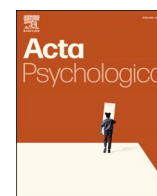




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Environmental effects of social media on university students: A joint moderated mediation analysis of social connectedness and sustainability awareness, and perceived social support

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ABSTRACT

The present study examines how social media engagement shapes environmental well-being among university students by integrating social connectedness, sustainability awareness, and perceived social support into a unified explanatory framework. Grounded in perspectives on social capital, digital connectedness, and environmental psychology, the study conceptualizes environmental well-being as an outcome influenced by the social and cognitive processes activated during online interactions. Social media is viewed as a context that enables relationship-building, identity reinforcement, and the circulation of sustainability-related meanings, all of which may contribute to more positive environmental orientations. Within this framework, social connectedness is positioned as a key mechanism that links online engagement with environmental well-being, while sustainability awareness and perceived social support serve as conditions that may strengthen this link. The study's implications highlight the potential for leveraging social media platforms to promote environmental engagement among university students through strategies that enhance connectedness, awareness, and supportive digital environments.

1. Introduction

Environmental well-being, defined as the extent to which individuals feel positively connected to and satisfied with their natural environment (Alaimo et al., 2020), is increasingly recognized as a critical component of overall well-being (Alam, 2022; Henderson & Loreau, 2023). With growing concerns over climate change, pollution, and resource depletion, fostering environmental well-being has become a pressing global priority (Dwyer, 2023; Martin et al., 2022). In this perspective, social media, with its pervasive reach and ability to facilitate communication and information dissemination, offers a unique platform for promoting environmental awareness and engagement (Kross et al., 2021). According to recent statistics, over 3.8 billion people use social media worldwide, with a significant proportion of users being university students who are highly engaged with these platforms. Beyond simple information exchange, social media functions as a socio-digital environment where identities are negotiated (Tajfel & Turner, 1979), social norms are shaped (Cialdini et al., 1990), and collective understandings of environmental issues are formed and reinforced.

Understanding how social media engagement influences environmental well-being is therefore of paramount importance.

The study has three primary objectives. The first objective is to investigate the mediating role of social connectedness in the relationship between social media engagement and environmental well-being. Social media platforms enable users to maintain and develop social ties, thereby fostering a sense of belonging and community (Beyens et al., 2020a, 2020b). Previous research has established the positive effects of social connectedness on general well-being (Hall & Liu, 2022), but its specific impact on environmental well-being remains underexplored. Theoretically, social connectedness may influence environmental orientations through multiple psychological pathways, including the development of shared group identities (Tajfel & Turner, 1979), the internalization of pro-environmental norms circulating within social networks (Cialdini et al., 1990), and enhanced perceptions of collective efficacy that enable individuals to feel capable of contributing to environmental goals (Bandura, 2000).

The study anticipates that social connectedness can provide individuals with a sense of purpose and collective identity, which may

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extend to pro-environmental attitudes and behaviors. For instance, individuals who feel connected to a community are more likely to engage in activities that benefit the collective good, including environmental conservation efforts (Beyens et al., 2020a, 2020b). Additionally, social networks can serve as channels for disseminating environmental information and fostering discussions about sustainability, further enhancing environmental awareness and action (Kong et al., 2021). Given that social connections can significantly influence individuals' attitudes and behaviors towards environmental issues, examining this mediation is crucial. Understanding the mediating role of social connectedness can reveal how the social benefits of social media engagement translate into positive environmental outcomes, thereby providing insights into leveraging social media for promoting environmental well-being.

The second objective is to examine the moderating effect of sustainability awareness on the relationship between social media engagement and environmental well-being. Sustainability awareness, which refers to the awareness of environmental issues and the importance of sustainable practices, is known to promote pro-environmental behaviors (Baena-Morales et al., 2021; Prabowo et al., 2022). We predict that individuals with high sustainability awareness are more likely to adopt behaviors that reduce their environmental impact, such as recycling, conserving energy, and supporting eco-friendly products. This heightened awareness can also make individuals more receptive to environmental information and initiatives they encounter on social media, amplifying the positive effects of social media engagement (Smaniotto et al., 2022). Despite this, the interaction between sustainability awareness and social media engagement in influencing environmental well-being has not been thoroughly investigated. Understanding this moderating effect can provide insights into how awareness can enhance the positive impacts of social media engagement on environmental outcomes. Specifically, it can reveal whether individuals with higher sustainability awareness derive greater environmental benefits from their social media activities, such as increased participation in environmental campaigns or greater adoption of sustainable practices. This knowledge can inform strategies to target and enhance sustainability awareness in social media campaigns, maximizing their effectiveness in promoting environmental well-being.

The third objective is to explore the moderating role of perceived social support in the relationship between social media engagement and environmental well-being. Perceived social support, or the perception of being supported by others in one's social network, has been shown to enhance individual well-being and encourage positive behaviors, including environmental conservation efforts (McDougall et al., 2016). Recent research has advocated that social support can provide emotional encouragement, practical assistance, and a sense of community (Grey et al., 2020; Szkody et al., 2021), which are crucial for sustaining engagement in pro-environmental activities. For instance, individuals who feel supported are more likely to participate in collective environmental actions, such as community clean-ups or advocacy campaigns, because they feel backed by their social network. Nonetheless, there is limited research on how perceived social support moderates the impact of social media engagement on environmental well-being. Investigating this aspect can reveal how support networks can amplify the benefits of social media engagement for environmental well-being. Specifically, it can show whether individuals who perceive high levels of social support from their network are more likely to translate their social media engagement into tangible environmental actions and improvements in environmental well-being. Understanding this dynamic can inform the design of social media interventions that foster supportive communities, thereby enhancing their effectiveness in promoting environmental sustainability.

Last but not the least, the significance of this study lies in its theoretical and practical contributions. Theoretically, it integrates social media engagement, social connectedness, sustainability awareness, and perceived social support into a comprehensive model of environmental well-being, providing a nuanced understanding of these

interrelationships. By embedding key concepts from social identity theory, norm internalization research, collective efficacy, and digital social capital (Ellison et al., 2007; Grieve et al., 2013), the study offers an integrated theoretical account of how digital interactions shape environmental orientations. Practically, the findings can inform the design of interventions and policies aimed at leveraging social media to promote environmental well-being among university students. By addressing these research gaps, this study advances the field of environmental psychology and social media research, offering valuable insights for scholars, educators, and policymakers (Fig. 1).

2. Theoretical framework

2.1. Hypothesizing the relationship between social media engagement and social connectedness

Social media engagement, which involves actively participating in social media activities such as posting updates, commenting on others' posts, and participating in online discussions (Cao et al., 2021), has been found to significantly influence social connectedness. Social connectedness refers to the feeling of belonging and having meaningful relationships within a community (Pandya & Lodha, 2021). Previous research indicates that social media platforms enable users to maintain and develop social ties, fostering a sense of belonging and community (Pérez-Escoda et al., 2020). These platforms provide an avenue for individuals to share personal experiences, seek advice, and offer support, thereby enhancing their social bonds. Given the interactive nature of social media (Cao et al., 2021), it is reasonable to hypothesize that higher levels of social media engagement lead to greater social connectedness among users.

According to Moran et al. (2020), engaging in social media allows individuals to participate in a variety of social interactions that can strengthen their sense of connectedness. For instance, commenting on friends' posts, sharing life updates, and engaging in group discussions can create a supportive online environment where individuals feel valued and understood. These interactions can foster strong social ties and a sense of community, as users regularly communicate and engage with one another (Pérez-Escoda et al., 2020). In addition, recent studies demonstrate that network externalities and perceived gratifications significantly enhance user engagement in social platforms, thereby strengthening opportunities for meaningful social connection (Pang et al., 2024). System interactivity further shapes ongoing relational engagement, as interactive and responsive platform features foster stronger connectivity and sustained participation in digital communities (Pang & Ruan, 2024). Emotional attachment to platform communities also facilitates belongingness and identification, reinforcing users' sense of connection with others in shared digital spaces (Pang & Zhang, 2024a). Moreover, multidimensional benefits derived from social media engagement, such as informational, social, and hedonic gratifications, can motivate deeper participation and increase relational bonds within online networks (Pang & Zhang, 2024b).

Additionally, the ubiquitous nature of social media means that individuals can stay connected with their social networks regardless of physical distance (Kong et al., 2021). This constant connectivity allows users to maintain relationships with family and friends who may be geographically distant, thereby preserving and enhancing social ties. Studies have shown that individuals who frequently engage in social media activities report higher levels of perceived social support and social connectedness (Lu & Hampton, 2017; Shensa et al., 2016). However, despite extensive empirical support, prior literature often explains this association descriptively rather than theoretically. Existing studies tend to focus on functional features of social platforms (e.g., interactivity, gratifications, attachment), but they rarely examine the deeper psychological mechanism that binds users to social groups. Social Identity Theory (Tajfel & Turner, 1979) asserts that individuals derive a sense of belonging, emotional security, and shared identity

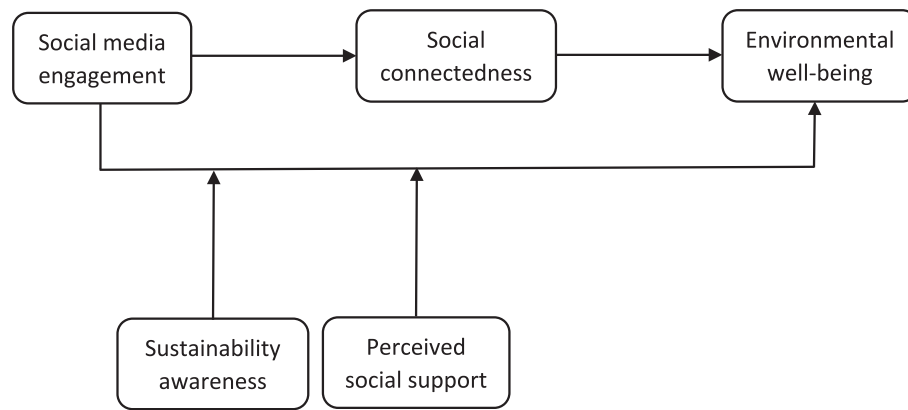


Fig. 1. A joint moderated mediation model.

through group-based interactions. Building on this, subsequent research demonstrates that identity processes shape social bonding, collective affiliation, and well-being outcomes (Haslam et al., 2015). Yet digital engagement research has largely overlooked this identity-building function of online participation, treating engagement mainly as a behavioral or technological outcome rather than an identity-relevant cue. By applying SIT, the present study clarifies that social media engagement provides salient social signals—recognition, validation, and group membership cues—that help users internalize group identity. Therefore, it is hypothesized that social media engagement positively influences social connectedness, as it facilitates regular and meaningful social interactions that contribute to a strong sense of community and belonging.

H1. *Social media engagement is positively related to social connectedness.*

2.2. Hypothesizing the relationship between social connectedness and environmental well-being

Social connectedness, characterized by a sense of belonging and meaningful relationships within a community (Haslam et al., 2015), is increasingly recognized as an important factor influencing various aspects of well-being, including environmental well-being. Environmental well-being refers to an individual's satisfaction with and positive feelings towards their natural environment (Alaimo et al., 2020). Previous research suggests that strong social ties can foster a sense of collective responsibility and engagement in pro-environmental behaviors (Capaldi & Zelenski, 2016). When individuals feel connected to their community, they are more likely to engage in actions that benefit the environment, motivated by a shared sense of purpose and mutual support. Social connectedness can enhance environmental well-being through several mechanisms. Firstly, individuals who are well-connected within their communities are more likely to participate in collective environmental initiatives, such as community clean-ups, recycling programs, and local conservation efforts (Anggraini et al., 2019). These activities not only contribute to the physical improvement of the environment but also reinforce the individuals' connection to their surroundings, thereby enhancing their environmental well-being. Additionally, being part of a supportive social network can provide the emotional and practical support needed to sustain engagement in environmentally friendly practices, even when such efforts are challenging or require significant personal investment (Moldavanova & Goerdel, 2021).

From a Social Identity Theory perspective, social connectedness reflects individuals' psychological identification with a social collective rather than merely interpersonal closeness (Tajfel & Turner, 1979). When individuals perceive themselves as connected members of a group, they are more likely to internalize group-level norms, values, and expectations that define appropriate attitudes and behaviors. In socially connected networks, sustainability-related norms are repeatedly

communicated, endorsed, and reinforced through shared interactions, enabling norm internalization to occur via social connectedness (Barrera-Hernández et al., 2020; Riechers et al., 2021). As environmental concern becomes embedded within individuals' social identity, evaluations of the surrounding natural environment become identity-consistent, thereby strengthening environmental well-being (Haslam et al., 2015).

Moreover, social networks often serve as channels for disseminating information about environmental issues and sustainable practices (Barrera-Hernández et al., 2020). Through their social connections, individuals can learn about new ways to reduce their environmental footprint, share tips and resources, and motivate each other to adopt more sustainable behaviors (Riechers et al., 2021). This exchange of information and encouragement can lead to greater environmental awareness and action, ultimately improving environmental well-being. Studies have shown that individuals who feel connected to their communities are more likely to report higher levels of environmental well-being, as they perceive a stronger alignment between their personal values and the collective efforts of their community (Barrera-Hernández et al., 2020; Martin et al., 2020). Therefore, it is hypothesized that social connectedness leads positively to environmental well-being.

H2. *Social connectedness is positively related to environmental well-being.*

2.3. Hypothesizing the mediation effect of social connectedness

Research suggests that social media engagement can lead to increased social connectedness, which subsequently enhances environmental well-being. The first hypothesis posits that social media engagement is positively related to social connectedness. Engaging actively on social media platforms allows individuals to interact, share experiences, and form meaningful connections, thereby increasing their sense of belonging and community (Dvorský et al., 2023). This implies that higher levels of social media engagement will result in greater social connectedness among users. Similarly, the second hypothesis proposes that social connectedness is positively related to environmental well-being. Individuals who feel connected to their community are more likely to participate in collective environmental efforts and adopt pro-environmental behaviors. This relationship is supported by research showing that social ties can foster a sense of collective responsibility and engagement in environmental actions, thereby enhancing environmental well-being (Kong et al., 2021).

From an environmental psychology perspective, social connectedness functions as a transmission mechanism through which sustainability-related norms encountered on social media are cognitively and emotionally assimilated. Repeated exposure to shared meanings, peer endorsements, and collective interpretations of environmental issues strengthens social connectedness, enabling norm internalization by embedding environmental values within shared

group identity (Barrera-Hernández et al., 2020; Riechers et al., 2021). Consequently, environmental well-being emerges not directly from digital engagement, but from socially reinforced and identity-consistent evaluations of the environment.

Taken together, we suggest our third hypothesis that social connectedness mediates the relationship between social media engagement and environmental well-being. This mediation effect implies that social media engagement leads to greater social connectedness, which in turn enhances environmental well-being. By fostering strong social bonds through digital interactions, individuals are more likely to engage in and support pro-environmental initiatives, translating their online engagement into tangible environmental benefits. The underlying premise highlights the importance of social connections in converting social media engagement into positive environmental outcomes (Bentley et al., 2021). Nevertheless, previous studies have rarely integrated these two pathways into a unified explanatory mechanism. Although research shows that connected communities are more willing to participate in conservation and sustainability practices (Anggraini et al., 2019), most work stops short of explaining *how* connectedness translates digital participation into environmental outcomes. Environmental psychology suggests that individuals embedded in strong social networks internalize shared environmental values, because community interactions enable the transmission of norms, expectations, and ecological awareness (Barrera-Hernández et al., 2020; Riechers et al., 2021). This perspective offers a more coherent explanation of the mediation process by highlighting that social connectedness does not merely provide emotional support—it functions as a channel through which environmental values are reinforced and enacted.

By adopting this value-transmission and norm-diffusion lens, the present study addresses a major gap: while past literature links social media engagement with connectedness and connects connectedness to environmental behavior, it rarely conceptualizes connectedness as the psychological mechanism that *transfers* environmental values into well-being. This interpretation contributes to a more integrated understanding of how digital social experiences evolve into environmentally meaningful outcomes.

H3. *Social connectedness mediates the relationship between social media engagement and environmental well-being.*

2.4. Hypothesizing the moderating role of sustainability awareness

Sustainability awareness plays a pivotal role in enhancing the impact of social media engagement on environmental well-being through the pathway of social connectedness. Research suggests that individuals with a heightened awareness of sustainability issues are more likely to interpret and act on environmental information encountered on social media platforms (Fifita et al., 2020). This awareness not only increases the likelihood of engaging in discussions about sustainability but also fosters a deeper connection with others who share similar environmental concerns, thereby strengthening social ties within these contexts (Wamsler, 2020).

Further supporting this notion, studies have shown that individuals who are aware of environmental challenges are more receptive to sustainability campaigns and information shared online, which can significantly influence their social behaviors and choices (Arnedo et al., 2021). These individuals often use their social media networks as platforms to disseminate environmental knowledge, thereby playing a crucial role in shaping public perceptions and behaviors towards sustainability (Mazzocchi, 2020). Additionally, the work of Lawrance et al. (2021) emphasizes that the personalization of climate change issues via social media can enhance the meaningfulness of these topics for individuals, thereby encouraging a more profound engagement and connection with others around sustainability initiatives.

It is hypothesized that sustainability awareness moderates the relationship between social media engagement and environmental well-

being through social connectedness. Specifically, for individuals with high sustainability awareness, the link between social media engagement and environmental well-being is expected to be stronger. This is because these individuals are more receptive to environmental content and community engagement on social media, which enhances their sense of connectedness to like-minded peers and motivates collective environmental actions (Lawrance et al., 2022). Thus, sustainability awareness could amplify the beneficial effects of social media by transforming social interactions into environmental activism and greater environmental well-being.

However, previous research has largely considered sustainability awareness as a direct predictor of environmental behavior, rather than a boundary condition that shapes how social processes unfold. Most studies emphasize what aware individuals *do*, but seldom examine how awareness alters the *strength* of social pathways triggered by digital engagement. Environmental psychology highlights that awareness functions as a cognitive amplifier—individuals with stronger knowledge structures process environmental cues more deeply and respond more strongly to value-consistent information (Arnedo et al., 2021; Fifita et al., 2020). From this perspective, awareness enhances sensitivity to sustainability-related content circulating within social networks, making social connectedness more consequential for environmental outcomes.

By adopting this cognitive-amplification view, the present study identifies a theoretical gap: although earlier literature documents the importance of sustainability awareness, it rarely positions awareness as a moderator that intensifies the social influence channel. This contribution advances the field by showing that awareness does not merely foster environmental action—it strengthens the social mechanisms through which environmental values are shared, reinforced, and enacted through connectedness.

H4. *Sustainability awareness moderates the positive relationship between social media engagement and environmental well-being via social connectedness, such that the relationship is stronger for individuals with higher levels of sustainability awareness.*

2.5. Hypothesizing the moderating role of perceived social support

In addition, perceived social support is hypothesized to play a critical moderating role in the relationship between social media engagement and environmental well-being through the conduit of social connectedness. Perceived social support enhances the effects of social interactions on individual well-being, providing individuals with emotional encouragement and practical assistance, which are essential for maintaining engagement in environmentally friendly practices (Lin & Kishore, 2021). Social media platforms, which facilitate widespread and diverse interactions, can be potent environments where perceived social support can strengthen the impact of these interactions on environmental behaviors.

Thus, the study hypothesizes that perceived social support moderates the link between social media engagement and environmental well-being, mediated by social connectedness. Specifically, individuals who perceive higher levels of support from their online networks are likely to experience a stronger positive relationship between their social media engagement and environmental well-being. This is because supportive networks can enhance the motivational and emotional resources available to individuals, making them more likely to engage with and act upon pro-environmental content shared on social media (Boulianne et al., 2020). Moreover, when people feel supported, they are more likely to share and propagate sustainable practices within their networks, thereby enhancing their connectedness and collective environmental impact (Hysa et al., 2022).

In essence, this hypothesis suggests that the benefits of social media engagement on environmental well-being are maximized in contexts where individuals perceive high levels of social support. Such support

not only bolsters personal capacity for environmental stewardship but also enriches the social fabric necessary for collective environmental action (Hysa et al., 2021). This interaction highlights the potential of leveraging perceived social support within social media strategies to enhance the environmental well-being of communities. Thus,

H5. *Perceived social support moderates the positive relationship between social media engagement and environmental well-being via social connectedness, such that the relationship is stronger for individuals with higher levels of perceived social support.*

2.6. Methodology

The study employs a quantitative, cross-sectional survey design to examine the environmental effects of social media among university students. A cross-sectional survey-based approach was utilized, enabling the collection of data at a single point in time to analyze the relationships between social media engagement, social connectedness, sustainability awareness, perceived social support, and environmental well-being. To strengthen methodological rigor, the sampling frame was expanded to include four universities representing diverse academic programs, and the selection of majors was based on disciplinary clusters commonly used in higher education research (e.g., social sciences, natural sciences, engineering, business, and arts/humanities).

The target population for this study consists of students enrolled in various universities. Students were chosen due to their high engagement with social media and their increasing awareness of environmental issues. To ensure disciplinary and demographic representation, a stratified random sampling technique was employed, with stratification based on gender, age, and academic major. Within each university, students were randomly selected from each disciplinary stratum. This approach enhanced the generalizability of the findings and minimized sampling bias (Ding et al., 1996).

Data was collected using a structured questionnaire administered through face-to-face mode of data collection. The questionnaire included validated scales to measure social media engagement, social connectedness, sustainability awareness, perceived social support, and environmental well-being. The items for each construct were rated on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The survey was accompanied by a cover letter explaining the purpose of the study and ensuring confidentiality.

In total, 800 students were approached to participate in the survey. Out of these, 650 students responded, resulting in a response rate of 81.25 %. After screening the responses for completeness and consistency, 620 valid responses were processed for analysis. Ethical approval for the study was obtained from the institutional review board (IRB) of the affiliated university. Participants were provided with detailed information about the study's purpose, procedures, and their rights as participants. Informed consent was obtained prior to participation, ensuring that participants were aware of their voluntary involvement and could withdraw at any time without any consequences. To improve transparency, a summary table of sample sources (universities $\times$ academic majors) has been added in [Appendix A](#).

The demographic details of the participants in this study are varied and represent a broad spectrum of university students. Among the 620 valid responses processed for analysis, 54.2 % of the participants were male, and 45.8 % were female. In terms of age, 33.5 % were between 18 and 21 years old, 42.7 % were between 22 and 25 years old, 17.8 % were between 26 and 29 years old, and 6.0 % were 30 years and above. The academic disciplines of the participants were also diverse, with 29.3 % studying social sciences, 25.7 % in natural sciences, 17.4 % in engineering, 15.5 % in business, and 12.1 % in arts and humanities. Regarding their year of study, 18.2 % were in 1st year, 26.7 % were in 2nd year, 33.1 % were in 3rd year, and 22.0 % were in 4th year. The frequency of social media use among participants also varied, with 10.5 % using social media for less than 1 h per day, 27.3 % for 1–2 h per day,

32.8 % for 2–3 h per day, and the remaining participants using it for more than 3 h per day.

2.7. Research instruments

In this study, we have adapted each scale from established sources to ensure the reliability and validity of our measurements. The social media engagement scale, comprising 7 items, was adapted from prior research on social media behaviors (e.g., “I actively participate in discussions on social media platforms”) (Bryla et al., 2022; Dessart, 2017; Dolan et al., 2019). The social connectedness scale, consisting of 7 items, was sourced from studies on online community engagement (e.g., “I feel a sense of belonging with my online community”) (Bailey et al., 2018; Kong et al., 2021). For environmental well-being, we adapted 8 items from environmental psychology literature (e.g., “I am satisfied with the quality of the environment in my community”) (Alaimo et al., 2020; Tam & Milfont, 2020; Vesely & Klöckner, 2020). Environmental well-being in this study refers to individuals' subjective perceptions, emotional evaluations, and satisfaction with the quality of their surrounding natural environment. This operationalization focuses on psychological appraisal rather than behavioral engagement, aligning with prior environmental psychology measures (Alaimo et al., 2020; Tam & Milfont, 2020). The sustainability awareness scale includes 7 items and was adapted from environmental awareness studies (e.g., “I am aware of the environmental impact of my actions”) (Oriade et al., 2021; Smaniotto et al., 2022). Lastly, the perceived social support scale, with 7 items, was adapted from social support research (e.g., “I feel that I have friends and family who support me”) (Gülaçtı, 2010; Ramkissoon, 2023) ([Appendix B](#)).

3. Results

3.1. Measurement model analysis

3.1.1. Construct and indicator reliability and convergent validity

For analyzing the structural equation model, we first need to assess the measurement model. According to Hair et al. (2019), factor loadings should exceed 0.70 to indicate that each item contributes significantly to the construct. Further, the average variance extracted (AVE) should be greater than 0.50 to demonstrate that the construct explains more than half of the variance of its indicators. Additionally, Cronbach's alpha (CA) and composite reliability (CR) should both be at least 0.70 to ensure adequate convergent validity and internal consistency of the scales.

The results of the measurement model assessment are presented in [Appendix 1](#). For all constructs—social media engagement, social connectedness, environmental well-being, sustainability awareness, and perceived social support—the factor loadings, AVE, CA, and CR values met the recommended thresholds. These results indicate that the scale items reliably measure their respective constructs, reflecting strong correlations between the items and their underlying factors. This robust measurement model provides a solid foundation for further analysis of the structural relationships between the constructs.

3.1.2. Discriminant validity

To assess discriminant validity, we used the Heterotrait-Monotrait (HTMT) ratio of correlations. According to Henseler et al. (2015), HTMT values should be below 0.85 to indicate that the constructs are distinct from one another. HTMT is a more stringent criterion compared to traditional methods such as Fornell-Larcker criterion and cross-loadings.

The results of the HTMT analysis are presented in [Table 1](#). The values for HTMT ranged from 0.01 to 0.811, indicating adequate discriminant validity between the constructs. Specifically, the HTMT values between environmental well-being and other constructs were all below 0.85, with the highest being 0.751 with social connectedness. Similarly, perceived social support had HTMT values below the threshold with

Table 1
Discriminant validity via HTMT ratio.

	EWB	PSS	SC	SME	SA
EWB					
PSS	0.211				
SC	0.751	0.774			
SME	0.552	0.098	0.32		
SA	0.362	0.526	0.811	0.01	

Note(s). EWB = environmental well-being, PSS = perceived social support, SC = social connectedness, SME = social media engagement, SA = sustainability awareness.

other constructs, ensuring its discriminant validity. The HTMT values for social connectedness with other constructs were also within acceptable limits, with the highest being 0.811 with sustainability awareness. Social media engagement and sustainability awareness had the lowest HTMT values with other constructs, further supporting discriminant validity. These results confirm that the constructs in the model are distinct and measure different underlying concepts.

3.1.3. Model's predictive relevance

To further assess the predictive relevance of the model, we conducted the construct cross-validated redundancy analysis using the Q^2 statistic. The Q^2 statistic is calculated as $Q^2 = 1 - SSESQ/Q^2 = 1 - SSOSSE$, where SSE is the sum of squared prediction errors and SSO is the sum of squared observations. According to Chin (1998), a Q^2 value greater than 0 indicates that the model has predictive relevance for a particular construct.

The results of the construct cross-validated redundancy analysis are presented in Appendix 2. The Q^2 value for environmental well-being is 0.325, indicating that the model has substantial predictive relevance for this construct. Similarly, the Q^2 value for social connectedness is 0.140, suggesting that the model also has predictive relevance for social connectedness, though to a lesser extent compared to environmental well-being.

These Q^2 values support the model's ability to predict the constructs of environmental well-being and social connectedness, reinforcing the validity and reliability of the proposed structural relationships.

In addition to Q^2 values, the model's explanatory power was evaluated through R^2 statistics. The R^2 value for social connectedness was 0.412, indicating that social media engagement explains a substantial proportion of variance in students' sense of connectedness. Similarly, the R^2 for environmental well-being was 0.489, demonstrating that the combination of social media engagement, social connectedness, sustainability awareness, and perceived social support collectively accounts for meaningful variance in environmental well-being. These R^2 values reinforce that the structural model possesses acceptable explanatory strength in the context of social-behavioral research.

In addition to R^2 and Q^2 , the global model fit was assessed using the standardized root mean square residual (SRMR), which is recommended as an approximate model fit measure in PLS-SEM (Hair et al., 2019). The SRMR value for the proposed model was 0.062, which is below the conservative threshold of 0.08, indicating an acceptable overall model fit.

3.2. Structural model analysis

3.2.1. Direct path analysis

To assess the structural model, direct path analysis was conducted. This involves examining the path coefficients (B), their standard deviations (STDEV), t-statistics ($|O/STDEV|$), p-values, and confidence intervals (CI) to determine the strength and significance of the relationships between the constructs. According to standard guidelines (Hair et al., 2019), a p-value less than 0.05 indicates statistical significance, and the confidence intervals should not include zero to confirm the significance of the path.

The results of the direct path analysis are presented in Table 2. The path from social media engagement to social connectedness had a coefficient (B) of 0.336 with a standard deviation of 0.073, a t-statistic of 4.612, and a p-value of 0.000. The confidence interval ranged from 0.192 to 0.488, indicating a significant positive relationship between social media engagement and social connectedness, confirming H1.

Similarly, the path from social connectedness to environmental well-being had a coefficient (B) of 0.549 with a standard deviation of 0.101, a t-statistic of 5.462, and a p-value of 0.000. The confidence interval ranged from 0.373 to 0.746, suggesting a strong and significant positive relationship between social connectedness and environmental well-being, supporting H2.

The path from social media engagement to environmental well-being showed a coefficient (B) of 0.264 with a standard deviation of 0.102, a t-statistic of 2.590, and a p-value of 0.010. The confidence interval ranged from 0.052 to 0.433, indicating a significant direct effect of social media engagement on environmental well-being. The direct path analysis demonstrates that social media engagement positively influences social connectedness, which in turn significantly enhances environmental well-being.

3.2.2. Specific indirect path analysis

To further understand the mediating effect of social connectedness, specific indirect path analysis was conducted. This analysis examines the indirect effects of social media engagement on environmental well-being through the mediator, social connectedness. The path coefficients (B), their standard deviations (STDEV), t-statistics ($|O/STDEV|$), p-values, and confidence intervals (CI) are reported to determine the significance and strength of these indirect relationships.

The results of the specific indirect path analysis are presented in Table 3. The path from social media engagement to environmental well-being through social connectedness had a coefficient (B) of 0.185 with a standard deviation of 0.056, a t-statistic of 3.314, and a p-value of 0.001. The confidence interval ranged from 0.098 to 0.313, indicating a significant indirect effect. These findings suggest that social connectedness significantly mediates the relationship between social media engagement and environmental well-being, confirming H3.

3.2.3. Moderated mediation path analysis

To investigate the moderated mediation effects, a moderated mediation path analysis was conducted using a 10 % significance level. This analysis examines how the interaction between perceived social support and social media engagement, as well as the interaction between sustainability awareness and social media engagement, influences environmental well-being. The path coefficients (B), their standard deviations (STDEV), t-statistics ($|O/STDEV|$), p-values, and confidence intervals (CI) are reported to determine the significance and strength of these interactions.

The results of the moderated mediation path analysis are presented in Table 4. The interaction effect of sustainability awareness and social media engagement on environmental well-being had a coefficient (B) of 0.138 with a standard deviation of 0.062, a t-statistic of 2.238, and a p-value of 0.026. The confidence interval ranged from 0.023 to 0.222, indicating a significant positive interaction effect at the 5 % significance level. This suggests that sustainability awareness enhances the positive impact of social media engagement on environmental well-being.

The interaction effect of perceived social support and social media engagement on environmental well-being had a coefficient (B) of 0.127 with a standard deviation of 0.067, a t-statistic of 1.881, and a p-value of 0.061. The confidence interval ranged from 0.020 to 0.243. With a 10 % significance level, this result is considered significant, indicating that perceived social support positively moderates the relationship between social media engagement and environmental well-being. These findings suggest that both sustainability awareness and perceived social support significantly moderate the relationship between social media engagement and environmental well-being, confirming H4 and H5. Fig. 2

Table 2

Direct path analysis.

	Path (B)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values	2.5 % CI	97.5 % CI
Social media engagement - > social connectedness	0.336	0.073	4.612	0	0.192	0.488
Social connectedness - > environmental well-being	0.549	0.101	5.462	0	0.373	0.746
Social media engagement - > environmental well-being	0.264	0.102	2.59	0.01	0.052	0.433

Table 3

Specific indirect path analysis.

	Path (B)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values	2.5 % CI	97.5 % CI
Social media engagement - > social connectedness - > environmental well-being	0.185	0.056	3.314	0.001	0.098	0.313

Table 4

Moderated mediation path analysis.

	Path (B)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values	5 % CI	95 % CI
Sustainability awareness x social media engagement - > environmental well-being	0.138	0.062	2.238	0.026	0.023	0.222
Perceived social support x social media engagement - > environmental well-being	0.127	0.067	1.881	0.061	0.02	0.243

presents the structural equation model.

Although the moderating effects of sustainability awareness ($\beta = 0.138$) and perceived social support ($\beta = 0.127$) are statistically significant, their magnitudes fall within the range commonly observed in behavioral moderation research. Small coefficients are typical in interaction models because moderation often reflects subtle boundary conditions rather than large direct effects. Accordingly, these effects should be understood as theoretically meaningful signals that the strength of the social media $\rightarrow$ environmental well-being pathway varies across individuals, rather than as large practical shifts in outcomes. This interpretation aligns with prior evidence showing that even modest interaction effects can meaningfully shape pro-environmental intentions and social-psychological processes.

Simple slope analyses are shown in Fig. 3 and Fig. 4. The three lines represent the relationship between social media engagement and environmental well-being. The middle line shows the average of the moderating variable. The other two lines show the relationship between social media engagement and environmental well-being for higher (i.e., mean value of the moderator plus one standard deviation) and lower (i.e., mean value of the moderator minus one standard deviation) levels of the moderator.

In Fig. 3, which illustrates the interaction between sustainability awareness and social media engagement, the relationship between social media engagement and environmental well-being is positive for all

three lines. This indicates that higher levels of social media engagement are associated with greater environmental well-being, particularly when sustainability awareness is high.

Similarly, in Fig. 4, depicting the interaction between perceived social support and social media engagement, the relationship between social media engagement and environmental well-being remains positive across all levels of perceived social support. Thus, higher levels of social media engagement correspond to higher environmental well-being, especially when perceived social support is high. This analysis demonstrates that both sustainability awareness and perceived social support enhance the positive effects of social media engagement on environmental well-being.

4. Discussion

The findings of this study provide valuable insights into the environmental effects of social media engagement on university students, aligning with and extending the existing body of research. Previous studies have established the role of social media in enhancing social connectedness and well-being (Ortiz-Ospina & Roser, 2024; Popat & Tarrant, 2023). Our study builds on this foundation by exploring the specific context of environmental well-being and integrating the moderating effects of sustainability awareness and perceived social support. In doing so, the findings contribute to a deeper theoretical understanding of how digital interactions intersect with environmental psychology through social-identity and social-capital mechanisms.

The positive relationship between social media engagement and social connectedness identified in our study is consistent with previous research that highlights how social media platforms facilitate social interactions and foster a sense of community (Abebe et al., 2024; Michikyan et al., 2023). This study extends these findings by demonstrating that social connectedness also mediates the relationship between social media engagement and environmental well-being. This suggests that the social bonds formed through social media can translate into a greater sense of responsibility and engagement with environmental issues, supporting the work of Schaar et al. (2024) who emphasize the social dimensions of environmental attitudes and behaviors. From a theoretical standpoint, this supports Social Identity Theory Jackman et al. (2023) by showing that online group belonging strengthens pro-environmental self-perceptions, and aligns with Social Capital Theory (Ellison et al., 2007; Wong, 2023) by illustrating how relational resources can translate into environmental outcomes.

Our results also confirm the significant positive impact of social connectedness on environmental well-being. This finding aligns with previous research that links social capital and community engagement with pro-environmental behaviors (Wong, 2023). From a Social Identity Theory perspective, these findings indicate that social connectedness operates by transforming digitally mediated social relationships into identity-relevant experiences, while norm internalization functions as the psychological process through which sustainability-oriented meanings circulating within social networks become personally significant, thereby enhancing environmental well-being (Tajfel & Turner, 1979; Haslam et al., 2015). The mediating role of social connectedness underscores the importance of fostering strong social networks to enhance environmental outcomes, suggesting that initiatives aimed at increasing social interaction could have positive environmental benefits.

The moderated mediation analysis reveals that sustainability awareness amplifies the positive effects of social media engagement on

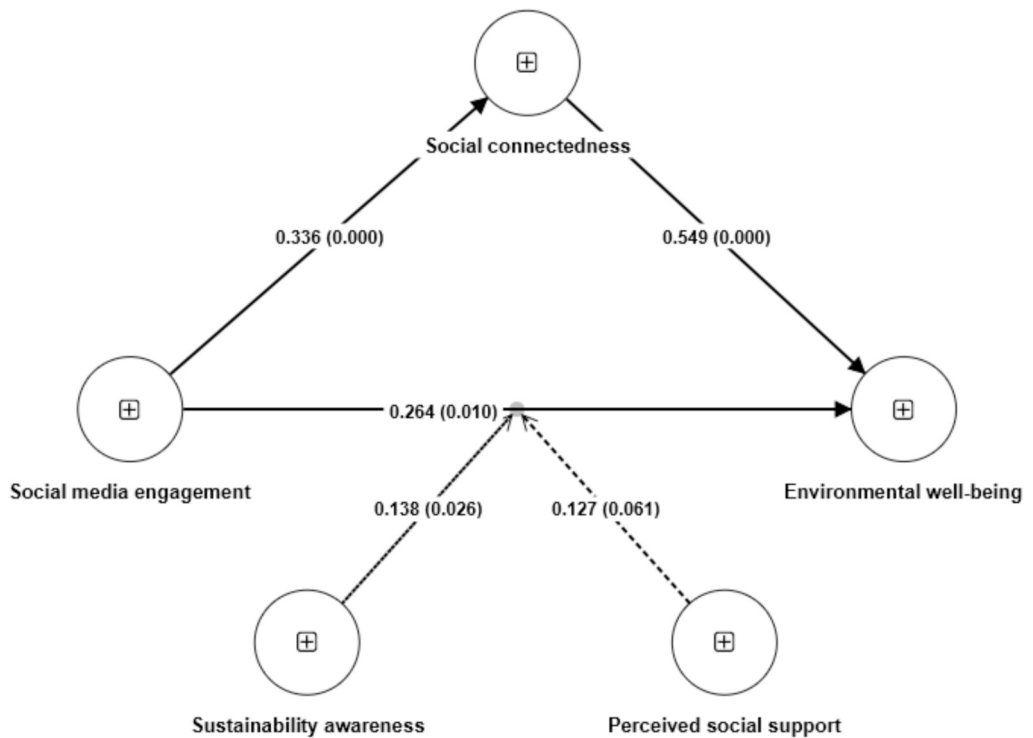


Fig. 2. A joint moderated mediation SEM.

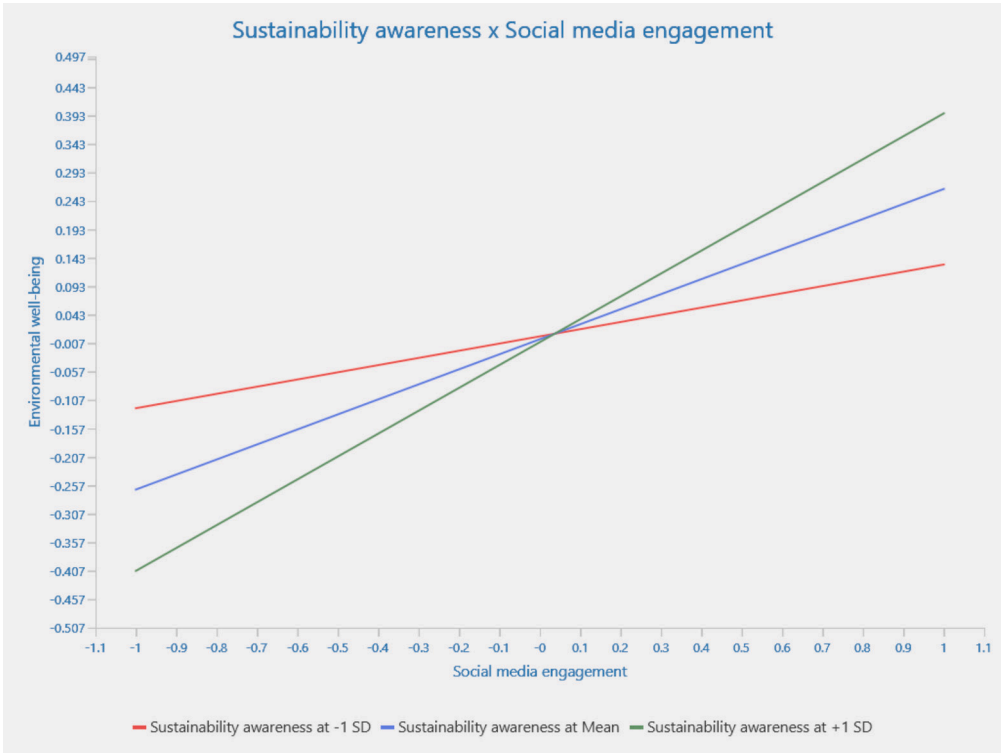


Fig. 3. Sustainability x social media engagement.

environmental well-being. This supports the findings of previous studies that emphasize the critical role of environmental knowledge and awareness in promoting sustainable behaviors (Chaihananchai & Anantachart, 2023). Our study contributes to this literature by showing that sustainability awareness not only directly influences environmental behaviors but also enhances the impact of social media engagement.

However, this relationship must be interpreted within the broader “double-edged sword” nature of social media: while digital platforms can build belonging and motivation, they can also produce information overload, distraction, and reduced offline engagement—factors that may weaken environmental focus for some students (Pang & Ruan, 2024). This dialectical interpretation highlights the need for intentional,

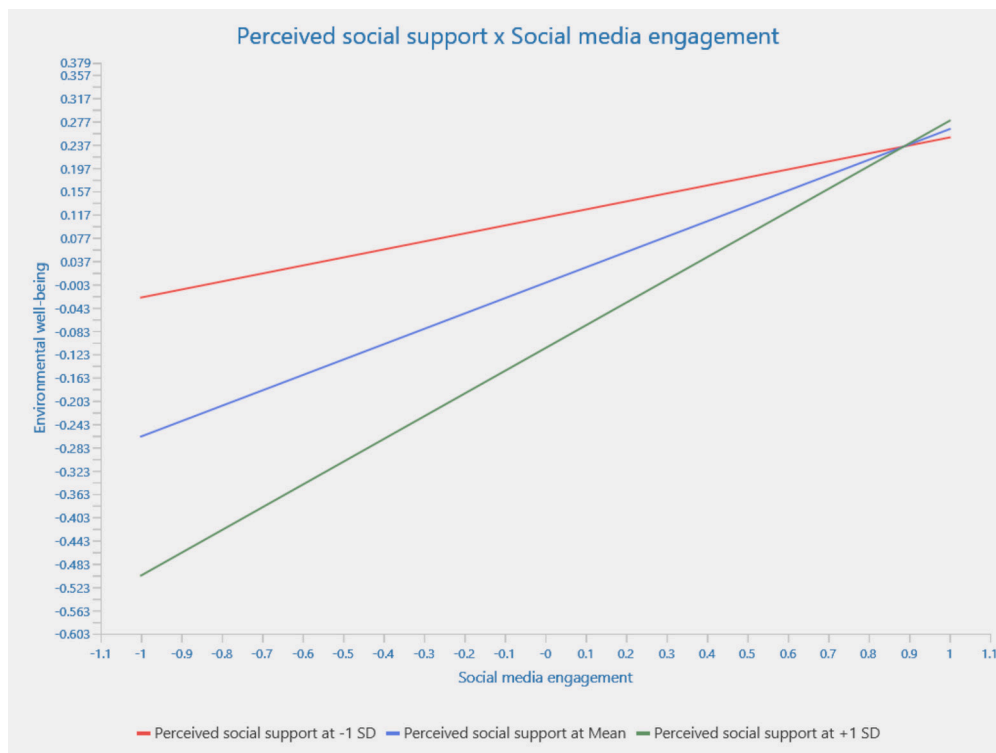


Fig. 4. Perceived social support x social media engagement.

structured digital environments to maximize positive outcomes.

Similarly, the moderating role of perceived social support in our study highlights the importance of social networks in environmental engagement. This is consistent with findings from prior research that demonstrate how social support can enhance individual well-being and motivate pro-environmental actions (Jackman et al., 2023; Novara et al., 2023). Our results suggest that students who feel supported by their peers and family are more likely to translate their social media engagement into positive environmental outcomes. This suggests that cognitive readiness acts as a psychological filter through which social media cues become meaningful environmental motivations.

In conclusion, this study provides empirical evidence that social media engagement can positively influence environmental well-being through the mediating role of social connectedness and the moderating effects of sustainability awareness and perceived social support. These findings highlight the interconnectedness of social and environmental factors and suggest pathways for enhancing environmental engagement among university students. Future research should continue to explore these relationships in different contexts and among diverse populations to further validate and extend these findings. This aligns with theoretical expectations that emotional and relational reassurance strengthens both identity-based motivation (Pang & Zhang, 2024a, 2024b) and sustained environmental commitment (Cop et al., 2020).

The findings of this study offer significant theoretical and practical implications, advancing our understanding of the intersection between social media engagement, social connectedness, sustainability awareness, perceived social support, and environmental well-being.

This study contributes to the theoretical framework of environmental psychology and social media research by integrating these domains to explore how digital interactions influence environmental well-being. The confirmation of social connectedness as a mediator between social media engagement and environmental well-being enriches existing theories that link social capital with pro-environmental behaviors (Satici et al., 2016). This mediation illuminates the importance of social relationships in the environmental context, suggesting that digital social

interactions can foster environmental consciousness and actions. More importantly, the results provide a theoretically grounded explanation—rooted in Social Identity Theory—of why online engagement fosters a sense of belonging that translates into environmental concern.

Additionally, the moderation effects of sustainability awareness and perceived social support highlight the nuanced ways in which individual differences impact the relationship between social media use and environmental outcomes. These findings support and extend the theoretical models of pro-environmental behavior that emphasize the role of knowledge and social influences (Zhang & Chabay, 2020). By demonstrating that sustainability awareness and social support can amplify the positive effects of social media engagement, this study suggests a more complex interplay of cognitive and social factors in environmental well-being.

From a practical perspective, the study's findings offer actionable insights for educators, policymakers, and social media platforms aiming to enhance environmental engagement among university students.

For educators and university administrators, the results suggest that integrating social media into environmental education programs could enhance student engagement and connectedness. Creating online communities and discussion groups focused on sustainability topics can leverage the positive relationship between social media engagement and environmental well-being. Universities could establish curated “green hubs” on existing platforms where students share environmental actions, participate in weekly challenges, and receive peer support for sustainable behavior.

Policymakers can use these insights to design more effective environmental campaigns. By targeting social media platforms and utilizing influencers who can reach a broad audience, campaigns can enhance social connectedness and promote sustainability awareness. Campaigns can be made more actionable by using micro-influencers within universities, embedding localized environmental tips, and promoting community-based environmental commitments that leverage peer support.

For social media platform developers, the study highlights the potential for these platforms to be used as tools for positive environmental

change. Features that promote community building and sustainability education can be incorporated to support users' environmental well-being. Platforms could integrate sustainability badges, content-curation tools that highlight credible environmental posts, or built-in support prompts encouraging users to join sustainability groups or share eco-friendly actions.

In summary, this study provides a comprehensive understanding of how social media engagement can be harnessed to enhance environmental well-being through increased social connectedness, sustainability awareness, and perceived social support. These theoretical and practical implications offer a roadmap for leveraging digital interactions to foster a more environmentally conscious and engaged student population.

Despite the valuable insights provided by this study, several limitations should be acknowledged. First, the cross-sectional design limits the ability to draw causal inferences about the relationships between social media engagement, social connectedness, sustainability awareness, perceived social support, and environmental well-being. Future research should employ longitudinal designs to better capture the dynamic and potentially causal nature of these relationships over time. Second, the study relies on self-reported data, which may be subject to social desirability bias and inaccuracies in participants' recall or reporting. Future studies could incorporate objective measures of social media usage and environmental behaviors to validate and extend these findings.

Additionally, while the sample of university students provides relevant insights into this population, the generalizability of the results to other groups, such as older adults or different cultural contexts, remains uncertain. Expanding research to diverse populations and settings will enhance the robustness and applicability of the findings.

Although the study captures environmental well-being as a subjective perceptual construct, it does not incorporate behavioral indicators such as recycling frequency or personal conservation activities. This limits the ability to infer whether positive environmental evaluations translate into actual pro-environmental behaviors. Future research should integrate both perceptual and behavioral measures to more comprehensively capture environmental well-being.

Finally, the study focuses on a limited number of moderators and mediators; future research should explore other potential factors that may influence the relationship between social media engagement and environmental well-being, such as personality traits, specific social media platform features, or types of environmental content. These directions will help build a more comprehensive understanding of the complex interplay between digital interactions and environmental

outcomes.

5. Conclusion

This study provides a comprehensive analysis of the environmental effects of social media engagement on university students, emphasizing the critical roles of social connectedness, sustainability awareness, and perceived social support. The findings underscore that social media engagement positively influences environmental well-being, primarily through enhanced social connectedness. Moreover, sustainability awareness and perceived social support significantly moderate this relationship, amplifying the positive impact. These insights highlight the potential of leveraging social media platforms to foster environmental consciousness and well-being among students. Beyond empirical findings, the study offers several key contributions. Theoretically, it advances environmental well-being research by integrating a social-psychological pathway (social connectedness) and two boundary conditions (sustainability awareness and perceived social support), thereby extending prior work that rarely examines these mechanisms together. Empirically, the study provides evidence from a large and diverse sample of university students, contributing to a deeper understanding of how digital engagement translates into pro-environmental attitudes. Practically, the results inform educators, policymakers, and platform designers on how to structure digital interventions that strengthen connectedness and supportive climates to promote sustainable behaviors. By integrating these findings into educational strategies, policy initiatives, and platform designs, stakeholders can promote more sustainable behaviors and enhance the environmental well-being of the broader community.

CRedit authorship contribution statement

Zhanyang Yuan: Writing – review & editing, Writing – original draft, Validation, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.
Xiaoyun Tang: Writing – review & editing, Writing – original draft, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Appendix A. Sample characteristics

University	Social Sciences	Natural Sciences	Engineering	Business	Arts & Humanities	Total
University A	58	52	37	33	26	206
University B	42	36	28	27	21	154
University C	46	40	25	21	18	150
University D	36	32	18	15	11	112
Total	182	160	108	96	76	620

Appendix B. Measurement scales

Social media engagement

1. I actively participate in discussions on social media platforms. (*sample*)
2. I frequently comment on posts made by others.
3. I regularly share content that interests me.
4. I stay updated by checking social media several times a day.
5. I engage with others' posts by liking or reacting to them.

6. I join social media groups or pages related to my interests.
7. I often create new posts or updates to share with my friends.

Social connectedness

1. I feel a sense of belonging with my online community. *(sample)*
2. I feel emotionally connected to the people I interact with online.
3. I can rely on my online friends when I need support.
4. I feel understood by the people I communicate with on social media.
5. I enjoy interacting with others on social media because it makes me feel included.
6. I feel close to people I regularly communicate with online.
7. Social media interactions help me feel part of a larger community.

Environmental well-being

1. I am satisfied with the quality of the environment in my community. *(sample)*
2. I feel that my surroundings provide a healthy living environment.
3. The natural areas around me make me feel emotionally refreshed.
4. I believe the environmental conditions in my community are improving.
5. I feel positive when I spend time in my surrounding environment.
6. I am satisfied with the cleanliness of public places around me.
7. The natural environment in my community contributes to my overall happiness.
8. I feel safe and comfortable with the environmental conditions where I live.

Sustainability awareness

1. I am aware of the environmental impact of my actions. *(sample)*
2. I understand how my lifestyle choices affect the environment.
3. I try to stay informed about environmental issues.
4. I can recognize practices that damage the environment.
5. I know which behaviors help protect the environment.
6. I am aware of global challenges such as pollution and climate change.
7. I believe my personal actions play a role in environmental protection.

Perceived social support

1. I feel that I have friends and family who support me. *(sample)*
2. I can talk to someone when I feel stressed or overwhelmed.
3. I receive emotional encouragement from people close to me.
4. I feel that others care about my well-being.
5. I can rely on someone when I need help.
6. I feel supported when I face difficulties.
7. I have people in my life who make me feel valued.

Data availability

Data will be made available on request.

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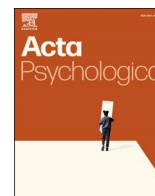
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Update

Acta Psychologica

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Corrigendum



Corrigendum to “Environmental effects of social media on university students: A joint moderated mediation analysis of social connectedness and sustainability awareness, and perceived social support” [Acta Psychologica 263 (2026) 106195]

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The authors regret that, in the originally published version of this article, two tables intended for the Supplementary Materials were inadvertently omitted during the final submission.

These tables contain the complete dataset underlying the summarized results presented in Sections 3.1.1 and 3.1.3. Their inclusion is essential for ensuring full transparency, reproducibility, and analytical rigor.

The omitted items have now been added to the supplementary materials:

Appendix 1: Factor loadings, composite reliability, Cronbach's alpha, and average variance extracted.

Appendix 2: Construct cross-validation results.

An updated Supplementary Materials file has been approved by all authors and is now available online alongside this corrigendum.

The authors sincerely apologize to readers, editors, and the publisher for any inconvenience caused.

Submitted on behalf of all authors.

Appendix C. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.actpsy.2026.106439>.

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