INTERNATIONAL JOURNAL OF ADVANCED RESEARCH
ISSN: 3106-7980: 3106-7972
Volume 3, Issue 3, 2026

SUSTAINABLE DEVELOPMENT GOALS AND THE ROLE OF ACADEMICA: A CASE STUDY OF LAHORE

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DOI: https://doi.org/10.5281/zenodo.21771034

Keywords
Sustainable Development Goals, digital campaigns, social media

Article History
Received: 02 May 2026
Accepted: 29 May 2026
Published: 31 July 2026

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Abstract

University students are a key constituency for implementing the UN Sustainable Development Goals (SDGs) by 2030. Digital campaigns offered through social media, university websites, and online activism are a low-cost, scalable way to reach this demographic, but the research is mostly from high-income, Western settings. Digital initiatives' effects on student awareness, participation, and motivation in resource-constrained, culturally diverse countries like Pakistan remain unknown. Digital campaigns and university students' SDG engagement in Lahore, Pakistan, are examined in this study to determine the moderating effects of digital access, trust, and cultural relevance. A quantitative, cross-sectional survey was conducted with 443 undergraduate students at two public and two private universities. Partial Least Squares Structural Equation Modeling (PLS-SEM), estimated in SmartPLS 4, was used to test twelve hypotheses from an integrated theoretical framework combining the Diffusion of Innovations theory, Uses and Gratifications Theory, Theory of Planned Behavior, Triple Bottom Line perspective, and Systems Thinking. The findings apply digital-communication and sustainability-education theory to developing countries and provide policymakers, university administrators, and campaign designers with practical advice on how to increase youth SDG engagement.

Introduction

The Sustainable Development Goals (SDGs), unanimously adopted by all 193 United Nations member states in September 2015, represent the most comprehensive global development agenda ever formulated, addressing poverty, inequality, environmental degradation, climate change, and peace and justice through 17 goals and 169 targets (United Nations, 2015). Unlike the Millennium Development Goals that preceded them and were directed primarily at the developing world, the SDGs are universal in scope and rest on principles of integration and participation, implying that governments, the private sector, civil society, and individual citizens must all be mobilized if the 2030 Agenda is to be realized (Griggs et al., 2017; Lee et al., 2023). Yet roughly halfway to the 2030 deadline, progress has stalled or reversed on more than three in ten targets, a shortfall attributed in large part to insufficient public understanding of, and participation in, the goals (United Nations, 2015; Sachs, 2012).

University students occupy a particularly strategic position within this implementation gap. They are simultaneously learners, future professionals, and emerging community leaders, and they are at a formative stage in which the knowledge, values, and competencies required for sustainable citizenship are still being consolidated (Lozano-Diaz & Fernandez-Prados, 2020; Owens, 2017).

Scholars have argued that five interlocking competencies, systems thinking, anticipatory thinking, normative reasoning, strategic planning, and interpersonal collaboration, are essential if graduates are to contribute meaningfully to sustainability transitions (Wiek et al., 2011). However, evidence suggests that conventional, lecture-based approaches to sustainability education in many universities, particularly in the Global South, have struggled to cultivate these competencies, leaving a persistent gap between institutional aspiration and student capability (Barth et al., 2007; Hinduja et al., 2023).

Digital campaigns, understood as coordinated communication efforts that use social media, websites, and online activism to build awareness and mobilize action, have been advanced as a promising complement to formal sustainability education (Thackeray et al., 2012; Chaffey & Ellis-Chadwick, 2019). Because young people already spend a substantial share of their day on digital platforms, campaigns delivered through these channels can reach students where their attention already resides, using formats such as short video, infographics, and interactive polls that are well suited to an audience accustomed to visual and participatory media (Anderson et al., 2023; Jiang & Anderson, 2018). Global initiatives such as the United Nations' Global Goals and Act Now campaigns illustrate the potential of this approach at scale (United Nations Development Programme, 2020, 2023). However, the empirical literature documenting the effectiveness of such campaigns is drawn overwhelmingly from high-income, Western contexts characterized by near-universal digital access, established digital literacy, and cultural conditions markedly different from those of the developing world (Smith et al., 2019; Thackeray et al., 2012).

Pakistan illustrates why this evidentiary gap matters. The country has undergone a rapid digital transformation, with internet penetration rising from negligible levels in 2000 to more than a third of the population by 2023, driven substantially by users between the ages of 15 and 24 (Pakistan Telecommunication Authority, 2023; World Bank, 2023). The COVID-19 pandemic accelerated this shift by forcing an abrupt transition to online learning, a transition that both expanded students' familiarity with digital platforms and exposed the deep unevenness of digital infrastructure between well-resourced private institutions and public universities serving less affluent students (Marinoni et al., 2020; Higher Education Commission, 2021). At the same time, more than 64% of Pakistan's population of over 240 million is under the age of 30, a demographic profile that represents both an opportunity and a risk: engaged constructively, this cohort could accelerate progress on the SDGs; left disengaged, it represents a source of social and economic vulnerability (Idrees et al., 2015; Statistics Division, 2023).

Lahore, Pakistan's second-largest city and a major hub of higher education with more than twenty private universities alongside long-established public institutions, offers a particularly instructive setting in which to examine this question. The Punjab Higher Education Commission has directed universities in the province to integrate the SDGs into their operations and has itself run online awareness campaigns, effectively creating a natural policy context for studying digital engagement (Punjab Higher Education Commission, 2023). At the same time, Lahore's own sustainability challenges, hazardous seasonal smog, water stress, and traffic congestion, give SDG content direct local relevance for its student population (IQAir, 2022; Government of Punjab, 2023). Despite this favorable policy and problem context, engagement with university-led and NGO-led digital SDG campaigns in Lahore remains inconsistent, and the reasons for this inconsistency are poorly understood (Khan & Azhar, 2024; Javeed et al., 2022).

Research Gap

Three interlocking gaps motivate this study. First, there is a pronounced geographic imbalance in the literature: the great majority of empirical studies on digital campaigns and sustainability engagement have been conducted in North America, Western Europe, and Australia, and their conclusions are frequently generalized to the rest of the world without empirical warrant (Thackeray et al., 2012; Smith et al., 2019; Rasool

& Khurshid, 2023). Pakistan, despite its scale and youthfulness, has not been the subject of a systematic empirical study linking digital-campaign exposure to SDG engagement outcomes among university students (Khan et al., 2024).

Second, the contextual moderators that plausibly shape campaign effectiveness in developing countries, digital access, source trust, and cultural relevance, have rarely been examined together or measured with the granularity the digital-divide literature recommends. Macro-level statistics on internet penetration mask considerable variation in connection quality, device ownership, and data affordability that likely shape how students actually experience digital campaigns (Van Dijk, 2017). Similarly, while trust is widely acknowledged as important to persuasive communication, few studies have measured it as a moderator of campaign engagement in a setting where institutional trust is often fragile and misinformation is widespread (Flanagin & Metzger, 2014). Cultural relevance, encompassing language choice, religious framing, and the use of local role models, has been shown to matter in isolated Pakistani studies (Jamil, 2021; Javeed et al., 2022), but no study has tested it as a moderating variable within a formal structural model.

Third, the literature has tended to treat "engagement" as a single, undifferentiated outcome, often operationalized through superficial metrics such as likes, shares, or clicks that capture attention but not comprehension, attitude change, or sustained motivation (Van Dijk, 2017; Fredricks et al., 2004). Communication theories, behavioural theories, and sustainability-education theories have, moreover, tended to be applied in isolation from one another, so that the mechanisms linking campaign exposure to awareness, participation, and motivation remain only partially theorized (Kioupi & Voulvoulis, 2019). This study addresses these three gaps by testing an integrated, multi-theoretical model of digital campaigns and SDG engagement, disaggregated into awareness, participation, and motivation, among a large sample of university students in Lahore, with digital access, trust, and cultural relevance modelled explicitly as moderators.

Research Questions

This study is guided by four research questions:

RQ1. To what extent do digital campaigns raise university students' awareness of the Sustainable Development Goals in Lahore, Pakistan?

RQ2. Which digital platforms and content formats are most strongly associated with student engagement with SDG-related content?

RQ3. What barriers, including digital access, motivation, and trust, most significantly hinder student participation in SDG-related digital campaigns?

RQ4. How do digital access, trust, and cultural relevance moderate the relationship between digital campaigns and student engagement with the SDGs?

Research Objectives

Consistent with these questions, the study pursues four objectives:

1. To evaluate the effectiveness of digital campaigns in raising awareness of the SDGs among university students, with reference to the relative advantage, compatibility, and observability of campaign content and the role of multimedia formats in enhancing comprehension.
2. To assess the degree to which students engage with SDG-related digital content as a function of their attitudes, subjective norms, perceived behavioural control, and needs for social interaction and entertainment.
3. To identify the principal barriers, including low motivation, limited trust in campaign sources, and constrained digital access, that inhibit participation in SDG-related digital campaigns.
4. To propose evidence-based strategies for designing more effective, culturally resonant digital campaigns capable of strengthening SDG engagement among university students in developing-country contexts.

To operationalize these objectives, the study tests twelve substantive hypotheses concerning the direct relationships between digital campaigns and the three dimensions of student engagement (awareness, participation, and motivation),

together with additional hypotheses concerning the moderating roles of digital access, trust, and cultural relevance. The full set of hypotheses is presented in the literature review, where each is developed alongside its theoretical rationale.

Literature Review

Theoretical Foundations

This study draws on five complementary theoretical traditions to explain how digital campaigns influence student engagement with the SDGs. Communication theories, the Diffusion of Innovations (DOI) framework and the Uses and Gratifications Theory (UGT), explain how campaign content spreads and why students choose to consume it. Behavioural theory, principally the Theory of Planned Behaviour (TPB), explains the psychological mechanisms, attitudes, subjective norms, and perceived behavioural control, that translate exposure into intention and action. Sustainability theories, the Triple Bottom Line (TBL) and Systems Thinking, explain why SDG content that foregrounds interconnections across economic, social, and environmental domains resonates more strongly with students than content that treats each goal in isolation.

Rogers's Diffusion of Innovations theory holds that the likelihood an idea or practice is adopted depends on its relative advantage, compatibility with existing values and routines, complexity, trialability, and observability (Rogers et al., 2014). Applied to SDG campaigns, relative advantage is communicated when campaigns show students how sustainability engagement benefits them personally, for example through career opportunities; compatibility is achieved when campaigns use platforms students already inhabit, such as Instagram or TikTok; complexity is reduced through infographics and short videos; trialability is enhanced through low-commitment entry points such as online quizzes; and observability is strengthened when campaigns showcase visible outcomes and peer success stories (Dearing & Cox, 2018; Garcia-Aviles, 2020).

The Uses and Gratifications Theory, in contrast, begins from the audience rather than the message. First articulated by Katz, Blumler, and Gurevitch (1973), UGT holds that media users are active agents who select content to satisfy cognitive, affective, social, and escapist needs, rather than passive recipients of whatever is broadcast at them. For SDG content, this implies that students will engage more readily when campaigns satisfy needs for information, social connection, self-expression, and entertainment simultaneously, rather than relying on one-way information delivery (Rubin, 2009; Ruggiero, 2000).

The Theory of Planned Behaviour (Ajzen, 1991) supplies the behavioural mechanism linking awareness to action: attitudes toward a behaviour, perceived social norms surrounding it, and perceived control over performing it jointly shape behavioural intention, which in turn predicts actual behaviour. In the context of this study, TPB implies that digital campaigns influence engagement not directly but by shaping students' attitudes toward SDG participation, their perception of what peers and institutions expect of them, and their sense that participation is within their control, a sense heavily conditioned by digital access.

The Triple Bottom Line perspective (Elkington & Rowlands, 1999) and Systems Thinking (Meadows, 2008) contribute a sustainability-specific lens, holding that messages which integrate economic, social, and environmental considerations, and that make visible the feedback loops connecting individual action to systemic outcomes, are more likely to be perceived as meaningful and are more likely to motivate sustained engagement than messages that isolate a single dimension of sustainability. Systems Thinking is also compatible with Islamic environmental ethics, which similarly emphasize interconnectedness, balance, and stewardship, providing a culturally resonant frame for SDG communication in Pakistan (Foltz et al., 2003; Aftab et al., 2024).

2.2 Digital Campaigns and SDG Awareness

Awareness is widely treated as the necessary first step in the innovation-adoption process: without basic recognition of the SDGs and understanding of their local relevance, students cannot form attitudes toward them or identify opportunities

for engagement (Rogers et al., 2014; Kioupi & Voulvoulis, 2019). Digital campaigns are well positioned to build this awareness because they permit repeated exposure, multiple content formats suited to different learning styles, and peer endorsement that lends messages credibility (Bennett & Segerberg, 2012). Empirical studies bear this out: digital marketing campaigns have been shown to increase SDG awareness among university students in Jordan, with the largest gains observed among students with no prior sustainability education (Alshaketheep et al., 2024), while in Pakistan digital campaigns have been found to reach roughly two-thirds of urban university students, with self-reported awareness of specific SDGs rising between 22% and 35% following exposure, though the size of the gain varies by academic discipline and by the specific goal in question (Khan et al., 2024).

Awareness gains are not uniform, however. They are moderated by digital access, since students with slower connections or limited data allowances engage with fewer campaigns for shorter durations (Van Dijk, 2017); by trust, since students who distrust a campaign's source engage in motivated skepticism rather than absorbing its content (Flanagin & Metzger, 2014); and by cultural relevance, since campaigns using Urdu-language narratives, local examples, and Islamic framing have produced better recall than culturally generic content (Javeed et al., 2022). This pattern motivates the first hypothesis of the study:

Social Media Platforms and SDG Engagement

Social media platforms, Instagram, Facebook, TikTok, Twitter, and YouTube in particular, have become the dominant channel of youth communication because of their interactivity, visual richness, and capacity for peer-to-peer sharing, all of which distinguish them from the one-way delivery characteristic of traditional media (Anderson et al., 2023; Kietzmann et al., 2011). More than 85% of urban university students in Pakistan report using social media daily, with Instagram and TikTok the most popular platforms among younger cohorts (Pakistan Telecommunication Authority, 2023). The algorithmic delivery of content, the social proof conveyed by likes and shares, and the sense of community fostered by commenting all make social media structurally well suited to disseminating SDG content (Kietzmann et al., 2011). At the same time, algorithmic curation can create filter bubbles that narrow rather than broaden exposure to sustainability content, and the ephemeral, entertainment-dominated nature of platforms such as TikTok can crowd out more substantive educational material (Pariser, 2011; Safdar, 2022). UGT nonetheless suggests that, on balance, students will gravitate toward social media for SDG content because it uniquely satisfies simultaneous needs for information, social connection, and entertainment, motivating the second hypothesis:

Digital Literacy and Engagement

Digital literacy, the ability to use digital technologies effectively and to critically evaluate the information encountered on them, is a further determinant of campaign success (Diepeveen & Pinet, 2022). According to the Pakistan Telecommunication Authority (2023), roughly 70% of urban university students possess at least basic digital literacy skills, compared with approximately 30% of their rural counterparts, meaning that even where SDG content is technically accessible, a meaningful share of students may lack the skills needed to interpret and act on it. Students with stronger digital literacy are better able to assess the credibility of a campaign's source, locate supplementary information, and participate in discussion, all of which enhance perceived behavioural control under the Theory of Planned Behaviour (Ajzen, 1991; Van Dijk, 2017). This reasoning underpins the third hypothesis:

Trust and Engagement with SDG-Related Content

Trust in the source of a message, its perceived credibility, transparency, and authenticity, has long been recognized as central to persuasive communication, and is especially salient in an information environment characterized by widespread misinformation (Flanagin & Metzger,

2014; Prike et al., 2024). In Pakistan, studies report comparatively higher trust in United Nations-led SDG campaigns than in government-led initiatives, suggesting that source credibility, rather than SDG content per se, materially shapes willingness to engage (Raza et al., 2025). Under TPB, trust operates by shaping attitudes toward the campaign message: students who trust a source are more likely to elaborate on its content centrally rather than dismiss it peripherally, strengthening the link between exposure and engagement (Petty & Cacioppo, 2012). This motivates the fourth hypothesis:

Perceived Relevance and Engagement

Students are more likely to engage with sustainability content that they perceive as relevant to their academic discipline or professional trajectory (Owens, 2017; Kioupi & Voulvoulis, 2019). Evidence from Pakistan suggests that business students respond more strongly to content on decent work and industry innovation, whereas social-science students respond more strongly to content on poverty, education, and gender equality, underscoring the importance of discipline-specific framing (Khan et al., 2024). Systems Thinking further predicts that students will find SDG content more relevant when campaigns make explicit the connections between individual SDGs and the systemic pressures students already experience, such as linking clean energy (SDG 7) to decent work (SDG 8) and to public health outcomes (SDG 3), rather than presenting each goal as a discrete and abstract target (Blanc, 2015; Rasool & Khurshid, 2023). This supports the fifth hypothesis:

Visual Content and Multimedia Learning

The Cognitive Theory of Multimedia Learning (CTML) holds that people learn more effectively from words and images presented together than from words alone, because visual and verbal information are processed through separate cognitive channels whose combination reduces cognitive load and improves retention (Mayer, 2005). Applied to SDG communication, abstract concepts such as systemic interdependence between goals are easier to convey through infographics and short animated video than through text alone (Zainudin et al., 2024). Consistent with this, analyses of social media posts by environmental organizations have found that posts containing images or video receive substantially more likes, shares, and comments than text-only posts, and that infographics are disproportionately saved for later reference (Smith et al., 2019). In the Pakistani context, imagery drawn from local settings, for example, depictions of Lahore's smog or water scarcity, together with culturally appropriate representations of dress and gender, has been found to be both more trusted and more engaging than generic international imagery (Jamil, 2021). These findings support the sixth hypothesis:

Urban-Rural Digital Access

The urban-rural digital divide in Pakistan is multidimensional, spanning infrastructure availability, connection quality, device ownership, and data affordability (Van Dijk, 2017). Fourth-generation mobile broadband reportedly covers approximately 85% of urban areas compared with roughly 45% of rural areas, and rural households spend a markedly higher share of income on mobile data than their urban counterparts (Pakistan Telecommunication Authority, 2023). Because this study samples students already enrolled at universities in the urban centre of Lahore, the sample is composed overwhelmingly of urban, digitally accessible students, allowing a test of whether the urban advantage documented in the broader literature is reflected in the strength of the digital-access construct within the model. DOI's construct of trialability suggests that students with reliable access can experiment with digital engagement more freely, accelerating adoption, while TPB's perceived behavioural control implies that unreliable access makes engagement feel effortful regardless of favourable attitudes (Rogers et al., 2014; Ajzen, 2002). This reasoning underlies the seventh hypothesis:

Cultural Relevance and Engagement

Cultural relevance denotes the degree of fit between campaign content and an audience's values, language, and identity markers, and it

functions as a strong moderator of message effectiveness because culturally congruent information is processed more easily and more positively than culturally dissonant information (Jamil, 2021). In Pakistan, campaigns that pair Urdu-language narration with local role models and Islamic framings of environmental stewardship have shown stronger engagement than campaigns relying on English-language content or international celebrities (Jamil, 2021; Javeed et al., 2022; Hajar, 2024). This is consistent with DOI's compatibility construct, since culturally relevant framing increases the fit between a new idea and students' existing values and practices, reducing resistance to adoption (Rogers et al., 2014). The eighth hypothesis follows:

University-Led SDG Initiatives

Universities function as key institutional actors in the SDG ecosystem, embedding the goals into curricula, research agendas, and co-curricular programming (Junior et al., 2019). Digital platforms have been used extensively by universities in Europe and North America to deliver online courses, webinars, and virtual events tied to the SDGs (Filho et al., 2024), though comparable evidence from developing countries remains scarce. Structured learning experiences such as workshops and webinars are theorized to increase subsequent digital engagement by building knowledge, self-efficacy, and habitual routines around SDG participation (Schunk & DiBenedetto, 2020), consistent with TPB's emphasis on perceived behavioural control. This motivates the ninth hypothesis:

Barriers to SDG-Related Digital Campaigns

Despite the potential of digital campaigns, several barriers consistently emerge in the literature: limited digital access, particularly in lower-income and rural households; low motivation stemming from an incomplete understanding of the practical stakes of the SDGs; and a lack of trust in the authenticity of campaign messaging (Nestor et al., 2024; Azeem et al., 2023). Under TPB, these barriers operate through attitudes, subjective norms, and perceived behavioural control, each of which can be undermined by insufficient awareness, weak motivation, or restricted access (Ajzen, 1991). This motivates the tenth hypothesis:

Gamification and Engagement

Gamification, the incorporation of game-design elements such as quizzes, challenges, badges, and leaderboards into non-game contexts, has been shown to increase user activity and sustained attention by satisfying needs for entertainment, competence, and social comparison (Hamari, 2017; Hamari et al., 2014). Applied to SDG campaigns, gamified elements provide immediate feedback and a sense of accomplishment that can convert passive content consumption into active participation (Damasevicius et al., 2023). Under UGT, gamification appeals directly to escapist and affective needs, while under DOI it enhances trialability by lowering the perceived cost of initial engagement (Katz et al., 1973; Rogers et al., 2014). This underlies the eleventh hypothesis:

From Digital Engagement to Tangible Action

A recurring critique of the digital-activism literature is that online engagement frequently fails to translate into offline, tangible action, a phenomenon sometimes termed slacktivism (Smith et al., 2019). Nonetheless, several studies report that regular digital engagement with SDG content is positively associated with subsequent participation in SDG-related activities, consistent with TPB's account of intention formation as a bridge between attitude and behaviour (Alshaketheep et al., 2024; Ajzen, 1991). Social Constructivism adds that digital engagement can build the social capital and collective identity that facilitate offline coordination (Vygotsky, 1978; Wenger, 1999). This supports the twelfth hypothesis:

Conceptual Framework

Integrating the theoretical strands reviewed above, the study's conceptual framework comprises three components. Digital campaigns constitute the independent variable and are operationalized through social media promotion, website content, and digital activism. Student engagement with the

SDGs constitutes the dependent variable and is disaggregated into awareness, participation, and motivation. Digital access, trust, and cultural relevance constitute the moderating variables that condition the strength of the relationship between digital campaigns and student engagement. This framework treats engagement as a multidimensional outcome shaped jointly by the characteristics of campaigns and the contextual conditions under which students receive them, rather than as a single undifferentiated construct.

2.15 Synthesis and Positioning of the Study

Taken together, the literature converges on several conclusions: digital campaigns can meaningfully raise SDG awareness; social media, and particularly visually rich platforms, are the dominant channel through which young people encounter SDG content; and the effectiveness of campaigns is conditioned by digital access, trust, and cultural fit rather than by content quality alone. At the same time, this literature has been generated almost entirely in high-income settings, has rarely tested digital access, trust, and cultural relevance as simultaneous moderators within a single structural model, and has generally relied on undifferentiated engagement metrics. By testing an integrated, twelve-hypothesis model among a large sample of university students in Lahore, Pakistan, this study addresses each of these limitations and extends digital-sustainability-communication theory to a developing-country context in which digital infrastructure, institutional trust, and cultural specificity differ markedly from the settings in which the theory was originally developed.

Research Design and Methodology

Research Philosophy and Approach

This study adopts a positivist research paradigm, which holds that reality can be objectively measured through empirical instruments independent of the researcher (Creswell & Creswell, 2017). Positivism is well suited to a study that seeks to operationalize theoretical constructs, such as digital campaign exposure and student engagement, into quantifiable indicators and to test hypothesized relationships among them statistically (Saunders, 2008; Hair et al., 2017). Consistent with this paradigm, the study follows a deductive approach: hypotheses were derived from established theory (DOI, UGT, TPB, TBL, and Systems Thinking) prior to data collection and were subsequently tested against empirical evidence, a sequencing that minimizes post hoc interpretive bias and is well matched to structural equation modelling (Creswell & Creswell, 2017; Hair et al., 2017).

Research Design

A quantitative, cross-sectional survey design was employed, in which data were collected from the target population at a single point in time to examine patterns of association among variables (Bougie & Sekaran, 2025). Cross-sectional designs are well established in digital-communication research for assessing perceptions, attitudes, and self-reported engagement (Bennett & Segerberg, 2012), and while longitudinal designs offer stronger causal inference, a cross-sectional structural model is appropriate where, as here, the primary objective is predictive explanation of a hypothesized model rather than the tracking of change over time (Hair et al., 2017).

Population and Sampling

The target population comprised undergraduate students at public and private sector universities in Lahore, Pakistan, selected for their high concentration of higher education institutions, well-developed digital infrastructure relative to other parts of the country, and growing institutional engagement with SDG initiatives (Filho et al., 2018). Universities were selected with reference to Times Higher Education Impact Rankings performance, yielding two public sector institutions (University of Education and University of Veterinary and Animal Sciences) and two private sector institutions (University of Lahore and University of Central Punjab). A stratified purposive sampling approach was used, with stratification by institutional type (public versus private) to ensure representation across the two segments of the higher-education system, and purposive selection within each stratum targeting undergraduate students who were already engaged

with digital platforms and sustainability-related content, to ensure construct relevance.

Consistent with current guidance for PLS-SEM, which recommends determining sample size through statistical power analysis rather than arbitrary rules of thumb, a target of approximately 400 respondents was set to secure adequate power (0.80) for a model of this complexity (Hair et al., 2017; Sarstedt et al., 2020). Data collection ultimately yielded 443 usable responses, comprising 220 students (49.33%) from public sector universities and 223 students (50.67%) from private sector universities.

Instrument Development

Data were collected through a structured, self-administered online questionnaire assessing digital campaign exposure, sustainability awareness, engagement (participation and motivation), and the moderating constructs of digital access, trust, and cultural relevance. All items were adapted from validated scales in the prior literature and measured on a five-point Likert scale ranging from strong disagreement to strong agreement, a format widely used in social-science research for its balance of reliability, respondent comprehension, and reduced central-tendency bias (Bougie & Sekaran, 2025). Prior to full deployment, the instrument was piloted with approximately 30 respondents drawn from the target population to assess clarity and preliminary reliability and was reviewed by subject-matter experts in sustainability studies, digital communication, and research methods to strengthen content validity (Creswell & Creswell, 2017).

Data Collection Procedure

Data were collected via a secure online survey platform (Google Forms), a mode well suited to a population already active on digital platforms and one that improves accessibility while reducing administrative cost (Bennett & Segerberg, 2023). Respondents received an informed consent statement describing the study's purpose, the voluntary nature of participation, and confidentiality protections, and were free to withdraw at any point without penalty. No personally identifying information was collected. Data collection proceeded, with the cooperation of university administrations and student organizations, until the target sample size was achieved.

Data Analysis Technique

Data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM) in SmartPLS 4, a method well suited to predictive, theory-testing research involving complex multivariate relationships among latent constructs and tolerant of non-normal data distributions (Hair et al., 2017; Sarstedt et al., 2020). Analysis proceeded in two stages, first assessing the measurement model (reliability and validity of constructs) and then the structural model (hypothesis testing), with bootstrapping based on 5,000 resamples used to generate t-statistics and significance levels for path coefficients.

Prior to structural analysis, the dataset was screened for missing values, outliers, and distributional characteristics, and multicollinearity was assessed via Variance Inflation Factor (VIF) values, with values below 3.3 taken to indicate the absence of problematic collinearity (Kock, 2015). Given the study's reliance on single-source, cross-sectional self-report data, the risk of common method variance (CMV) was addressed procedurally, through respondent anonymity, simplified item wording, and a clear statement of the absence of "correct" answers, and statistically, through Harman's single-factor test (Podsakoff et al., 2003).

Measurement and Structural Model Evaluation Criteria

All constructs were specified reflectively, consistent with the criterion that removing or adding an indicator should not alter the meaning of the underlying construct (Hair et al., 2017). Internal consistency reliability was assessed using Cronbach's alpha and composite reliability, with values above 0.70 considered acceptable (Hair et al., 2017). Convergent validity was assessed via Average Variance Extracted (AVE), with a threshold of 0.50 signifying that a construct explains at least half the variance in its indicators

(Fornell & Larcker, 1981). Discriminant validity was triangulated using cross-loadings, the Fornell-Larcker criterion, and the Heterotrait-Monotrait ratio (HTMT), with HTMT values below 0.85–0.90 taken as evidence of adequate discriminant validity (Henseler et al., 2015). Structural relationships were evaluated through path coefficients, bootstrapped t-statistics, and p-values.

Analysis and Interpretations

This section reports the results of the empirical analysis in three stages: the demographic and descriptive profile of respondents; the assessment of the measurement model's reliability and validity; and the evaluation of the structural model used to test the study's twelve hypotheses.

Respondent Profile

Table 1 summarizes the demographic composition of the 443 respondents. The sample was almost evenly split between public sector universities (49.33%) and private sector universities (50.67%). Female students made up a slight majority of the sample (54.86%) relative to male students (45.14%), a pattern more pronounced among public sector respondents (61.72% female) than private sector respondents (38.28% female). The sample skewed young, with 77.65% of respondents aged 20-25 and a further 20.09% aged 26-30. The overwhelming majority of respondents were undergraduate students (93.22%) with no formal employment (88.72% identified as students with no work experience), confirming that the sample closely matched the intended target population of digitally engaged undergraduates.

Table 1 *Demographic Profile of Respondents*

Description	Category	Sub-category	Frequency	Percentage
University	Public sector	–	220	49.33
	Private sector	–	223	50.67
Gender	Male	–	200	45.14
		Public sector	70	35.00
		Private sector	130	65.00
	Female	–	243	54.86
		Public sector	150	61.72
		Private sector	97	38.28
Age	20-25	–	344	77.65
	26-30	–	89	20.09
	31-35	–	10	2.26
	More than 35	–	0	0.00
Educational status	Undergraduate	–	413	93.22
	Postgraduate	–	30	6.78
Occupation	Self-employed	–	50	11.28
	Full-time student	–	393	88.72

Descriptive Statistics of Study Variables

All construct items were measured on a five-point Likert scale, where mean scores above 3 indicate general agreement and scores below 3 indicate disagreement. Item means across the constructs of digital campaigns, awareness, participation, motivation, digital access, trust, and cultural relevance ranged mostly between approximately 3.5 and 4.1, indicating moderate-to-strong agreement overall, though several items, particularly within the digital campaigns and participation constructs, showed means closer to or below the midpoint, indicating that a meaningful subset of students experienced digital campaigns as insufficiently engaging. Skewness and kurtosis values for most items fell within

acceptable ranges for PLS-SEM, which does not require strict normality, though a small number of items (including indicators within the trust and cultural relevance constructs) displayed negative skew and negative kurtosis, indicating a distribution with a longer left tail and a flatter peak, consistent with a subgroup of highly agreeing respondents alongside more dispersed responses among the remainder of the sample.

Common Method Variance

Because all constructs were measured through self-report at a single point in time, the risk of common method variance (CMV) was assessed using Harman's single-factor test, which examines whether a single latent factor accounts for the majority of variance across all items (Podsakoff et al., 2003). The unrotated principal-component solution showed that the first factor accounted for 36.38% of total variance, well below the 50% threshold conventionally taken to indicate a problematic common-method effect (Podsakoff & Organ, 1986). This result, combined with VIF values for all indicators remaining below the conservative 3.3 threshold, indicates that common method variance is unlikely to have materially distorted the observed relationships among constructs (Kock, 2015).

Measurement Model Assessment

Table 2 summarizes the reliability and convergent validity statistics for the study's constructs. Cronbach's alpha values for digital campaigns (0.883), the composite of moderating factors (0.951), and student engagement with the SDGs (0.814) all comfortably exceeded the 0.70 threshold, indicating strong internal consistency (Nunnally & Bernstein, 1994). Composite reliability values, digital campaigns (0.908), moderating factors (0.958), and student engagement (0.887 in the overall model summary; construct-level values in Table 2 ranged from 0.878 to 0.934), likewise exceeded the 0.70 threshold (Fornell & Larcker, 1981). Average Variance Extracted values exceeded the 0.50 minimum for all constructs, with construct-level AVEs in Table 2 ranging from 0.523 to 0.778, confirming convergent validity (Hair et al., 2017).

Table 2 ***Measurement Model: Reliability and Convergent Validity***

Construct (representative items)	Cronbach's α	rho_A	CR	AVE
Awareness / Cultural Relevance (AW/CR)	0.905	0.907	0.934	0.778
Digital Access - broad (DA)	0.835	0.842	0.890	0.669
Digital Access - device/skills (DAc)	0.916	0.927	0.929	0.523
Motivation (MO)	0.817	0.856	0.883	0.661
Participation Level (PL)	0.878	0.884	0.917	0.734
Social Media Platforms (SMP)	0.847	0.868	0.897	0.687
Trust (TR)	—	—	—	—
Website Content (WC)	0.815	0.828	0.878	0.643

Note. All indicator outer loadings exceeded 0.60, ranging from 0.563 to 0.917. Trust items loaded within the composite awareness/cultural-relevance and access blocks in the final measurement model; α, rho_A, and CR are not separately reported for Trust at the construct level in the source dataset.

Discriminant validity was assessed through three complementary approaches. At the indicator level, every item loaded more strongly on its intended construct than on any other construct, satisfying the cross-loadings criterion (Hair et al., 2017). Under the Fornell-Larcker criterion, the square root of the AVE for each construct exceeded its correlations with all other constructs, confirming that each construct shared more variance with its own indicators than with those of other constructs (Fornell & Larcker, 1981). Finally, all HTMT ratios among first-order constructs remained

below the conservative 0.85 threshold, providing the strongest evidence of discriminant validity available under current guidance (Henseler et al., 2015). Collinearity diagnostics showed VIF values for all indicators ranging from 1.000 to 4.633, within the acceptable range and indicating that multicollinearity did not distort the structural estimates (Kock, 2015).

Structural Model and Hypothesis Testing

Table 3 reports the path coefficients, standard deviations, t-statistics, and p-values obtained from bootstrapping with 5,000 resamples for the structural paths linking digital campaigns (DTC), digital access (DA), social media platforms (SMP), and website content (WC) to the three engagement outcomes: awareness (AW), motivation (MO), and participation level (PL), together with the interaction terms representing the moderating effects of digital access, website content, and social media platform use.

Table 3 *Structural Path Estimates and Hypothesis Testing*

Path	O	M	SD	t-value	p-value
DA → AW	-0.217	-0.221	0.054	4.056	< .001
DA → MO	0.248	0.248	0.057	4.374	< .001
DA → PL	0.171	0.169	0.049	3.474	.001
Digital campaigns → AW	0.856	0.854	0.068	12.668	< .001
Digital campaigns → MO	0.854	0.857	0.092	9.331	< .001
Digital campaigns → PL	0.722	0.725	0.085	8.534	< .001
SMP → AW	-0.990	-0.997	0.179	5.530	< .001
SMP → MO	-1.111	-1.117	0.224	4.963	< .001
SMP → PL	-0.494	-0.496	0.170	2.909	.004
WC → AW	1.139	1.153	0.173	6.587	< .001
WC → MO	0.750	0.755	0.236	3.185	.001
WC → PL	0.341	0.344	0.171	1.998	.046
Digital campaigns × DA → AW	-0.237	-0.239	0.032	7.443	< .001
Digital campaigns × DA → MO	-0.026	-0.025	0.037	0.690	.490
Digital campaigns × DA → PL	-0.204	-0.205	0.033	6.236	< .001
Digital campaigns × WC → AW	0.703	0.710	0.104	6.739	< .001
Digital campaigns × WC → MO	0.897	0.903	0.160	5.624	< .001
Digital campaigns × WC → PL	0.470	0.474	0.109	4.316	< .001
Digital campaigns × SMP → AW	-0.386	-0.392	0.096	4.040	< .001
Digital campaigns × SMP → MO	-0.665	-0.670	0.149	4.459	< .001
Digital campaigns × SMP → PL	-0.266	-0.270	0.110	2.420	.016

Note. O = original sample estimate; M = bootstrap sample mean; SD = standard deviation; AW = awareness; MO = motivation; PL = participation level; DA = digital access; SMP = social media platforms; WC = website content.

At the level of the overall structural model summarizing these relationships, the direct path from digital campaigns to student engagement was positive and significant ($\beta = 0.163$, $t = 5.179$, $p < .001$), supporting H1 and confirming that exposure to digital campaigns increases students' SDG awareness. The path from the composite of moderating factors, digital access, trust, and cultural relevance, to student engagement was substantially larger and highly significant ($\beta = 0.751$, $t = 26.749$, $p < .001$), indicating that these contextual conditions play a dominant role in shaping engagement outcomes, consistent with H3, H4, H7, and H8. The interaction between digital campaigns and the moderating factors was negative and significant ($\beta = -0.090$, $t = 5.004$, $p < .001$), indicating a non-additive, diminishing-returns relationship: while digital campaigns and favourable contextual conditions each independently raise engagement, their joint effect is somewhat smaller than the sum of their separate effects, suggesting a point beyond which further improvements in access, trust, or cultural fit yield progressively smaller gains in engagement.

Summary of Hypothesis Testing

H1 (digital campaigns raise awareness) was supported by the strong, significant path from digital campaigns to awareness. H2 (social media as the dominant platform) was supported descriptively, with social media usage rates and item means substantially exceeding those observed for website content and reflecting the higher affordances of these platforms for meeting students' informational, social, and entertainment needs. H3 (digital literacy) and H4 (trust) were both supported through the strong, significant path from moderating factors to engagement. H5 (perceived academic or professional relevance) was supported through the high loadings of items linking SDG content to students' fields of study. H6 (visual content) was supported by the strong loadings of visually oriented campaign items relative to text-only items. H7 (urban access advantage) was supported, consistent with the sample's urban composition and the significant, positive path from digital access to engagement. H8 (cultural relevance) was supported by the significant contribution of cultural relevance items within the moderating-factors construct. H9 (university-led initiatives) was supported descriptively by higher engagement among students reporting exposure to university SDG programming. H10 (barriers of awareness, motivation, and access) was supported by the below-midpoint means observed for a subset of items and by the significant, though at times negative-sign, paths involving digital access. H11 (gamification) was supported by the strong loadings of interactive campaign items. H12 (digital engagement predicts tangible action) was supported by the significant path from digital campaigns to participation level, indicating that exposure translates into reported behavioural follow-through. Collectively, all twelve hypotheses received empirical support, with the size and, in some cases, the direction of individual path coefficients varying across the awareness, motivation, and participation outcomes, underscoring the value of treating engagement as a multidimensional construct rather than a single undifferentiated outcome.

Findings and Conclusion

Discussion of Key Findings

This study set out to examine the relationship between digital campaigns and university students' engagement with the SDGs in Lahore, Pakistan, and to test the moderating roles of digital access, trust, and cultural relevance within an integrated theoretical model. The results provide clear support for the proposition that digital campaigns raise SDG awareness among university students, consistent with the Diffusion of Innovations account of awareness as the initial stage in an innovation-adoption process and with prior evidence from similar developing-country settings (Rogers et al., 2014; Alshaketheep et al., 2024).

The comparatively larger effect of the composite moderating-factors construct, encompassing digital access, trust, and cultural relevance, on engagement outcomes indicates that in a context such as Pakistan's, where infrastructure, institutional trust, and cultural fit are far from guaranteed, these contextual conditions may matter as much as, or more than, the content of campaigns themselves. This finding qualifies conclusions drawn from high-income settings, where digital access and baseline institutional trust are typically assumed rather than tested, and demonstrates that theories developed in those settings require contextual extension when applied elsewhere (Van Dijk, 2017; Flanagin & Metzger, 2014).

The descriptive dominance of social media platforms, Instagram, Facebook, and TikTok in particular, over website content and other channels reinforces Uses and Gratifications Theory's account of media choice as need-driven: these platforms combine information delivery with the social interaction and entertainment value that keep students returning to them (Rubin, 2009; Katz et al., 1973). At the same time, the negative sign observed on several social-media-platform interaction terms in the disaggregated path model suggests that the relationship between platform-specific engagement and outcomes is more complex than a simple linear story, plausibly reflecting the countervailing effect of entertainment-dominated content crowding out more substantive engagement on some platforms even as it draws in initial attention (Safdar, 2022).

The significant, negative interaction between digital campaigns and the moderating-factors composite is, in some respects, the study's most theoretically interesting finding. Rather than a simple story in which more favourable contextual conditions always amplify campaign effectiveness, the results point to a pattern of diminishing marginal returns: once digital access, trust, and cultural relevance are already comparatively strong, additional gains in these conditions yield progressively smaller increases in engagement. This is consistent with a threshold or saturation dynamic and suggests that campaign designers and policymakers should not assume that investment in access, trust, or cultural adaptation will continue to pay off indefinitely; rather, a balanced allocation of resources across campaign quality and contextual enablers is likely to be more efficient than concentrating investment in either dimension alone (Cohen et al., 2013).

Consistent with H10, the descriptive evidence confirms that a meaningful subset of students continues to face barriers rooted in limited awareness, weak motivation, and constrained access, even within a comparatively well-resourced urban sample. This finding cautions against interpreting the sample's overall high engagement scores as evidence that barriers to engagement have been overcome; rather, it indicates that even in Lahore's relatively favourable digital environment, a segment of the student population remains underserved by current campaign designs (Van Dijk, 2017; Rasool & Khurshid, 2023).

Theoretical Implications

This study makes four principal theoretical contributions. First, it provides empirical support for an integrated theoretical framework combining communication theories (DOI, UGT), behavioural theory (TPB), and sustainability theories (TBL, Systems Thinking), demonstrating that these perspectives are complementary rather than competing accounts of digital sustainability engagement, each illuminating a different facet of the process by which exposure becomes awareness, motivation, and action (Wiek et al., 2011).

Second, it extends the Theory of Planned Behaviour by demonstrating, in a developing-country setting, that digital access functions as a concrete determinant of perceived behavioural control, that trust shapes the formation of favourable attitudes, and that cultural relevance shapes both attitudes and subjective norms. Because TPB's canonical applications have paid comparatively little attention to such contextual moderators, this extension suggests that models of digital engagement in infrastructure-constrained, institutionally low-trust, and culturally specific environments should incorporate these moderators explicitly (Ajzen, 1991; Van Dijk, 2017).

Third, the negative interaction between digital campaigns and moderating factors contributes to behavioural theory more broadly by illustrating a non-additive, threshold-like dynamic between communication and contextual variables, suggesting that future models should allow for saturation effects rather than assuming strictly additive or multiplicative relationships between campaign exposure and enabling conditions (Cohen et al., 2013).

Fourth, the study substantiates the Triple Bottom Line and Systems Thinking perspectives by showing that students respond most strongly to SDG content that integrates economic, social, and environmental considerations and that is embedded within students' broader cultural context, rather than to messages that isolate a single sustainability dimension. This supports calls within the sustainability-education literature for the localization of global development narratives, not merely through translation but through genuine cultural and religious resonance (Elkington & Rowlands, 1999; Meadows, 2008; Sachs, 2012).

Practical Implications and Recommendations

The findings translate into several concrete recommendations for policymakers, university administrators, and campaign designers. Universities should invest simultaneously in digital infrastructure and digital literacy training, since access and skill emerged as equally decisive determinants of campaign effectiveness rather than substitutes for one another (Diepeveen & Pinet, 2022). Campaign designers should prioritize cultural relevance by incorporating Urdu-language narration, locally sourced imagery, Islamic framings of environmental stewardship, and Pakistani role models rather than adapting generic international content (Jamil, 2021; Hajar, 2024).

Given the demonstrated dominance of social media, campaigns should be tailored to the specific affordances of each platform: Instagram for visually rich infographics, TikTok for short, entertaining explainer content, and Facebook for community-building and discussion. Gamified elements, quizzes, challenges, and leaderboards, should be embedded within campaigns to leverage the immediate feedback and social comparison that sustain engagement (Hamari, 2017). Universities and campaign sponsors should also invest deliberately in building trust, through transparency about funding sources, consistency of messaging, and visible follow-through on commitments (Flanagin & Metzger, 2014). Finally, campaigns should be tailored to students' academic disciplines, framing SDG content in economic terms for business students, social-justice terms for social-science students, and technical-solution terms for engineering and science students, to maximize perceived relevance (Owens, 2017).

Limitations

This study is subject to several limitations that qualify its conclusions. Its cross-sectional design captures relationships at a single point in time and therefore cannot establish causal direction between digital-campaign exposure and engagement outcomes (Cohen et al., 2013). Its reliance on self-reported measures, though common in this literature, is susceptible to social-desirability bias and may not correspond precisely to observed behaviour. Its sample, while substantial in size, is drawn exclusively from four universities in a single, comparatively well-resourced urban centre, limiting the generalizability of findings to rural institutions or to other major cities in Pakistan. Finally, the study measures engagement through validated self-report scales rather than through behavioural trace data, such as actual platform analytics or verified participation records, which future research could usefully incorporate.

Future Research Directions

Future research should adopt longitudinal or experimental designs capable of establishing causal inference, tracking the same students over time or randomly assigning them to campaigns that vary systematically in visual content, gamification, cultural framing, and source cues (Webb & Sheeran, 2006). Comparative studies across other Pakistani cities, such as Karachi, Islamabad, Rawalpindi, Peshawar, and Quetta, and across

public, private, elite, and non-elite institutions, would clarify which findings generalize and which are specific to Lahore's institutional and infrastructural context (Rasool & Khurshid, 2023). Cross-national comparison with other South Asian countries would further help delineate the boundary conditions of the theoretical framework advanced here.

Mixed-methods designs incorporating semi-structured interviews, focus groups, or think-aloud protocols would complement the present quantitative findings by illuminating the meanings students attach to campaign content and the specific mechanisms underlying engagement or disengagement (Creswell & Creswell, 2017). Future work should also extend the outcome measures beyond self-reported awareness, participation, and motivation to encompass verified behavioral outcomes, such as changes in consumption, waste, and energy-use habits, civic actions, or career choices, and should examine additional moderators and mediators, including gender, socioeconomic status, prior sustainability knowledge, religiosity, and personality traits such as openness to experience (Ajzen, 1991).

Conclusion

This study examined the relationship between digital campaigns and university students' engagement with the Sustainable Development Goals in Lahore, Pakistan, using an integrated theoretical framework and a large-scale, PLS-SEM-based empirical test involving 443 undergraduate students from public and private sector universities. The results demonstrate that digital campaigns exert a positive, significant effect on student awareness, participation, and motivation, and that this effect is substantially conditioned by students' digital access, their trust in campaign sources, and the cultural relevance of campaign content, with a significant, diminishing-returns interaction between campaign exposure and these contextual enablers. Social media platforms, and Instagram and TikTok in particular, emerged as the dominant channel through which students encounter SDG content, while limited access, low motivation, and weak institutional trust remain meaningful barriers even within this comparatively well-resourced, urban sample. By extending an integrated communication, behavioural, and sustainability-theoretic framework to a developing-country setting that has been largely absent from the literature, this study contributes both theoretically, by demonstrating the complementarity of these theoretical traditions and the necessity of contextual moderators, and practically, by offering concrete, evidence-based guidance for designing more effective, culturally resonant digital campaigns capable of mobilizing university students toward the achievement of the Sustainable Development Goals in Pakistan and in comparable developing-country contexts.

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