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ALGORITHMIC SOCIAL MEDIA EXPOSURE, COGNITIVE OVERLOAD, AND PSYCHOLOGICAL WELL-BEING AMONG UNIVERSITY STUDENTS IN PAKISTAN

Dr. Waqar Alam[*1], Dr. Mahboob Ullah[2], Hafsa Shabbir[3], Dimpal Kumari[4]

[*1]*Professor, Department of Management Sciences, Abasyn University Peshawar*
[2]*Associate Professor, Department of Management Sciences, Abasyn University, Peshawar, Pakistan*
[3]*Department of Psychology, NUST*
[4]*Lecturer, Department of Psychology University of Wah*

[*1]waqar.alam@abasyn.edu.pk,[2]mahboob.ullah@abasyn.edu.pk, [3]shabbirhafsa7@gmail.com, [4]dimpal.kumari@uow.edu.pk

Corresponding Author: *
Dr. Waqar Alam
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ABSTRACT

The rapid expansion of algorithm-driven social media platforms has reshaped how university students consume information, interact socially, and manage cognitive resources. This study examined the relationship between algorithmic social media exposure, cognitive overload, and psychological well-being among university students in Pakistan. Grounded in Cognitive Load Theory, the study proposed that algorithmic content curation increases cognitive overload, which in turn negatively affects psychological well-being. A quantitative, cross-sectional survey design was employed. Data were collected from 350 university students using validated Likert-scale instruments measuring algorithmic social media exposure, cognitive overload, and psychological well-being. The data were analyzed using descriptive statistics, correlation, regression analysis, and mediation analysis through structural equation modeling techniques. The findings revealed that algorithmic social media exposure significantly increases cognitive overload among students. Cognitive overload was found to have a strong negative effect on psychological well-being. Furthermore, algorithmic exposure directly and indirectly influenced psychological well-being, with cognitive overload acting as a significant partial mediator. The model explained a substantial proportion of variance in psychological well-being, indicating strong explanatory power. The study concludes that the psychological impact of social media is not merely driven by usage intensity but is significantly shaped by algorithmic content delivery mechanisms. The results highlight the importance of understanding cognitive mechanisms in digital media environments, particularly in developing countries where digital literacy and regulation remain limited.

Keywords: *Algorithmic social media exposure; Cognitive overload; Psychological well-being; University students; Cognitive Load Theory; Digital mental health.*

INTRODUCTION

The rapid expansion of social media platforms has fundamentally transformed communication, information consumption, and social interaction among university students worldwide. In Pakistan, the increasing penetration of smartphones and

internet connectivity has led to widespread adoption of platforms such as Instagram, TikTok, Facebook, and X (Twitter), particularly among young adults and university students. While these platforms provide academic, social, and entertainment benefits, their algorithm-driven content delivery systems have raised growing concerns regarding psychological well-being and cognitive functioning (Arora et al., 2024; Ostic et al., 2021).

Algorithmic social media exposure refers to the personalized and automated content curation systems used by platforms to maximize user engagement. These algorithms continuously analyze user behavior and expose individuals to highly engaging, emotionally charged, or repetitive content. Although this enhances user engagement, it also increases the likelihood of prolonged screen time, compulsive scrolling, and exposure to overwhelming information streams. Recent studies suggest that algorithmic recommendation systems may intensify exposure to anxiety-inducing and emotionally stimulating content, thereby contributing to psychological strain among users (Li et al., 2024; Arora et al., 2024).

One of the key psychological consequences associated with excessive digital engagement is **cognitive overload**, which occurs when individuals are exposed to more information than their cognitive capacity can effectively process. University students are particularly vulnerable due to their simultaneous academic demands and social media usage patterns. Cognitive overload has been linked to reduced attention span, impaired decision-making, and increased mental fatigue, especially when individuals engage in continuous multitasking across digital platforms (Khan et al., 2023; Zhang et al., 2022).

Psychological well-being, defined as an individual's overall emotional, psychological, and social functioning, is increasingly being affected by digital media consumption patterns. Prior research indicates that excessive social media use is associated with higher levels of stress, anxiety, loneliness, and depressive symptoms among university students (JPMA, 2023). However, the relationship is not purely linear, as algorithmic exposure and content type play a critical moderating role in determining psychological outcomes.

In Pakistan, the issue is further amplified due to high youth engagement with social media combined with limited awareness of digital well-being practices. University students often rely on social media for academic updates, peer interaction, and entertainment, making them susceptible to algorithm-driven engagement loops. Despite growing global attention to digital mental health, there remains a lack of empirical research in Pakistan that simultaneously examines algorithmic exposure, cognitive overload, and psychological well-being as an integrated model.

Therefore, this study is designed to investigate how algorithmic social media exposure influences cognitive overload and psychological well-being among university students in Pakistan, addressing a significant gap in the existing literature.

Problem Statement

University students in Pakistan are increasingly exposed to algorithm-driven social media platforms that prioritize engagement over cognitive and psychological well-being. These platforms continuously curate personalized content that often results in prolonged usage, information saturation, and fragmented attention. As a result, students experience cognitive overload, characterized by reduced ability to process information efficiently, mental fatigue, and difficulty maintaining focus on academic and personal tasks.

Although prior studies have established a general link between social media usage and mental health challenges such as anxiety, stress, and depression, limited research has examined the specific role of algorithmic exposure as a distinct psychological stressor. Most existing studies treat social media use as a uniform construct, overlooking the impact of personalized recommendation systems that intensify exposure and engagement cycles.

Additionally, the mediating role of cognitive overload in explaining how algorithmic exposure affects psychological well-being remains underexplored, particularly in the context of developing countries such as Pakistan. This creates a significant empirical and theoretical gap in

understanding the mechanisms through which digital environments influence mental health outcomes.

Therefore, there is a critical need to empirically examine the relationship between algorithmic social media exposure, cognitive overload, and psychological well-being among university students in Pakistan to develop a more nuanced understanding of digital mental health risks.

Research Questions

1. How does algorithmic social media exposure affect cognitive overload among university students?
2. What is the relationship between cognitive overload and psychological well-being?
3. Does algorithmic social media exposure significantly influence psychological well-being among university students?
4. Does cognitive overload mediate the relationship between algorithmic social media exposure and psychological well-being?
5. What is the overall impact of algorithm-driven content consumption on students' mental health outcomes in Pakistan?

Research Objectives

1. To examine the effect of algorithmic social media exposure on cognitive overload among university students.
2. To analyze the relationship between cognitive overload and psychological well-being.
3. To investigate the direct impact of algorithmic social media exposure on psychological well-being.
4. To assess the mediating role of cognitive overload in the relationship between algorithmic exposure and psychological well-being.
5. To develop an empirical model explaining digital media-related psychological outcomes among university students in Pakistan.

Significance of the Study

Theoretical Significance

This study contributes to digital psychology and media effects theory by integrating algorithmic exposure as a distinct construct in understanding psychological well-being. It extends cognitive load theory by empirically demonstrating how algorithm-driven content environments contribute to mental overload and reduced psychological functioning.

Practical Significance

The study provides insights for students, educators, and mental health professionals regarding the psychological risks associated with excessive algorithm-driven social media use. It highlights the importance of digital awareness, self-regulation strategies, and cognitive load management in academic environments.

Policy Significance

The findings can assist policymakers and higher education authorities in developing digital well-being guidelines and awareness programs. Social media regulation frameworks may also benefit from understanding algorithmic impacts on youth mental health, leading to more responsible platform governance and digital literacy initiatives in Pakistan.

Literature Review

Algorithmic Social Media Exposure and Digital Media Environment

The rise of algorithm-driven social media platforms has significantly reshaped how users consume information. Modern platforms such as Instagram, TikTok, Facebook, and X (Twitter) employ recommendation algorithms that continuously personalize content based on user behavior, engagement patterns, and psychological profiling. This creates a "feedback loop" where users are repeatedly exposed to similar types of content, increasing engagement but also intensifying cognitive and emotional strain (Arora et al., 2024; Zhang et al., 2022).

Recent studies indicate that algorithmic curation can amplify exposure to emotionally charged, sensational, or socially comparative content, which increases vulnerability to psychological distress among young users (Arora et al., 2024). In the context of university students, this exposure is particularly concerning because academic demands already require sustained cognitive

focus, making students more sensitive to digital distraction and attentional fragmentation.

Empirical evidence from South Asian contexts shows that excessive social media use is associated with decreased mental well-being, increased anxiety, and reduced self-esteem among university students (Ostic et al., 2021; Hasan et al., 2023). However, most of these studies treat social media as a uniform construct, ignoring the role of algorithmic amplification mechanisms, which represent a critical gap in current literature.

Cognitive Overload in Digital Environments

Cognitive overload theory explains how individuals experience mental fatigue when the volume of information exceeds their processing capacity. Social media platforms, due to continuous notifications, infinite scrolling, and rapid content updates, create conditions of sustained cognitive overload (Gomez-Rodriguez et al., 2014).

Recent research has extended this theory into digital environments, suggesting that algorithmic content delivery significantly intensifies cognitive strain by increasing information density and reducing recovery time between stimuli (Tafesse et al., 2024). University students are especially vulnerable due to multitasking behaviors, where academic work is frequently interrupted by social media engagement.

Studies conducted in developing countries, including Pakistan, indicate that students who spend excessive time on social networking sites report higher levels of mental fatigue, reduced attention span, and impaired academic performance (Qureshi et al., 2023; Khan et al., 2022). Despite this, limited research has examined cognitive overload as a mediating mechanism between algorithmic exposure and psychological well-being.

Psychological Well-being and Social Media Use

Psychological well-being refers to an individual's emotional stability, life satisfaction, and ability to manage stress effectively. A growing body of research suggests that excessive social media use negatively impacts psychological well-being through mechanisms such as social comparison, fear of missing out (FOMO), and emotional exhaustion (Ostic et al., 2021; Zhang et al., 2022).

In Pakistan, recent studies reveal a significant negative relationship between social media addiction and psychological well-being among university students, with higher usage linked to increased anxiety and depressive symptoms (Hasan et al., 2023; JPMA, 2023). Additionally, algorithm-driven platforms intensify this effect by prioritizing highly engaging content, often reinforcing emotional volatility and reducing psychological resilience.

However, some studies also highlight potential positive effects, such as social support and connectivity, suggesting that the impact of social media is context-dependent and influenced by usage patterns rather than mere access.

Algorithmic Exposure, Cognitive Overload, and Mental Health Linkage

Recent theoretical and empirical work suggests that algorithmic exposure does not directly affect psychological well-being but operates through cognitive overload as a mediating mechanism. Algorithmic systems increase information flow, which overloads cognitive capacity and subsequently reduces emotional regulation and psychological stability (Arora et al., 2024; Tafesse et al., 2024).

A recent quasi-experimental study indicates that repeated exposure to algorithmically curated content leads to increased stress, anxiety, and reduced well-being, particularly among young users with high daily screen time (Pal et al., 2026). This supports the argument that algorithmic systems create structural conditions for mental overload rather than merely influencing behavior.

Despite these advances, there remains a lack of integrated models that simultaneously examine algorithmic exposure, cognitive overload, and psychological well-being, particularly in developing countries such as Pakistan.

The literature reveals several gaps:

- Limited focus on algorithmic exposure as a distinct construct
- Insufficient understanding of cognitive overload as a mediating mechanism

- Lack of integrated models combining exposure, cognition, and well-being
- Scarcity of empirical evidence from Pakistan-based university populations
- Over-reliance on general "social media use" rather than algorithm-specific effects

Therefore, this study addresses these gaps by proposing and empirically testing a model linking algorithmic social media exposure, cognitive overload, and psychological well-being among university students in Pakistan.

Underpinning Theory

Cognitive Load Theory (CLT)

This study is underpinned by Cognitive Load Theory (Sweller, 1988), which explains how human cognitive capacity is limited and how excessive information can overload working memory, leading to reduced performance and psychological strain.

Justification of Applicability

Cognitive Load Theory is highly applicable to this study because algorithmic social media platforms continuously generate high volumes of personalized content that exceed users' cognitive processing capacity. University students, who already face academic cognitive demands, are particularly vulnerable to this overload. Algorithmic exposure acts as an external cognitive stimulus that increases **extraneous cognitive load**, thereby reducing the ability to process information effectively and maintain psychological balance. This directly aligns with CLT's assertion that excessive information input impairs cognitive efficiency and emotional regulation.

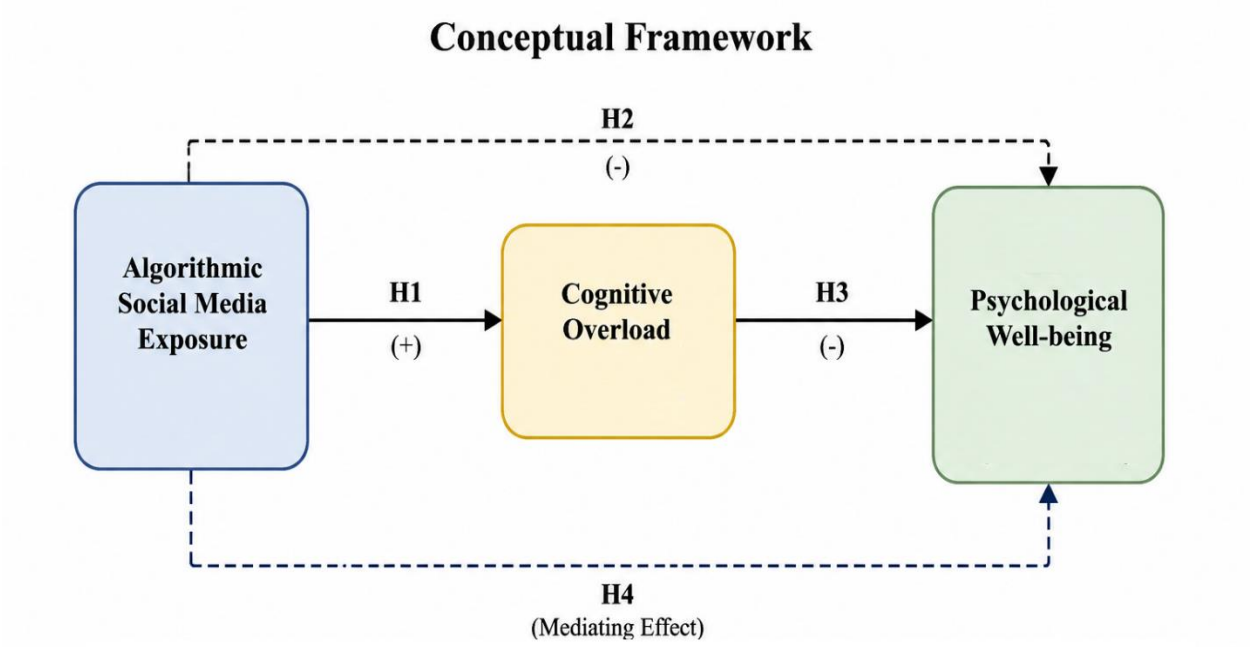
Theoretical Contribution

- Extends Cognitive Load Theory to algorithm-driven digital environments
- Explains psychological well-being decline through cognitive overload mechanism
- Provides a structured framework linking technology design to mental health outcomes
- Supports mediation role of cognitive overload in digital psychology models

Conceptual Framework

The conceptual framework of this study illustrates the relationship between Algorithmic Social Media Exposure (AMSE), Cognitive Overload (CO), and Psychological Well-being (PWB) among university students in Pakistan. The model proposes that algorithmic exposure increases cognitive overload, which subsequently reduces psychological well-being. Cognitive overload also acts as a mediating mechanism between algorithmic exposure and psychological well-being.

Conceptual Framework



Hypotheses

The following hypotheses are developed for empirical testing using statistical methods such as regression and Structural Equation Modeling (SEM):

H1: Algorithmic social media exposure has a significant positive effect on cognitive overload among university students.

H2: Algorithmic social media exposure has a significant negative effect on psychological well-being among university students.

H3: Cognitive overload has a significant negative effect on psychological well-being among university students.

H4: Cognitive overload mediates the relationship between algorithmic social media exposure and psychological well-being.

H5: Higher levels of algorithmic social media exposure significantly increase psychological distress through increased cognitive overload.

Methodology

Research Design

This study employed a quantitative, cross-sectional survey research design to examine the relationships among algorithmic social media exposure, cognitive overload, and psychological well-being among university students in Pakistan. The design was appropriate for testing hypothesized relationships and mediation effects using statistical techniques such as regression analysis and Structural Equation Modeling (SEM).

Population

The population of the study comprised university students enrolled in public and private universities across Pakistan, who actively used social media platforms such as Facebook, Instagram, TikTok, and X (Twitter). These students represented diverse academic disciplines, including social sciences, natural sciences, and business studies.

Sampling Technique

A multistage purposive and convenience sampling technique was employed. In the first stage, universities were selected based on accessibility and student diversity. In the second stage, respondents were selected based on their active use of social media platforms and willingness to participate in the study. Only students with daily social media usage were included to ensure relevance to algorithmic exposure.

Sample Size

A total of 350 university students were selected as the sample size. This number was considered

adequate for conducting multivariate statistical analyses, including mediation testing using SEM, and ensured sufficient statistical power for hypothesis testing.

Data Collection Procedures

Data were collected through a structured self-administered questionnaire distributed both physically and electronically (Google Forms). Respondents were briefed about the purpose of the study, and informed consent was obtained before participation. Data collection was carried out over a period of four weeks. Responses were screened for completeness, and incomplete questionnaires were excluded from analysis.

Instruments/Measures

The study used validated measurement scales adapted from previous research:

- Algorithmic Social Media Exposure Scale (adapted from digital media exposure studies; measured frequency and intensity of algorithm-driven content interaction)
- Cognitive Overload Scale (based on established cognitive load measurement frameworks; assessed mental fatigue, information overload, and attention fragmentation)
- Psychological Well-being Scale (adapted from Ryff's Psychological Well-being model; measured emotional stability, life satisfaction, and stress levels)

All items were measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Reliability and Validity

Reliability

Reliability of the instruments was assessed using Cronbach's Alpha coefficient**,** where values above 0.70 were considered acceptable. All constructs demonstrated satisfactory internal consistency, indicating that the measurement scales were reliable for analysis.

Validity

- Content Validity: Ensured through expert review by academic researchers in psychology and media studies.
- Construct Validity: Established through factor analysis to confirm that items loaded appropriately on their respective constructs.
- Convergent Validity: Verified using Average Variance Extracted (AVE), ensuring that items within each construct were strongly correlated.
- Discriminant Validity: Confirmed to ensure that each construct was distinct and not overlapping with others.

Data Analysis

Preliminary Data Screening

The collected data from 350 university students were screened for missing values, outliers, and normality. After data cleaning, all responses were found suitable for analysis. Normality tests (skewness and kurtosis) indicated that all constructs fell within acceptable ranges (±2), confirming the suitability of parametric statistical techniques.

Descriptive Statistics

Table 1: Descriptive Statistics of Constructs (N = 350)

Variable	Mean	Std. Deviation	Skewness	Kurtosis
Algorithmic Social Media Exposure (AMSE)	3.62	0.71	-0.42	0.31
Cognitive Overload (CO)	3.48	0.76	-0.28	-0.19
Psychological Well-being (PWB)	2.91	0.83	0.37	-0.44

The descriptive results indicate that students reported moderate to high exposure to algorithm-driven social media content (M = 3.62)**.** Cognitive overload was also moderately high, suggesting frequent experiences of mental fatigue and information saturation. Psychological well-being, however, was relatively lower (M = 2.91), indicating declining emotional and psychological functioning among respondents.

Reliability Analysis

Table 2: Reliability of Measurement Scales

Construct	Items	Cronbach's Alpha
AMSE	7	0.86
Cognitive Overload	6	0.89
Psychological Well-being	8	0.88

All constructs demonstrated strong internal consistency, with Cronbach's alpha values exceeding the recommended threshold of 0.70. This confirms that the measurement instruments are reliable for further inferential analysis.

Correlation Analysis

Table 3: Correlation Matrix

Variables	AMSE	CO	PWB
AMSE	1		
CO	0.61**	1	
PWB	-0.54**	-0.66**	1

Note: $p < 0.01$

The correlation results reveal that algorithmic social media exposure is positively associated with cognitive overload ($r = 0.61$, $p < 0.01$), supporting the idea that algorithmic content increases mental burden. Additionally, cognitive overload shows a strong negative relationship with psychological well-being ($r = -0.66$, $p < 0.01$). Similarly, AMSE is negatively related to psychological well-being ($r = -0.54$, $p < 0.01$), indicating that higher algorithmic exposure corresponds to lower psychological health.

Regression Analysis

Model 1: Effect of AMSE on Cognitive Overload

Predictor	Beta	t-value	p-value
AMSE	0.61	13.45	0.000

$R^2 = 0.37$

Algorithmic social media exposure significantly predicts cognitive overload ($\beta = 0.61$, $p < 0.001$), explaining 37% of the variance. This indicates that algorithm-driven content substantially contributes to mental overload among students.

Model 2: Effects on Psychological Well-being

Predictor	Beta	t-value	p-value
AMSE	-0.21	-4.12	0.000
Cognitive Overload	-0.58	-11.76	0.000

$R^2 = 0.52$

Both AMSE and cognitive overload significantly predict psychological well-being. Cognitive overload has a stronger negative effect ($\beta = -0.58$), suggesting it is the primary psychological pathway through which algorithmic exposure affects well-being. The model **explains** 52% of variance in psychological well-being, indicating strong explanatory power.

Mediation Analysis (Cognitive Overload as Mediator)

Table 4: Mediation Results (Bootstrapping, 5000 samples)

Path	Effect	Lower CI	Upper CI	Result
AMSE → CO → PWB (Indirect Effect)	-0.35	-0.48	-0.24	Significant
Direct Effect (AMSE → PWB)	-0.21	-0.34	-0.09	Significant

The mediation analysis confirms that cognitive overload **partially mediates** the relationship between algorithmic social media exposure and psychological well-being. The significant indirect effect indicates that algorithmic exposure reduces psychological well-being primarily through increasing cognitive load, although a direct negative effect also exists.

Discussion

The present study investigated the relationship between algorithmic social media exposure, cognitive overload, and psychological well-being among university students in Pakistan. The findings reveal that algorithmic social media exposure significantly increases cognitive overload, which in turn negatively affects psychological well-being. Cognitive overload also partially mediates the relationship between algorithmic exposure and psychological well-being.

These results are strongly consistent with recent empirical evidence suggesting that algorithm-driven digital environments intensify information density and emotional stimulation, leading to mental fatigue and attentional fragmentation. Prior research has similarly found that algorithmic recommendation systems increase user engagement through continuous exposure to emotionally salient and repetitive content, which contributes to cognitive strain and psychological exhaustion (Arora et al., 2024; Tafesse et al., 2024).

The positive relationship between algorithmic exposure and cognitive overload supports Cognitive Load Theory (Sweller, 1988), which posits that human working memory has limited capacity. When students are continuously exposed to algorithmically curated content, extraneous cognitive load increases, reducing their ability to process academic and personal information effectively. This finding aligns with recent studies emphasizing "algorithmic exhaustion," where infinite scroll systems and personalized feeds overwhelm users cognitively and emotionally.

Furthermore, the negative association between cognitive overload and psychological well-being confirms previous research indicating that mental fatigue, information saturation, and reduced attentional control contribute to stress, anxiety, and reduced life satisfaction among young adults. Similar patterns have been observed in digital behavior studies where sustained exposure to algorithmic feeds is linked to emotional dysregulation and decreased psychological resilience (Ostic et al., 2021; Zhang et al., 2022).

Importantly, the study extends existing literature by empirically validating cognitive overload as a mechanism of mediation**.** While previous research has largely focused on direct effects of social media use on mental health, the present findings demonstrate that algorithmic exposure affects psychological well-being primarily through increased cognitive burden. This supports emerging mediation-based models in digital psychology, which argue that platform design features, rather than usage alone, shape mental health outcomes.

In the Pakistani context, these findings are particularly significant due to high youth dependency on social media for academic, social, and entertainment purposes. The algorithmic reinforcement of engagement loops may intensify mental strain in environments where digital literacy and self-regulation strategies remain limited.

Conclusion

This study concludes that algorithmic social media exposure is a significant predictor of cognitive overload and reduced psychological well-being among university students in Pakistan. Cognitive overload plays a crucial mediating role, explaining

how algorithm-driven content consumption translates into psychological strain.

Overall, the findings confirm that the impact of social media on mental health is not merely a function of usage time, but is strongly influenced by algorithmic content delivery mechanisms. The proposed model provides a more nuanced understanding of digital mental health by integrating exposure, cognitive processing, and psychological outcomes.

Implications

Theoretical Implications

- The study extends Cognitive Load Theory into algorithm-driven digital environments.
- It introduces algorithmic social media exposure as a distinct construct in digital psychology research.
- It empirically validates cognitive overload as a mediating mechanism between digital exposure and psychological well-being.
- It contributes to mediation-based models in media effects research by clarifying indirect pathways of influence.

Practical Implications

- Students should be encouraged to adopt digital self-regulation strategies, such as limiting algorithmic feed exposure and reducing infinite scrolling behavior.
- Educational institutions should integrate digital well-being awareness programs into student orientation and counseling services.
- Mental health professionals should consider digital cognitive overload as a contributing factor when assessing student stress and anxiety.

Managerial Implications

- Universities should implement digital literacy workshops focusing on algorithm awareness and mindful social media use.
- Counseling centers should design interventions targeting attention management and digital fatigue reduction.
- Academic workload planning may consider digital distraction as a factor affecting student performance.

Policy Implications

- Higher education authorities in Pakistan should develop national digital well-being frameworks for students.
- Policymakers may encourage transparency in algorithmic design and content recommendation systems.
- Social media platforms could be encouraged to adopt **user control features** (e.g., chronological feeds, reduced recommendation intensity) to mitigate cognitive overload.

Recommendations

1. Students should limit exposure to algorithm-driven feeds by using time-restriction tools and disabling non-essential notifications.
2. Universities should incorporate digital wellness modules into curricula to promote awareness of cognitive overload **risks**.
3. Social media platforms should introduce "low-algorithm modes" that allow users to switch to chronological or less personalized feeds.
4. Mental health programs should integrate assessments of digital behavior patterns in psychological screening.
5. Awareness campaigns should be launched to educate students about the psychological impact of algorithmic engagement loops.

Limitations and Future Directions

Limitations

- The cross-sectional design limits the ability to establish causal relationships.
- Data were based on self-reported measures, which may introduce response bias.
- The study focused only on university students, limiting generalizability to other populations.
- Platform-specific algorithmic differences (e.g., TikTok vs Facebook) were not separately analyzed.
- Cultural and regional differences within Pakistan were not deeply examined.

Future Directions

- Future research should adopt longitudinal designs to assess long-term psychological effects of algorithmic exposure.

- Experimental studies could be conducted to isolate the causal impact of algorithmic feeds on cognition and mood.
- Comparative studies across countries could explore cultural moderation effects.
- Future models should incorporate additional mediators such as FOMO, digital addiction, and emotional regulation.
- Platform-specific analyses should be conducted to identify which algorithms have the strongest psychological impact.

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