (Dai et al., 2021; Elamin et al., 2024).

The complexity lies not only in the quantity of use, but also in the quality of engagement. Studies in collectivistic cultures highlight that smartphone-mediated interactions can both alleviate and exacerbate distress, depending on whether gratifications—such as emotional connection or informational support—are effectively met (Merchán Tamayo et al., 2024; Zheng et al., 2024). This suggests that the effects of smartphone use on mental health are contingent upon the interplay between individual behaviors and cultural norms.

2.5 Social support as a moderating factor

A growing body of evidence supports the moderating role of social support in the relationship between technology use and psychological outcomes. For example, social support has been found to mitigate the impact of stress on depression among students (Wang et al., 2014; Chen et al., 2023). In Indonesia, where communal ties remain strong, this modifying role may be particularly salient.

Empirical findings suggest that while compulsive smartphone use is associated with higher distress, individuals with strong social support networks experience significantly reduced negative outcomes (McLean et al., 2023; Vicary et al., 2025).

2.6 Theoretical framework

This study applies two complementary frameworks:

1. Stress-Buffering Hypothesis (Cohen and Wills, 1985): Social support reduces the harmful effects of stressors, including those arising from problematic smartphone use.
2. Uses and Gratifications Theory (Katz et al., 1973): Students use smartphones to fulfill emotional, social, and informational needs. However, unmet gratifications may lead to compulsive use and psychological strain.

By integrating these frameworks, this study situates the analysis within Indonesia's collectivistic cultural context. This approach highlights how culturally embedded social support systems influence the digital-mental health nexus, offering a contextually grounded contribution to the global literature.

3 Methodology

3.1 Research design

This study employed a quantitative descriptive-analytic approach with a cross-sectional design. This design was chosen to identify the relationships among smartphone-mediated communication, social support, and mental health at a single point in time. This approach allowed researchers to efficiently describe trends and test the moderation hypothesis within the context of a large population (Baron and Kenny, 1986). To align with current best practices for moderation, we additionally followed recommendations on mean-centering and interaction testing as described by Aiken and West (1991).

3.2 Population and sample

The target population comprised undergraduate (S1) students from three state universities in Makassar:

1. Hasanuddin University (UNHAS)
2. State University of Makassar (UNM)
3. Alauddin State Islamic University of Makassar (UINAM)

Our study focused exclusively on undergraduate (S1) students in the young adult age range (18–24 years). This sampling choice was based on:

First, university students represent the so-called digital native generation who use smartphones intensively for academic, social, and entertainment purposes. In Indonesia, smartphone penetration exceeded 63% in 2019 (Badan Pusat Statistik, 2020), and the 15–24 age group recorded the highest ownership rate at 92.14% (Badan Pusat Statistik, 2024). Since this age group largely overlaps with undergraduate students, they constitute the most relevant population for examining the interplay between digital behavior and mental health. Multiple large-scale sources indicate that university-age populations show very high smartphone access and intensive use; for example, Indonesia's official statistics report 92.14% ownership among those aged 15–24, and systematic reviews focused on university students document substantial prevalence of problematic smartphone use in this group (Candussi et al., 2023; Sánchez-Fernández and Borda-Mas, 2023; Badan Pusat Statistik, 2024).

Second, university students face unique psychosocial stressors that distinguish them from both younger adolescents and older adults. Prior studies show that the top three concerns among undergraduates are academic performance, pressure to succeed, and post-graduation plans. Demographically, the most stressed, anxious, and depressed students tend to be transfer students, upperclassmen, and those living off-campus (Beiter et al., 2015). These developmental and situational challenges make university students a particularly relevant population. Furthermore, problematic smartphone use is particularly prevalent among university students and strongly correlated with psychological distress (Elamin et al., 2024).

Third, the study population was defined as active undergraduate students enrolled during four academic years (2021–2024) at three major universities in Makassar: Universitas Hasanuddin (UNHAS), Universitas Negeri Makassar (UNM), and Universitas Islam Negeri Alauddin Makassar (UIN). Based on the total population of active students in these universities ($N = 369,940$), the minimum required sample size was calculated using Slovin's formula with a 95% confidence level and a 5% margin of error. The calculation indicated that at least 400 respondents were necessary to ensure the representativeness of the sample.

Nevertheless, we acknowledge this as a limitation. Problematic smartphone use also affects other age groups, including adolescents in secondary schools and older adults. Therefore, the findings of this study should be interpreted as specific to the young adult university population and should not be generalized to the broader Indonesian population.

3.3 Sampling technique

The sample was selected using a stratified random sampling approach with the following criteria:

1. Active undergraduate enrollment
2. Gender (balanced at 50% male and 50% female)
3. Field of study (exact sciences versus social sciences/humanities)
4. Academic year (restricted to 2021–2024)

Stratification was employed exclusively to ensure proportional representation across universities, gender, fields of study (50% exact sciences and 50% non-exact sciences), and academic years (2021–2024, for consistency across the three institutions). These stratifications were implemented solely to achieve balance in the sample distribution and were not intended for, nor used in, comparative analyses.

In addition, respondents' religion, ethnicity, and native language were not considered as sampling criteria. These demographic characteristics were deliberately excluded, as the study did not aim to differentiate participants based on cultural or linguistic backgrounds.

3.4 Research instruments

3.4.1 Smartphone use scale

The Smartphone Use Scale employed in this study was adapted from existing instruments on smartphone addiction and problematic smartphone use, particularly the *Smartphone Addiction Scale* (SAS-SV) by Kwon et al. (2013) and related conceptualizations of excessive mobile phone use, e.g., (Lee et al., 2014; Ching et al., 2015). These instruments are grounded in behavioral addiction theory, which views problematic smartphone use as sharing core features with other forms of addictive behavior, including salience, compulsive use, withdrawal, and functional impairment.

Drawing on these theoretical foundations, the scale in this study was organized into three primary dimensions: Social Communication (five items), Productivity and Information (four items), and Dependency and Compulsive Use (five items). Each item was rated on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). The adapted version demonstrated satisfactory reliability in this sample, with a Cronbach's $\alpha = 0.83$.

The detailed items for each dimension are presented in the tables below. Respondents were instructed to indicate the degree to which each statement described their smartphone use.

A) Social communication

No	Statement	1	2	3	4	5
1	I use my smartphone to stay connected with friends.					
2	I use my smartphone to maintain communication with my family.					
3	I find it easier to socialize with the help of my smartphone.					
4	I use instant messaging apps (e.g., WhatsApp, Line) to interact socially.					
5	I feel connected to my social environment through my smartphone.					

B) Productivity and information

No	Statement	1	2	3	4	5
6	My smartphone helps me complete academic tasks.					
7	I use my smartphone to search for important information.					
8	My smartphone helps me organize my schedule or activities.					
9	I use my smartphone to improve my study productivity.					

C) Dependency and compulsive use

No	Statement	1	2	3	4	5
10	I often check my smartphone even when there are no new notifications.					
11	I feel anxious if I do not carry my smartphone with me.					
12	I feel uneasy if there are messages I have not replied to.					
13	I often use my smartphone longer than I originally planned.					
14	I use my smartphone to reduce stress or boredom.					

Validity approach. In this study, only content validity was employed because the research objective is descriptive in nature, focusing on the prevalence and patterns of smartphone-mediated communication and mental health among university students in Makassar, with social support as a modifying factor, rather than on the development of a new theoretical model. Three academic experts were consulted to evaluate the clarity, relevance, and cultural appropriateness of the items, ensuring that they adequately represented the constructs being measured. Reliability was tested using Cronbach's α , which indicated satisfactory internal consistency across the scales.

3.4.2 Depression, anxiety, and stress scale (DASS-21)

The Depression Anxiety Stress Scales-21 (DASS-21) was originally developed by Lovibond and Lovibond (1995) based on the tripartite model of psychological distress, which conceptualizes depression, anxiety, and stress as distinct yet interrelated emotional states. Subsequent studies have supported its cross-cultural applicability, with (Oei et al., 2013) conducting a validation study across different cultural contexts, although not specifically within Indonesia. More localized psychometric evidence was later established by Ifdil et al. (2020), who confirmed the validity and reliability of the instrument in the Indonesian context. The DASS-21 consists of three subscales—depression, anxiety, and stress—each comprising seven items. Respondents rate their experiences on a 4-point Likert scale ranging from 0 (“did not apply to me at all”) to 3 (“applied to me very much or most of the time”).

English original items

Dimension	Item no.	Statement
Depression	D1	I found it hard to wind down.
	D2	I could not seem to experience any positive feeling at all.
	D3	I felt that I had nothing to look forward to.
	D4	I felt down-hearted and blue.
	D5	I was unable to become enthusiastic about anything.
	D6	I felt I wasn't worth much as a person.
	D7	I felt that life was meaningless.
Anxiety	A1	I was aware of dryness of my mouth.
	A2	I experienced breathing difficulty (e.g., often gasping for breath or feeling unable to breathe, even without prior physical activity).
	A3	I experienced trembling (e.g., in my hands).
	A4	I was worried about situations in which I might panic and embarrass myself.
	A5	I felt that I was close to panic.
	A6	I was aware of my heart action (e.g., heart rate increase or decrease) even though I was not engaged in physical activity.
	A7	I felt scared without any good reason.
Stress	S1	I found it hard to rest.
	S2	I tended to over-react to situations.
	S3	I felt that my energy was drained due to excessive worry.
	S4	I found myself feeling agitated.
	S5	I found it difficult to calm down.
	S6	I found it hard to be patient when interrupted while doing something.
	S7	I felt that I was easily upset or touchy.

Dimension	Item no.	English statement	Indonesian statement
Depression	D1	I could not seem to experience any positive feeling at all (e.g., happiness, pride, etc.).	Saya sama sekali tidak dapat merasakan perasaan positif (misalnya: gembira, bangga, dll).
	D2	I found it difficult to work up the initiative to do things.	Saya merasa sulit berinisiatif melakukan sesuatu.
	D3	I felt that I had nothing to look forward to.	Saya merasa tidak ada lagi yang bisa saya harapkan.
	D4	I felt sad and depressed.	Saya merasa sedih dan tertekan.
	D5	I was unable to feel enthusiastic about anything.	Saya tidak bisa merasa antusias terhadap hal apa pun.
	D6	I felt that I wasn't worth much as a person.	Saya merasa diri saya tidak berharga.
	D7	I felt that life was meaningless.	Saya merasa hidup ini tidak berarti.
Anxiety	A1	I was aware of dryness of my mouth.	Saya merasa rongga mulut saya kering.
	A2	I experienced breathing difficulty (e.g., often gasping for breath or feeling unable to breathe, even without prior physical activity).	Saya merasa kesulitan bernapas (misalnya sering terengah-engah atau tidak dapat bernapas tanpa aktivitas fisik).
	A3	I experienced trembling (e.g., in my hands).	Saya merasa gemetar (misalnya pada tangan).
	A4	I was worried about situations in which I might panic and embarrass myself.	Saya khawatir dengan situasi di mana saya mungkin panik dan mempermalukan diri sendiri.
	A5	I felt that I was close to panic.	Saya merasa hampir panik.
	A6	I was aware of my heart action (e.g., heart rate increase or decrease) even though I was not engaged in physical activity.	Saya menyadari detak jantung saya (misalnya meningkat atau melemah) meskipun tidak beraktivitas fisik.
	A7	I felt scared without any good reason.	Saya merasa ketakutan tanpa alasan yang jelas.

Stress	S1	I found it hard to rest.	Saya merasa sulit untuk beristirahat.
	S2	I tended to over-react to situations.	Saya cenderung bereaksi berlebihan terhadap suatu situasi.
	S3	I felt that my energy was drained due to excessive worry.	Saya merasa energi saya terkuras karena terlalu cemas.
	S4	I found myself feeling agitated.	Saya merasa gelisah.
	S5	I found it difficult to calm down.	Saya merasa sulit untuk merasa tenang.
	S6	I found it hard to be patient when interrupted while doing something.	Saya sulit bersabar menghadapi gangguan ketika sedang melakukan sesuatu.
	S7	I felt that I was easily upset or touchy.	Perasaan saya mudah tergugah atau tersinggung.

Validity and reliability in the Indonesian context

- 1) Construct validity: A Confirmatory Factor Analysis (CFA) conducted by [Muttaqin and Ripa \(2021\)](#) confirmed a bifactor structure (depression, anxiety, stress, plus general distress) with good model-fit indices (GFI = 0.954; CFI = 0.956; RMSEA = 0.049). The composite reliability of each subscale ranged from 0.806 to 0.917.
- 2) Overall validity and reliability: In the Indonesian context, the DASS-21 has been validated by [Ifdil et al. \(2020\)](#) using the Rasch model, demonstrating high reliability (item reliability = 0.99; person reliability = 0.89; KR-20/Cronbach's $\alpha \approx 0.91$). These results indicate that the DASS-21 is a valid and reliable instrument for measuring depression, anxiety, and stress among Indonesian populations.

3.4.3 Social support scale

Theoretical basis and concept. The Social Support Scale used in this study was adapted from [Cutrona and Russell \(1987\)](#), who conceptualized social support as a multidimensional construct comprising four domains: emotional support, instrumental support, informational support, and social integration. Emotional support refers to expressions of empathy, care, and trust; instrumental support concerns tangible aid or services; informational support refers to guidance and advice; and social integration reflects a sense of belonging to a network of supportive relationships.

The scale consists of 12 items rated on a 4-point Likert scale (1 = never, 2 = rarely, 3 = often, 4 = always). Higher scores indicate stronger perceived social support. In this study, social support is conceptualized as a *modifying factor* rather than a *protective factor*, to reflect its role in shaping the quality and outcomes of smartphone interactions. Only content validity was conducted through expert judgment (rather than CFA) because the research is descriptive and not intended for theoretical model development. This is acknowledged as a limitation, and future studies are encouraged to perform CFA to

further establish construct validity. Reliability testing in the current study showed a Cronbach's $\alpha = 0.86$, indicating satisfactory internal consistency.

Adapted items

Dimension	Item no.	English statement
Emotional Support	ES1	I have someone who listens to me when I need to talk.
	ES2	I feel that there is someone who understands my feelings.
	ES3	I can rely on someone to comfort me when I am upset.
Instrumental support	IS1	I have someone who can help me when I face practical difficulties.
	IS2	There is someone willing to provide assistance when I need it.
	IS3	I can count on someone to help me manage daily tasks.
Informational support	INF1	I have someone who gives me advice when I need guidance.
	INF2	There is someone I can consult when I face academic or personal problems.
	INF3	I receive useful suggestions from others when I face difficulties.
Social integration	SI1	I feel that I belong to a supportive group of friends.
	SI2	I have people with whom I can share my experiences.
	SI3	I feel part of a social group that accepts me.

3.5 Data collection procedure

Data were collected directly by the researcher through printed questionnaires administered in person across three public universities in Makassar. The researcher approached students on campus and conducted data collection in lecture halls, libraries, and student common areas, following a stratified random sampling procedure.

1) Recruitment

Students were approached on-site and invited to participate in the study. Recruitment targeted proportionate samples from Hasanuddin University, Makassar State University, and Alauddin State Islamic University of Makassar, ensuring balance by gender, faculty, and academic year.

2) Informed consent

Before participation, each student received a printed informed consent form describing the study's objectives, procedures, confidentiality assurances, and the voluntary nature of participation. Only students who provided signed consent were included.

3 Information for participants

Participants were explicitly informed of their rights prior to data collection. They were assured that:

- No personally identifiable information would be recorded.
- Their participation was entirely voluntary.
- They could withdraw from the study at any time without any penalty.
- The results would be used strictly for academic purposes.

A pilot test with 30 students was conducted beforehand to ensure clarity and reliability of the instruments. Completion of the questionnaire required approximately 15–20 min.

3.6 Data analysis techniques

Analysis was conducted in several stages using SPSS v28.0 and R.

3.6.1 Descriptive statistics

Used to describe the distribution of age, gender, university of origin, and the value distribution for each variable.

3.6.2 Pearson correlation analysis

Used to examine the bivariate relationships among smartphone use, mental health, and social support.

3.6.3 Moderation analysis with hierarchical regression. The moderation test was performed using hierarchical regression analysis in three steps

1. Entering the primary predictor (smartphone use);
2. Adding the moderator (social support); and
3. Adding the interaction term (smartphone use $\times$ social support).

All continuous variables were mean-centered prior to the creation of the interaction term. This procedure was conducted for two primary reasons:

- Reducing multicollinearity: Mean-centering helps minimize non-essential multicollinearity between the main effects (predictor and moderator) and their interaction term, thereby stabilizing the estimation of regression coefficients (Aiken and West, 1991).
- Facilitating interpretation: With mean-centered variables, the regression coefficients for the main effects can be interpreted as the effect of the predictor when the moderator is at its average value (and vice versa). This enhances the clarity of interpreting moderation effects, particularly in psychological and behavioral studies.

It should be noted that mean-centering does not alter the statistical significance of the interaction term; it only improves the interpretability and precision of the regression model. This procedure is widely recommended in moderation analyses where the predictor and moderator are continuous variables (Baron and Kenny, 1986; Aiken and West, 1991). In this study, the moderation analysis

operationalizes social support as a *modifying factor* of the smartphone–distress association.

3.7 Ethical considerations

Ethical approval for this study was grounded in two levels of official authorization. First, the Faculty of Social and Political Sciences, Hasanuddin University, issued a research permission letter (No. 02741/UN4.8/PT.01.04/2025, dated March 12, 2025) endorsing the research project and forwarding it to the relevant provincial authorities. Subsequently, the Provincial Government of South Sulawesi, through the Office of Investment and One-Stop Integrated Services (DPMPSTP), granted an official research permit (No. 6345/S.01/PTSP/2025; Registration No. 20250319657868, dated March 19, 2025), covering Hasanuddin University, Makassar State University, and Alauddin State Islamic University of Makassar.

While Indonesian universities do not typically operate formal Institutional Review Boards (IRBs), this study adhered to international ethical standards for human subject research. All participants were fully informed about the objectives and procedures of the study, signed written informed consent forms, were assured of anonymity, and were informed of their right to withdraw at any time without penalty.

4 Results and findings

4.1 Respondent characteristics

A total of 400 university students participated in the study. The average age of participants was 20.1 years ($SD = 1.4$), with ages ranging from 18 to 24 years. The study population comprised a total of 369,940 students from three state universities in Makassar: Hasanuddin University (136,506 students), Makassar State University (148,180 students), and Alauddin State Islamic University of Makassar (85,254 students). Our sample was drawn proportionally from this population, with 148 students (37%) from Hasanuddin University, 160 students (40%) from Makassar State University, and 92 students (23%) from Alauddin State Islamic University of Makassar. Furthermore, the sample was perfectly balanced by gender, with 200 males (50%) and 200 females (50%). Students were also evenly split by field of study (50% in exact sciences and 50% in non-exact sciences) and were drawn proportionally from the 2021–2024 academic years.

4.2 Descriptive statistics of research variables

Table 1 presents the descriptive statistics for the study's main variables, including mean, standard deviation, and reliability coefficients.

The descriptive analysis provided an overview of the variables measured. The Smartphone Use scale had a mean score of 3.27 ($SD = 0.26$), with its sub-dimensions showing varying levels of use. The Social Communication sub-dimension had the highest mean score at 3.83 ($SD = 0.36$), followed by Productivity at 3.16 ($SD = 0.45$). The lowest mean score was for the Dependency and Compulsive Use sub-dimension at 2.79 ($SD = 0.51$). The overall DASS-21 (Depression, Anxiety, and Stress Scale) mean score was 15.30 ($SD = 3.67$). The scores

for the three sub-scales were similar, with Depression at 5.26 ($SD = 2.27$), and both Anxiety and Stress at 5.02 ($SD = 2.15$). For the Social Support scale, the mean score was 3.10 ($SD = 0.21$). All scales demonstrated satisfactory internal consistency, with Cronbach's α values of 0.83 for Smartphone Use, 0.92 for DASS-21, and 0.86 for Social Support.

4.3 Correlation analysis

Pearson correlation analysis was conducted to examine the relationships among the main variables. Results are summarized in Table 2.

A Pearson correlation analysis was conducted to examine the bivariate relationships among the key variables. The results showed a weak but statistically significant positive correlation between total smartphone use and psychological distress (DASS-21), with a coefficient of $r = 0.12$ and $p < 0.05$. This relationship was notably stronger when specifically looking at compulsive smartphone use, which had a significant positive correlation with psychological distress ($r = 0.28$, $p < 0.001$). In contrast, a robust and significant negative correlation was found between social support and psychological distress ($r = -0.34$, $p < 0.001$). The sub-dimensions of smartphone use, namely Communication ($r = 0.06$) and Productivity ($r = -0.05$), did not show a statistically significant relationship with psychological distress.

4.4 Moderation analysis (hierarchical regression) and simple slopes analysis

Hierarchical regression was performed to test the moderating role of social support. Results are shown in Table 3.

Simple slopes analysis was conducted to further examine the interaction effect. Results are presented in Table 4.

To test the moderating role of social support, a hierarchical regression analysis was performed. The analysis included three models:

1. Model 1 included only the primary predictor (smartphone use) and accounted for 1.4% of the variance in psychological distress ($R^2 = 0.014$).
2. Model 2 added the moderator (social support), which led to a significant increase in the explained variance ($\Delta R^2 = 0.114$,

TABLE 1 Descriptive statistics for main variables.

Variable	Mean (M)	SD	α
Smartphone use (total)	3.27	0.26	0.83
Communication	3.83	0.36	
Productivity	3.16	0.45	
Compulsive/dependency	2.79	0.51	
DASS-21 (total)	15.30	3.67	0.92
Depression	5.26	2.27	
Anxiety	5.02	2.15	
Stress	5.02	2.15	
Social support (total)	3.10	0.21	0.86

TABLE 2 Pearson correlation matrix.

Variable	DASS-21	Smartphone use (total)	Communication	Productivity	Compulsive/dependency	Social support
DASS-21	1	$r = 0.12^*$	$r = 0.06$	$r = -0.05$	$r = 0.28^{***}$	$r = -0.34^{***}$
Smartphone use (total)	$r = 0.12^*$	1	–	–	–	–
Communication	$r = 0.06$	–	1	–	–	–
Productivity	$r = -0.05$	–	–	1	–	–
Compulsive/dependency	$r = 0.28^{***}$	–	–	–	1	–
Social support	$r = -0.34^{***}$	–	–	–	–	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE 3 Results of hierarchical regression predicting psychological distress.

Model	R^2	ΔR^2	Significant interaction
Model 1 (X)	0.014	–	No
Model 2 (X + Z)	0.128***	0.114***	Yes
Model 3 (X × Z)	0.135*	0.007*	Yes ($\beta = -0.09$, $p < 0.05$)

X, smartphone use; Z, social support, * $p < 0.05$, *** $p < 0.001$.

TABLE 4 Simple slopes analysis for smartphone use × social support.

Level of social support	β (smartphone → distress)	p -value	Significant
–1 SD (low)	$\beta = 0.18$	$p < 0.01$	Yes
+1 SD (high)	$\beta = 0.04$	$p = 0.57$	No

Level of social support	β (smartphone → distress)	p -value	Significant
Test of slope difference	$t = 2.14$	$p = 0.033$	Significant

$p < 0.001$). This model accounted for 12.8% of the variance ($R^2 = 0.128$, $p < 0.001$).

- Model 3 introduced the interaction term between smartphone use and social support. This interaction term was statistically significant ($\beta = -0.09$, $p < 0.05$), indicating that social support significantly moderated the relationship between smartphone use and psychological distress. The addition of the interaction term resulted in a further, albeit small, increase in the explained variance ($\Delta R^2 = 0.007$, $p < 0.05$).

A simple slopes analysis was then performed to further investigate this interaction effect at different levels of social support. The results demonstrated that for students with low social support (at –1 SD), the positive relationship between smartphone use and psychological distress was significant ($\beta = 0.18$, $p < 0.01$). However, for students with high social support (at +1 SD), the relationship between smartphone use and distress was no longer statistically significant ($\beta = 0.04$, $p = 0.57$). The test of slope difference was also significant ($t = 2.14$, $p = 0.033$), confirming that the effect of smartphone use on distress is different depending on the level of social support.

5 Discussion

5.1 Key findings and theoretical contributions

The present study suggests that social support plays a significant modifying role in the relationship between smartphone use and university students' mental health. General smartphone use showed only a small yet statistically significant correlation with psychological distress ($r = 0.12$, $p < 0.05$). In contrast, compulsive or dependency-oriented use was more consistently associated with higher levels of depression, anxiety, and stress ($r = 0.28$, $p < 0.001$). Social support demonstrated a moderate negative correlation with psychological distress ($r = -0.34$, $p < 0.001$). The interaction effect in the moderation model ($\beta = -0.09$, $p < 0.05$) indicates that social support modifies the quality and nature of smartphone interactions, attenuating the positive association between smartphone use and mental health. This effect, while statistically reliable, was modest in magnitude and should be interpreted cautiously.

These findings provide tentative support for extending the Stress-Buffering Hypothesis (Cohen and Wills, 1985) into smartphone-mediated interactions within the collectivistic cultural context of Makassar. Traditionally, the hypothesis posits that social support mitigates the impact of stressors by providing emotional, instrumental, and informational resources. The present results are consistent with this mechanism, but the effect was modest ($\beta = -0.09$, $p < 0.05$) and should therefore be interpreted with caution. Importantly, the findings highlight that not all smartphone use poses the same risk; compulsive patterns, characterized by reduced self-regulation, were more consistently associated with psychological distress in this specific student population.

Furthermore, the results resonate with the Uses and Gratifications Theory (Katz et al., 1973). While students may initially use smartphones to meet social and emotional needs, such as maintaining relationships and accessing support, these gratifications may not always be achieved. Superficial interactions, pressure to be constantly available, or unmet expectations can contribute to heightened distress. Thus, when smartphone use becomes compulsive, it may transform from a coping resource into a stressor—unless modified by robust social support that enhances the positive aspects of digital engagement.

5.2 Interpretation in the Indonesian cultural context

Indonesia's collectivistic cultural setting is characterized by social norms such as *gotong royong* (mutual cooperation) and *kekeluargaan*

(familial closeness), in which interpersonal support is embedded in daily life. Consistent with the moderation result ($\beta = -0.09, p < 0.05$), the attenuated association between smartphone use and distress at higher levels of perceived social support can be interpreted as a theory-driven instance of the classic stress-buffering mechanism—that is, supportive relationships can modify the impact of stressors on wellbeing (Cohen and Wills, 1985). In contemporary student life, such support is often mobilized through smartphone-mediated channels (e.g., messaging and online communities), which prior studies link to supportive interaction and improved psychosocial outcomes (Timmis, 2012; Oh et al., 2014; Naslund et al., 2016). In addition, research on cultural adaptation highlights that collectivistic values shape patterns of engagement with digital mental-health supports, reinforcing the importance of context in interpreting such findings (Spanhel et al., 2021; Naderbagi et al., 2024).

At the same time, collectivistic expectations may generate social pressures that intensify digital engagement—for example, the felt obligation to remain constantly reachable in family or campus group chats (Timmis, 2012). This cultural duality—where supportive ties can both alleviate and amplify digital demands—helps explain why general smartphone use showed only a small association with distress, whereas compulsive or dependency-driven use was more robustly related to distress. These dynamics are often underemphasized in Western-centric frameworks. Accordingly, the present moderation effect should be viewed as culturally situated and modest in magnitude, consistent with the cross-sectional design and with the principle that social support functions as a modifying factor rather than a blanket protection.

5.3 Consistency with previous studies and cross-cultural alignment

These findings are consistent with prior research conducted in other collectivistic contexts. Studies from Saudi Arabia (Elamin et al., 2024) and China (Zheng et al., 2024) also report significant associations between compulsive smartphone use and symptoms of depression and anxiety. This pattern suggests that smartphones are not only communication tools but also central to emotional regulation and coping mechanisms. Depending on the context, these mechanisms may be adaptive or maladaptive.

A systematic review by Vicary et al. (2025) emphasizes that social support is a key determinant of mental health among university students globally, reducing the risk of depression and suicidal ideation. The consistency of the present findings with prior research underscores the significance of social support for student mental health, while also drawing attention to cultural differences in how such support operates. In the collectivistic context of Makassar, social support is normative and embedded within daily life, which may contribute to a stronger capacity to modify digital interactions. However, this interpretation should be regarded as context-specific and modest in scope, rather than universal, given the limited sample and cross-sectional design of the study.

While these findings align with studies from other collectivistic societies, they should be interpreted cautiously. The results primarily reflect the cultural and academic context of Makassar, an urban center with strong collectivistic values, and may not be fully generalizable to all Indonesian students across diverse regions.

5.4 Practical applications

The results of this study have several practical applications:

- **Campus interventions:** Efforts should prioritize strengthening organic peer networks, academic study groups, and mentoring systems, rather than focusing solely on reducing screen time.
- **Digital wellness curricula:** Non-academic programs should incorporate modules on healthy coping strategies, critical digital literacy, and emotional management to mitigate risks of compulsive use.
- **Policy initiatives:** Broader approaches should combine responsible technology use with community-based support systems, family engagement, and enhanced access to campus mental health resources.

5.5 Gender reflection and specific vulnerabilities

Although gender was not explicitly analyzed as a moderator, the balanced sample provides room for reflection. Prior evidence (Bai et al., 2024; Elamin et al., 2024) suggests that female students often experience stronger smartphone dependence and greater psychological strain compared to their male counterparts, while simultaneously benefiting from more robust social support systems. This underlines the importance of recognizing gender-related variations when examining digital mental health outcomes.

A uniform approach to intervention may therefore be ineffective. Gender-sensitive strategies are needed to address diverse psychological needs. Future research should explicitly examine gender-based differences, using longitudinal and qualitative methods to explore how coping styles, social expectations, and cultural context interact with smartphone use and mental health outcomes.

6 Conclusion

This study provides empirical insights from university students in Makassar, Indonesia, indicating that compulsive smartphone use shows a stronger association with psychological distress than general smartphone engagement. At the same time, social support shapes the nature of smartphone-mediated interactions, helping to reduce the adverse effects of excessive digital use on mental wellbeing. Taken together, these findings validate the continuing significance of the Stress-Buffering Hypothesis in digitally mediated contexts.

This research focuses solely on three higher education institutions in Makassar. Hence, the findings should be viewed with caution and are not meant to represent the entire Indonesian student body, which is shaped by extensive cultural, ethnic, and linguistic variation.

Despite these limitations, the study offers meaningful contributions by highlighting that interventions should prioritize strengthening students' social support networks rather than focusing narrowly on screen-time reduction. In the specific context of Makassar, where collectivistic values and dense kinship ties shape students' daily lives, social support emerges as both culturally congruent and practically effective in modifying digital interactions to safeguard mental health.

Future research could extend this inquiry by employing longitudinal designs, exploring additional moderators such as gender, and conducting cross-regional comparisons across Indonesia to better capture the country's diversity. Such work would enrich our understanding of how culture, technology use, and social support jointly shape student wellbeing.

Thus, the findings of this research should be interpreted as specifically reflecting the experiences of university students in Makassar, rather than as a general picture of Indonesia's student population, which is marked by substantial cultural, linguistic, and regional heterogeneity.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Hasanuddin University, Makassar State University, Alauddin State Islamic University of Makassar. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

RR: Data curation, Conceptualization, Investigation, Writing – review & editing, Writing – original draft. JF: Writing – review &

editing, Supervision, Methodology, Conceptualization. HH: Methodology, Conceptualization, Supervision, Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

Any alternative text (alt text) provided alongside figures in this article has been generated by Frontiers with the support of artificial intelligence and reasonable efforts have been made to ensure accuracy, including review by the authors wherever possible. If you identify any issues, please contact us.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

- Aiken, L. S., and West, S. G. (1991). Multiple regression: testing and interpreting interactions. London: Sage Publications.
- Badan Pusat Statistik (2020). Telecommunication statistics in Indonesia 2019. Available online at: <https://www.bps.go.id/en/publication/2020/12/02/be999725b7aeec62d84c6660/telecommunication-statistics-in-indonesia-2019.html> (Accessed June 15, 2025).
- Badan Pusat Statistik (2024). Proporsi individu yang menguasai/memiliki telepon genggam menurut kelompok umur (persen) 2023. Available online at: <https://www.bps.go.id/id/statistics-table/2/MTlyMiMy/proporsi-individu-yang-menguasai-memiliki-telepon-genggam-menurut-kelompok-umur.html> (Accessed June 15, 2025).
- Bai, H., Liu, J., Bai, W., and Cao, T. (2024). Social pressures and their impact on smartphone use stickiness and use habit among adolescents. *Heliyon* 10, e29111–e29115. doi: 10.1016/j.heliyon.2024.e29111
- Baron, R. M., and Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* 51, 1173–1182. doi: 10.1037/0022-3514.51.6.1173
- Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., et al. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *J. Affect. Disord.* 173, 90–96. doi: 10.1016/j.jad.2014.10.054
- Braithwaite, S. R., Delevi, R., and Fincham, F. D. (2010). Romantic relationships and the physical and mental health of college students. *Pers. Relat.* 17, 1–12. doi: 10.1111/j.1475-6811.2010.01248.x
- Candussi, C. J., Kabir, R., and Sivasubramanian, M. (2023). Problematic smartphone usage, prevalence and patterns among university students: a systematic review. *J. Affect. Disord. Rep.* 14, 1–12. doi: 10.1016/j.jadr.2023.100643
- Chen, C., Bian, F., and Zhu, Y. (2023). The relationship between social support and academic engagement among university students: the chain mediating effects of life satisfaction and academic motivation. *BMC Public Health* 23, 1–13. doi: 10.1186/s12889-023-17301-3
- Ching, S. M., Yee, A., Ramachandran, V., Lim, S. M. S., Sulaiman, W. A. W., Foo, Y. L., et al. (2015). Validation of a Malay version of the smartphone addiction scale among medical students in Malaysia. *PLoS One* 10, 1–11. doi: 10.1371/journal.pone.0139337
- Cohen, S., and Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychol. Bull.* 98, 310–357. doi: 10.1037/0033-2909.98.2.310
- Cutrona, C. E., and Russell, D. W. (1987). The provisions of social relationships and adaptation to stress. Greenwich, Connecticut, USA: JAI Press Inc.
- Dai, C., Tai, Z., and Ni, S. (2021). Smartphone use and psychological well-being among college students in China: a qualitative assessment. *Front. Psychol.* 12, 1–13. doi: 10.3389/fpsyg.2021.708970
- Elamin, N. O., Almasaad, J. M., Busaeed, R. B., Aljafari, D. A., and Khan, M. A. (2024). Smartphone addiction, stress, and depression among university students. *Clin. Epidemiol. Glob. Health.* 25:101487. doi: 10.1016/j.cegh.2023.101487
- Feeney, B. C., and Collins, N. L. (2015). New look at social support: a theoretical perspective on thriving through relationships. *Personal. Soc. Psychol. Rev.* 19, 113–147. doi: 10.1177/1088868314544222
- Gooding, P., Crook, R., Westwood, M., Faichnie, C., and Peters, S. (2023). Social support resilience as a protective mental health factor in postgraduate researchers' experiences: a longitudinal analysis. *Stud. Grad. Postdoc. Educ.* 14, 245–258. doi: 10.1108/SGPE-04-2022-0032

- Haug, S., Castro, R. P. A. Z., Kwon, M. I. N., Filler, A., Kowatsch, T., and Schaub, M. P. (2015). Smartphone use and smartphone addiction among young people in Switzerland. *J. Behav. Addict.* 4, 299–307. doi: 10.1556/2006.4.2015.037
- Herrero, J., Torres, A., Vivas, P., and Uruña, A. (2019). Smartphone addiction and social support: a three-year longitudinal study. *Psychosoc. Interv.* 28, 111–118. doi: 10.5093/pi2019a6
- Hunt, J., and Eisenberg, D. (2010). Mental health problems and help-seeking behavior among college students. *J. Adolesc. Health* 46, 3–10. doi: 10.1016/j.jadohealth.2009.08.008
- Ifdil, I., Syahputra, Y., Fadli, R. P., Zola, N., Putri, Y. E., Amalianita, B., et al. (2020). The depression anxiety stress scales (DASS-21): an Indonesian validation measure of the depression anxiety stress. *Couns-Edu Int. J. Couns. Educ.* 5, 205–215. doi: 10.23916/0020200536840
- Johnson-Esparza, Y., Rodriguez Espinosa, P., Verney, S. P., Boursaw, B., and Smith, B. W. (2021). Social support protects against symptoms of anxiety and depression: key variations in Latinx and non-Latinx white college students. *J. Lat. Psychol.* 9, 161–178. doi: 10.1037/lat0000184
- Katz, E., Blumler, J. G., and Gurevitch, M. (1973). Uses and gratifications research. *Public Opin. Q.* 37, 509–523. doi: 10.1086/268109
- Kim, S. E., Kim, J. W., and Jee, Y. S. (2015). Relationship between smartphone addiction and physical activity in Chinese international students in Korea. *J. Behav. Addict.* 4, 200–205. doi: 10.1556/2006.4.2015.028
- Kong, F., and You, X. (2013). Loneliness and self-esteem as mediators between social support and life satisfaction in late adolescence. *Soc. Indic. Res.* 110, 271–279. doi: 10.1007/s11205-011-9930-6
- Kwon, M., Kim, D. J., Cho, H., and Yang, S. (2013). The smartphone addiction scale: development and validation of a short version for adolescents. *PLoS One* 8, 1–7. doi: 10.1371/journal.pone.0083558
- Lachmann, B., Sindermann, C., Sariyska, R. Y., Luo, R., Melchers, M. C., Becker, B., et al. (2018). The role of empathy and life satisfaction in internet and smartphone use disorder. *Front. Psychol.* 9, 1–11. doi: 10.3389/fpsyg.2018.00398
- Lee, H., Ahn, H., Choi, S., and Choi, W. (2014). The SAMS: smartphone addiction management system and verification. *J. Med. Syst.* 38, 1–10. doi: 10.1007/s10916-013-0001-1
- Lei, L. Y. C., Al-Aarifin Ismail, M., Mohammad, J. A. M., and Bahri Yusoff, M. S. (2020). The relationship of smartphone addiction with psychological distress and neuroticism among university medical students. *BMC Psychol.* 8, 1–9. doi: 10.1186/s40359-020-00466-6
- Liu, C. (2023). The unique role of smartphone addiction and related factors among university students: a model based on cross-sectional and cross-lagged network analyses. *BMC Psychiatry* 23, 1–12. doi: 10.1186/s12888-023-05384-6
- Lopez-Fernandez, O. (2017). Short version of the smartphone addiction scale adapted to Spanish and French: towards a cross-cultural research in problematic mobile phone use. *Addict. Behav.* 64, 275–280. doi: 10.1016/j.addbeh.2015.11.013
- Lovibond, P. F., and Lovibond, S. H. (1995). The structure of negative emotional states: comparison of the depression anxiety stress scales (DASS) with the Beck depression and anxiety inventories. *Behav. Res. Ther.* 33, 335–343. doi: 10.1016/0005-7967(94)00075-U
- McLean, L., Gaul, D., and Penco, R. (2023). Perceived social support and stress: a study of 1st year students in Ireland. *Int. J. Ment. Health Addict.* 21, 2101–2121. doi: 10.1007/s11469-021-00710-z
- Merchán Tamayo, J. P., Rocchi, M. A., St-Denis, B., Bonneville, L., and Beaudry, S. G. (2024). A motivational approach to understanding problematic smartphone use and negative outcomes in university students. *Addict. Behav.* 148, 107842–107848. doi: 10.1016/j.addbeh.2023.107842
- Muttaqin, D., and Ripa, S. (2021). Psychometric properties of the Indonesian version of the depression anxiety stress scale: factor structure, reliability, gender, and age measurement invariance. *Psikohumaniora J. Penelit. Psikol.* 6, 61–76. doi: 10.21580/pjpp.v6i1.7815
- Naderbagi, A., Loblay, V., Zahed, I. U. M., Ekambareshwar, M., Poulsen, A., Song, Y. J. C., et al. (2024). Cultural and contextual adaptation of digital health interventions: narrative review. *J. Med. Internet Res.* 26, e55130–e55114. doi: 10.2196/55130
- Naslund, J. A., Aschbrenner, K. A., Marsch, L. A., and Bartels, S. J. (2016). The future of mental health care: peer-to-peer support and social media. *Epidemiol. Psychiatr. Sci.* 25, 113–122. doi: 10.1017/S2045796015001067
- Oei, T. P. S., Sawang, S., Goh, Y. W., and Mukhtar, F. (2013). Using the depression anxiety stress scale 21 (DASS-21) across cultures. *Int. J. Psychol.* 48, 1018–1029. doi: 10.1080/00207594.2012.755535
- Ogunmodede, J. A., Dele-Ojo, B. F., Ogunmodede, A. J., Buhari, O. I. N., Agede, O. A., Bojuwoye, M. O., et al. (2023). The influence of smartphone use on psychological distress in university undergraduates. *J. Educ. Commun. Health* 10, 78–86. doi: 10.34172/jech.2023.2314
- Oh, H. J., Ozkaya, E., and Larose, R. (2014). How does online social networking enhance life satisfaction? The relationships among online supportive interaction, affect, perceived social support, sense of community, and life satisfaction. *Comput. Hum. Behav.* 30, 69–78. doi: 10.1016/j.chb.2013.07.053
- Okasha, T., Saad, A., Ibrahim, I., Elhabiby, M., Khalil, S., and Morsy, M. (2022). Prevalence of smartphone addiction and its correlates in a sample of Egyptian university students. *Int. J. Soc. Psychiatry* 68, 1580–1588. doi: 10.1177/00207640211042917
- Prensky, M. (2001). Digital natives, digital immigrants. *Horizon* 9, 1–6. doi: 10.15187/adr.2020.02.33.1.17
- Rahiem, M. D. H. (2021). Remaining motivated despite the limitations: university students' learning propensity during the COVID-19 pandemic. *Child Youth Serv. Rev.* 120, 105802–105814. doi: 10.1016/j.childyouth.2020.105802
- Sánchez-Fernández, M., and Borda-Mas, M. (2023). Problematic smartphone use and specific problematic internet uses among university students and associated predictive factors: a systematic review. *Educ. Inf. Technol.* 28, 7111–7204. doi: 10.1007/s10639-022-11437-2
- Sohn, S. Y., Krasnoff, L., Rees, P., Kalk, N. J., and Carter, B. (2021). The association between smartphone addiction and sleep: a UK cross-sectional study of young adults. *Front. Psych.* 12, 1–10. doi: 10.3389/fpsyg.2021.629407
- Spanhel, K., Balci, S., Feldhahn, F., Bengel, J., Baumeister, H., and Sander, L. B. (2021). Cultural adaptation of internet- and mobile-based interventions for mental disorders: a systematic review. *NPJ Digit. Med.* 4, 1–18. doi: 10.1038/s41746-021-00498-1
- Stawarz, K., Preist, C., and Coyle, D. (2019). Use of smartphone apps, social media, and web-based resources to support mental health and well-being: online survey. *JMIR Ment. Heal.* 6, 1–14. doi: 10.2196/12546
- Tateno, M., Kim, D., Teo, A. R., Skokauskas, N., Guerrero, A. P. S., and Kato, T. A. (2019). Smartphone addiction in Japanese college students: usefulness of the Japanese version of the smartphone addiction scale as a screening tool for a new form of internet addiction. *Psychiatry Investig.* 16, 115–120. doi: 10.30773/pi.2018.12.25.2
- Thoits, P. A. (2011). Mechanisms linking social ties and support to physical and mental health. *J. Health Soc. Behav.* 52, 145–161. doi: 10.1177/0022146510395592
- Timmis, S. (2012). Constant companions: instant messaging conversations as sustainable supportive study structures amongst undergraduate peers. *Comput. Educ.* 59, 3–18. doi: 10.1016/j.compedu.2011.09.026
- Veissière, S. P. L., and Stendel, M. (2018). Supernatural monitoring: a social rehearsal account of smartphone addiction. *Front. Psychol.* 9, 1–10. doi: 10.3389/fpsyg.2018.00141
- Vicary, E., Kapadia, D., Bee, P., Bennion, M., and Brooks, H. (2025). The impact of social support on university students living with mental illness: a systematic review and narrative synthesis. *J. Ment. Health* 34, 463–475. doi: 10.1080/09638237.2024.2408237
- Wang, X., Cai, L., Qian, J., and Peng, J. (2014). Social support moderates stress effects on depression. *Int. J. Ment. Health Syst.* 8, 1–5. doi: 10.1186/1752-4458-8-41
- Yus, F. (2022). Smartphone communication: Interactions in the app ecosystem. New York: Routledge.
- Zheng, W., Chen, W., Fang, J., Li, N., Huang, J., Wang, L., et al. (2024). The influence of organizational caring on mobile phone addiction in undergraduate nursing students: the chain mediating role of perceived stress and self-control. *Heliyon* 10, e37679–e37610. doi: 10.1016/j.heliyon.2024.e37679