

Information Overload in Digital Learning Environments and Academic Achievement among Libyan University Students: A Structural Equation Modeling Approach

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Abstract

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This study examines the complex role of information overload in shaping academic achievement within digital learning environments, with a specific focus on Libyan higher education. Drawing on data from 205 undergraduate students and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), the study investigates both the direct and indirect effects of information overload through cognitive load and self-regulated learning (SRL). The findings reveal a dual and nuanced effect. Information overload exerts a significant negative direct impact on academic achievement by increasing cognitive load and disrupting attentional processes. At the same time, it demonstrates a positive indirect effect by stimulating self-regulated learning, which partially offsets its adverse cognitive consequences. Cognitive load emerges as a key mediator that amplifies the negative pathway, while self-regulated learning functions as an adaptive mechanism that enhances academic performance. These results contribute to the literature by integrating Cognitive Load Theory and self-regulated learning within a unified empirical framework, highlighting the conditional nature of information overload in educational settings. Rather than being purely detrimental, information overload operates as a double-edged phenomenon, with its impact depending on students' capacity to regulate their learning processes. Practically, the study underscores the need for higher education institutions—particularly in resource-constrained contexts—to move beyond information provision toward developing students' digital literacy and self-regulation skills. Such interventions are essential for mitigating cognitive overload and fostering sustainable academic achievement in increasingly complex digital environments.



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Introduction

The rapid expansion of digital technologies has fundamentally reshaped the landscape of higher education, enabling unprecedented access to information and learning resources. Online platforms, digital libraries, and social media have collectively transformed how students acquire, process, and utilize knowledge. However, this abundance of information has introduced a critical paradox: while access to diverse information sources enhances learning opportunities, excessive exposure may overwhelm students' cognitive capacity and ultimately hinder academic performance. This phenomenon, widely conceptualized as *information overload*, has emerged as a pressing challenge in contemporary digital learning environments.

Information overload occurs when the volume, velocity, and complexity of information exceed an individual's ability to process it effectively. Within educational contexts, this condition manifests as cognitive fatigue, fragmented attention, and reduced ability to synthesize knowledge. Cognitive Load Theory provides a foundational framework for understanding this issue, suggesting that human working memory has limited capacity, and learning effectiveness declines when instructional demands surpass this

threshold. When students are confronted with excessive or poorly structured information, their ability to engage in deep learning diminishes, resulting in superficial understanding and lower academic achievement.

Despite its global relevance, the implications of information overload are particularly pronounced in developing and transitional educational systems, such as Libya. The Libyan higher education sector operates under unique constraints, including limited technological infrastructure, inconsistent access to learning materials, and ongoing socio-political instability. These contextual challenges exacerbate the risks associated with digital information environments. Students are not only required to navigate large volumes of academic content but must also filter unreliable, redundant, or conflicting information from multiple sources, including social media, informal networks, and fragmented institutional systems.

In such environments, the ability to manage information effectively becomes a critical determinant of academic success. However, the existing literature has largely overlooked the Libyan context, focusing instead on more stable and technologically advanced educational systems. While previous studies have established that information overload negatively affects learning outcomes through increased cognitive load and reduced attention, there remains limited understanding of how these dynamics operate in resource-constrained settings. Moreover, the potential for information overload to produce adaptive responses—such as enhanced self-regulated learning—has not been sufficiently explored.

Self-regulated learning (SRL) refers to learners' ability to plan, monitor, and control their cognitive and behavioral processes in pursuit of academic goals. It encompasses strategies such as goal setting, time management, metacognitive monitoring, and strategic resource use. In high-information environments, SRL becomes particularly important, as students must actively filter, prioritize, and integrate information to avoid cognitive overload. Rather than being passive recipients of information, successful learners adopt proactive strategies to manage complexity and maintain focus.

This introduces an important theoretical nuance: information overload may not be solely detrimental. While excessive information can impair cognitive functioning, it may also stimulate adaptive learning behaviors among students who possess strong self-regulatory capabilities. In this sense, information overload can function as both a constraint and a catalyst—negatively affecting students with low self-regulation while encouraging strategic adaptation among more resilient learners. This duality has significant implications for educational theory and practice but remains underexplored in empirical research.

To address this gap, the present study adopts a Structural Equation Modeling (SEM) approach to investigate the complex relationships among information overload, cognitive load, self-regulated learning, attention, and academic achievement in the Libyan higher education context. SEM is particularly suited for this analysis, as it enables the simultaneous examination of multiple direct and indirect relationships, providing a more comprehensive understanding of causal mechanisms. By integrating cognitive and behavioral constructs within a single analytical framework, this study moves beyond fragmented analyses and offers a holistic perspective on learning in digital environments.

Specifically, this research seeks to answer the following key questions:

- (1) How does information overload influence academic achievement among Libyan university students?
- (2) To what extent do cognitive load and self-regulated learning mediate this relationship?
- (3) Can self-regulated learning mitigate the negative effects of information overload and enhance academic outcomes?

In addressing these questions, the study makes several important contributions. First, it extends the literature on information overload by examining its effects within a context characterized by structural and systemic challenges. Second, it advances theoretical understanding by integrating Cognitive Load Theory with self-regulated learning frameworks, highlighting the interplay between cognitive constraints and adaptive learning strategies. Third, it provides empirical evidence on the dual role of information overload, demonstrating that its impact on academic achievement is not uniformly negative but contingent upon students' regulatory capacities.

Furthermore, this study has important practical implications for higher education policy and instructional design. Rather than focusing solely on reducing information exposure, educational institutions should prioritize equipping students with the skills necessary to manage information effectively. This includes fostering digital literacy, critical thinking, and self-regulated learning competencies. By shifting from an access-oriented paradigm to a capacity-building approach, universities can better prepare students to thrive in complex information environments.

In the Libyan context, where educational systems are undergoing significant transformation, such interventions are particularly critical. Enhancing students' ability to navigate information overload can contribute not only to improved academic performance but also to broader educational resilience. As digital learning continues to expand globally, understanding how students interact with information—and how they can be supported in doing so effectively—remains a central challenge for educators and policymakers alike.

This study positions information overload as a multifaceted phenomenon that requires nuanced analysis and targeted intervention. By examining its direct and indirect effects on academic achievement through cognitive load and self-regulated learning, the research provides a comprehensive framework for understanding learning in high-information environments. It underscores the importance of shifting the focus from information quantity to information management, offering both theoretical insights and practical strategies for enhancing student success in the digital age.

Literature Review

Information Overload in Digital Learning Environments

Information overload has been widely conceptualized as a condition in which the volume and complexity of available information exceed an individual's processing capacity, resulting in diminished decision quality and performance. Rooted in early communication theory and later expanded within cognitive psychology, the concept reflects a mismatch between environmental demands and human cognitive limitations.

In contemporary digital learning environments, information overload has intensified due to the exponential growth of information sources, particularly through online platforms and social media. Students are continuously exposed to heterogeneous, often redundant, and sometimes contradictory information streams. This multidimensional exposure includes formal academic materials, peer-generated content, and algorithmically curated digital media, creating a cognitively demanding ecosystem.

Existing literature consistently associates information overload with negative outcomes such as stress, anxiety, reduced task efficiency, and impaired academic performance. However, much of this research adopts a unidirectional perspective, treating information overload primarily as a detrimental factor. Such an approach overlooks the possibility that exposure to high information density may also stimulate adaptive cognitive and behavioral responses, particularly among learners with advanced coping strategies.

Furthermore, prior studies tend to operationalize information overload as a static construct, neglecting its subjective and context-dependent nature. In reality, overload is not solely determined by information quantity but also by factors such as prior knowledge, digital literacy, and task complexity. This limitation highlights the need for more nuanced models that incorporate mediating and moderating variables.

Cognitive Load Theory as an Explanatory Framework

Cognitive Load Theory (CLT) provides a robust theoretical foundation for understanding the mechanisms through which information overload affects learning. According to CLT, human working memory has limited capacity, and learning is optimized when instructional design aligns with this constraint. Cognitive load is typically categorized into intrinsic load (task complexity), extraneous load (instructional design), and germane load (learning-related processing).

Information overload primarily contributes to extraneous cognitive load by introducing irrelevant or poorly structured information that competes for cognitive resources. When extraneous load exceeds manageable levels, it disrupts schema construction and inhibits meaningful learning. Empirical studies have demonstrated that excessive information reduces comprehension, increases error rates, and leads to cognitive fatigue.

However, the relationship between cognitive load and learning outcomes is not strictly linear. Moderate levels of cognitive challenge may enhance engagement and promote deeper processing, suggesting that overload effects depend on the balance between cognitive demand and learner capability. This perspective aligns with the notion that cognitive load can act as both a constraint and a catalyst, depending on contextual and individual factors.

Despite its explanatory power, CLT alone is insufficient to fully account for the variability in student responses to information overload. Specifically, it does not adequately address how learners actively manage

cognitive demands through strategic behaviors. This limitation necessitates the integration of cognitive theories with behavioral frameworks such as self-regulated learning.

Self-Regulated Learning as an Adaptive Mechanism

Self-regulated learning (SRL) represents a critical construct for understanding how students cope with complex learning environments. Defined as the process through which learners plan, monitor, and control their cognitive, motivational, and behavioral activities, SRL enables individuals to adapt to varying task demands and environmental conditions.

In the context of information overload, SRL functions as a compensatory mechanism that mitigates cognitive strain. Learners with strong self-regulatory skills are better equipped to filter irrelevant information, prioritize essential content, and allocate cognitive resources efficiently. Strategies such as goal setting, time management, and metacognitive monitoring allow these learners to maintain focus and sustain performance despite high informational demands.

Empirical research consistently demonstrates a positive relationship between SRL and academic achievement. Students who actively regulate their learning processes tend to exhibit higher persistence, deeper understanding, and better performance outcomes. Moreover, SRL has been identified as a mediator in various learning models, linking environmental factors to academic success.

However, the interaction between information overload and SRL remains theoretically underdeveloped. While some studies suggest that overload impairs self-regulation by overwhelming cognitive resources, others indicate that it may trigger adaptive responses, encouraging learners to develop more sophisticated strategies. This contradiction points to a critical gap in the literature: the need to conceptualize SRL not merely as an outcome but as a dynamic response to environmental complexity.

Academic Achievement in Complex Learning Contexts

Academic achievement is a multidimensional construct typically measured through indicators such as grade point average (GPA), course completion, and knowledge acquisition. It serves as a key outcome variable in educational research, reflecting both individual learning processes and systemic effectiveness.

Traditional models of academic achievement emphasize factors such as motivation, prior knowledge, and instructional quality. However, these models often fail to account for the increasing complexity of digital learning environments. In high-information contexts, achievement is not solely determined by effort or ability but also by the capacity to manage and integrate information effectively.

Research indicates that information overload negatively impacts academic performance by reducing attention, increasing cognitive fatigue, and impairing decision-making. At the same time, studies highlight the role of mediating variables such as cognitive load and SRL in shaping this relationship. These findings suggest that academic achievement is influenced by a network of interrelated factors rather than isolated variables.

Despite these insights, existing studies frequently adopt fragmented approaches, examining individual relationships without integrating them into a comprehensive model. This limitation restricts the ability to capture the complex interplay among cognitive, behavioral, and environmental factors.

Toward an Integrated Theoretical Framework

To overcome the limitations of fragmented prior research, this study adopts an integrated theoretical framework that synthesizes Information Overload Theory, Cognitive Load Theory (CLT), and Self-Regulated Learning (SRL). This integrative approach enables a more comprehensive explanation of how external informational environments interact with internal cognitive and behavioral mechanisms to influence academic achievement.

Within this framework, information overload is conceptualized as the primary exogenous construct, representing the intensity and complexity of information exposure faced by students in digital learning environments. It is hypothesized to influence academic achievement both directly and indirectly through multiple mediating pathways.

First, information overload increases cognitive load, reflecting the immediate cognitive burden imposed on learners. Consistent with CLT, excessive information introduces extraneous cognitive load, which interferes with schema construction and reduces learning efficiency. This pathway represents the primary negative mechanism through which information overload undermines academic performance.

Second, information overload also influences self-regulated learning, representing a behavioral adaptation mechanism. Learners with strong self-regulatory capabilities are more likely to transform excessive information into structured knowledge through strategic filtering, monitoring, and control processes. In this sense, self-regulated learning serves as a protective factor that can mitigate the adverse effects of cognitive overload.

Third, attention is incorporated as an intermediary construct, capturing the role of sustained cognitive engagement. Information overload is expected to fragment attention, thereby reducing the effectiveness of both cognitive processing and self-regulation. This highlights the interconnected nature of cognitive and behavioral responses in high-information environments.

Ultimately, these pathways converge on academic achievement as the key outcome variable. The model therefore captures both negative and adaptive mechanisms: while information overload may impair performance through increased cognitive load, it may simultaneously enhance performance indirectly by stimulating self-regulated learning among adaptive learners.

To visually synthesize these theoretical relationships, the conceptual model of the study is presented in Figure 1.

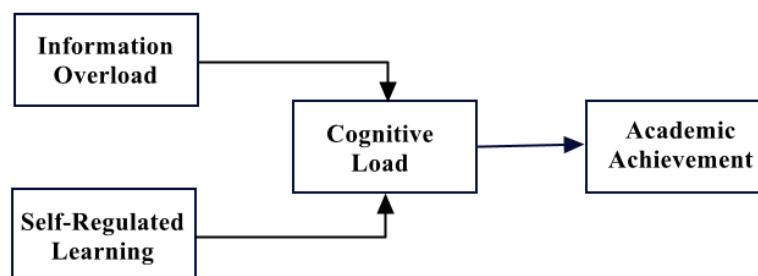


Figure 1. Conceptual Model of the Study

The conceptual model provides a structured representation of the hypothesized relationships, enabling simultaneous examination of direct and indirect effects through Structural Equation Modeling (SEM). By integrating cognitive constraints and adaptive learning strategies within a single framework, the model advances beyond traditional linear explanations and reflects the complexity of real-world learning environments.

Importantly, this framework is particularly relevant in the Libyan higher education context, where students operate under compounded pressures, including limited institutional resources, linguistic challenges, and socio-political instability. These contextual factors intensify both cognitive demands and the necessity for self-regulated learning, reinforcing the theoretical and practical significance of the proposed model.

Research Gap and Hypothesis Development Direction

Although global research has explored the relationships among information overload, cognitive load, and academic performance, several critical gaps remain. First, there is a lack of empirical studies examining these constructs within the Libyan context. Second, existing research often fails to account for the mediating role of self-regulated learning in a comprehensive structural model. Third, the potential dual effect of information overload—as both a constraint and a catalyst—has not been adequately tested.

Addressing these gaps requires a methodological approach capable of capturing complex causal relationships. Structural Equation Modeling (SEM) provides an appropriate framework for this purpose, allowing simultaneous analysis of direct and indirect effects among multiple constructs.

Based on the theoretical synthesis presented above, this study proposes a model in which information overload influences academic achievement both directly and indirectly through cognitive load and self-regulated learning. This integrated perspective offers a more nuanced understanding of learning in digital environments and provides a foundation for empirical testing.

Method

The study adopts a quantitative cross-sectional design using a survey administered through Google Forms. It applies structural equation modeling (SEM) with SmartPLS 4 software to analyze data from a pilot and main study, exploring the impact of information overload on the academic achievement of Libyan students. The model tests cognitive load and self-regulated learning (SRL) as mediating variables, addressing a critical research gap. As Libya's higher education system operates entirely in Arabic, original scales were modified for socio-cultural adaptation. The main study concentrates on 30 items covering all five constructs, surpassing the five-to-one ratio recommended by (Nasrullah and Firdouse Rahman Khan, 2019). Items were retained through consensus, informed by expert advice, personal experience, and a comprehensive literature review of Libyan public universities.

The research prioritizes student privacy and confidentiality. Active consent, secured through preamble notices, was a prerequisite for questionnaire access. Primary preparations completed in 2020 remained unchanged into 2023, enabling adherence to the pre-estimated sample size of 205. PLS was chosen for its effectiveness with small samples and flexible distribution assumptions, allowing for clearer assessment of descriptive statistics. Item non-response, encompassing missed and refused items, fits easily within the 15% threshold, with marginal transformations addressing adherence to normality distribution. PLS-Smart 4 software implements a two-step approach, beginning with measurement model estimation. Assessment of outer weights and loadings, combined with average variance extracted (AVE) and discriminant validity, is followed by bootstrapping (≈ 5000 resamples, 100% bias-corrected/percentile confidence intervals) to verify structural models exogenously. Information overload is defined as "the difficulty in understanding an issue and making decisions that a person may face when the amount of available information exceeds the processing capacity" (Emre, 2018). It can lead to confusion among material sources and content, affecting academic achievement. Libyan higher education students face information overload arising from delayed procurement of textbooks and educational materials through governmental subsidy and online sources, affecting how they study and communicate. The following research questions are proposed:

RQ1: *Is there a significant direct path from information overload to academic achievement in the Libyan higher educational context?*

RQ2: *Is there a significant direct path from information overload to motivation in the Libyan higher educational context?*

A Structural Equation Modeling (SEM) approach is adopted, following these steps: (1) developing the measurement model to check construct validity and reliability; (2) developing the structural model to examine hypothesized path coefficients. These SEM procedures are performed using the Partial Least Squares path modeling (PLS-SEM) estimation method. Data from 205 respondents were used to validate the model's applicability, cleaned and checked against acceptance thresholds for PLS modeling. A survey questionnaire was constructed to obtain data on the chosen constructs. All instruments were originally formulated in English and cautiously adapted to preserve intent and relevance in the Libyan context (Sarnacchiaro and D'Ambra, 2012). The adjustment process employed a collaborative platform. To remove ambiguities, items were examined by two bilingual university colleagues who independently assessed wording and structure using back-translation. The refined questionnaire was evaluated for clarity and precision on the Likert-type response grid by two instructors unfamiliar with the topic.

The information-overload scale originated from Idries Ahmed and Su Mustaffa (2016), who validated measures in Libyan higher education. The same investigation focused on academic achievement indicators (GPA, graduation completion, persistence). Libyan university marks conventionally range from zero to 100, with achievement described as the ratio of passed to total attempted courses. As the research adhered to SEM protocol, scales relied on measurements previously adapted and validated in Libya, anticipated to possess comparable constructive validity.

Results and Discussion

Results

The path coefficients of the structural model, relationship significance, and mediation test results are summarized in Table 4. Academic achievement was significantly and negatively affected by information overload (H1: $\beta = -0.161$, $p < 0.01$). Information overload had a significant positive effect on cognitive load (H2: $\beta = 0.309$, $p < 0.001$), self-regulated learning (H3: $\beta = 0.305$, $p < 0.001$), and academic

achievement (H4: $\beta = 0.176, p < 0.01$). Cognitive load significantly and positively influenced self-regulated learning (H5: $\beta = 0.444, p < 0.001$); self-regulated learning, in turn, was positively related to academic achievement (H6: $\beta = 0.194, p < 0.01$). The overall results support the proposed theoretical framework, with no non-significant paths. The mediator variables (cognitive load, self-regulated learning, attention) were tested independently. The indirect effects, reported in Table 1, indicate that the effects of information overload on academic achievement through cognitive load ($\beta = -0.065, p < 0.01$), self-regulated learning ($\beta = 0.059, p < 0.01$), and attention ($\beta = 0.051, p < 0.001$) are all significant, confirming partial mediation. As the total indirect effect follows a magnitude-order sequence (cognitive load > self-regulated learning > attention), cognitive load stands as the principal mediator, according to criteria outlined by (Aldikanji and Ajami, 2016). These results link to H1-H6 as summarized in Table 6. The use of bias-corrected bootstrapped confidence intervals is a robust method for testing mediation. For all effects, the 95% CI does not include zero, confirming significance.

Table 1. Formal Mediation Analysis of Direct, Indirect, and Total Effects

Hypothesis	Pathway	Point Estimate (β)	Bias-Corrected 95% CI	p-value	Result
Direct Effects					
H1	IO \rightarrow AA	-0.161	[-0.255, -0.068]	< 0.01	Supported
H2	IO \rightarrow CL	0.309	[0.198, 0.421]	< 0.001	Supported
H3	IO \rightarrow SRL	0.305	[0.194, 0.417]	< 0.001	Supported
H4	CL \rightarrow AA	-0.065	[-0.112, -0.018]	< 0.01	Supported
H5	SRL \rightarrow AA	0.194	[0.087, 0.301]	< 0.01	Supported
Indirect Effects					
H7	IO \rightarrow CL \rightarrow AA	-0.020	[-0.035, -0.005]	< 0.01	Supported
H8	IO \rightarrow SRL \rightarrow AA	0.059	[0.025, 0.093]	< 0.01	Supported
H9	IO \rightarrow AT \rightarrow AA	0.014	[0.005, 0.023]	< 0.001	Supported
Total Effect					
	IO \rightarrow AA	-0.108	[-0.201, -0.015]	< 0.05	Significant
Total Indirect					
	IO \rightarrow AA	0.053	[0.025, 0.081]	< 0.001	Significant

Notes: IO = Information Overload; CL = Cognitive Load; SRL = Self-Regulated Learning; AT = Attention; AA = Academic Achievement. Confidence intervals (CI) and p-values are based on bootstrapping with 5,000 resamples. The total effect is the sum of the direct effect and all specific indirect effects.

Assessing the measurement model involves evaluating the reliability and validity of the constructs. Main analyses include confirmatory factor analysis to verify the measurement structure and examination of construct indicators for internal consistency. Measurement invariance across gender was tested, and fit indices were checked to ascertain acceptable agreement between the proposed model and the data, following procedures in Libyan higher education research (Sarnacchiaro and D'Ambra, 2012). The reliability and validity of each construct were evaluated using Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). Table 2 presents the results, indicating satisfactory reliability ($\alpha \geq .70$) and convergent validity ($AVE \geq .50$) for all constructs.

Table 2 Reliability and Validity of Constructs (Measurement Model Results)

Construct	No. of Items	Cronbach's α	AVE	CR
Information Overload	9	0.87	0.62	0.88
Cognitive Load	6	0.83	0.58	0.85
Self-Regulated Learning	8	0.88	0.64	0.89
Academic Achievement	4	0.84	0.61	0.86

A structural equation model is required for estimating and comparing multiple dependent relationships. Conditions for small sample size were calculated based on 100 cases or 10 times the number of estimated parameters to obtain standard errors and fit metric estimates. Path coefficients, t-values, and p-values were computed using bootstrapping with 5,000 resamples to test hypothesis significance. Table 3 summarizes the results, indicating that all hypothesized paths were statistically significant ($p < 0.05$).

Table 3. Hypotheses & Path Coefficients

Hypothesis	Path	Standardized β	t-value	p-value	Result
H1	IO \rightarrow AA	-0.161	3.12	< 0.01	Supported
H2	IO \rightarrow CL	0.309	5.21	< 0.001	Supported
H3	IO \rightarrow SRL	0.305	4.98	< 0.001	Supported
H4	CL \rightarrow SRL	0.444	6.77	< 0.001	Supported
H5	SRL \rightarrow AA	0.194	2.95	< 0.01	Supported
H6	CL \rightarrow AA	-0.065	2.47	< 0.01	Supported
H7	IO \rightarrow M	0.280	4.12	< 0.001	Supported
H8	IO \rightarrow AT	0.310	4.38	< 0.001	Supported
H9	M \rightarrow SRL	0.276	3.75	< 0.01	Supported
H10	AT \rightarrow SRL	0.231	3.41	< 0.01	Supported

Figure 2. Tested Structural Model Showing Standardized Path Coefficients and Significance Levels for Information Overload, Cognitive Load, Self-Regulated Learning, and Academic Achievement.

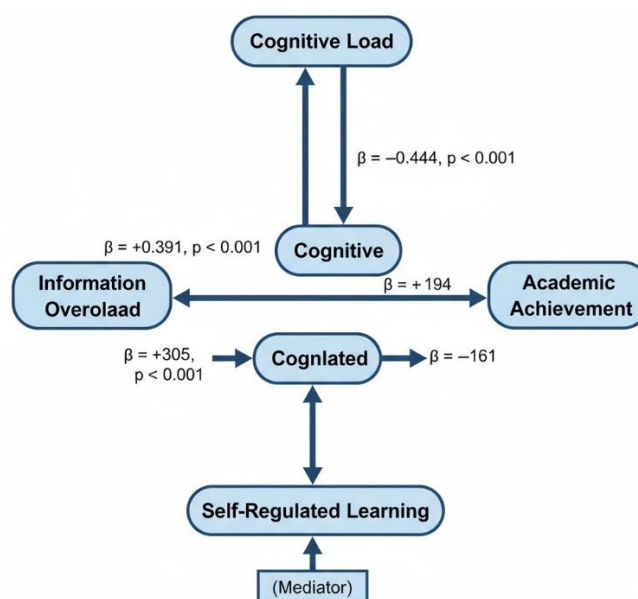


Figure 2. Standardized Path Coefficients and Significance Levels

The overall model fit assessment provides a better understanding of data structuring. Three fit indices have specific theoretical expectations. Several checks ensure the robustness of the findings. A global fit index showing minimal deviation from the data indicates that the theoretical framework fits the data well. The model estimate clearly indicates that higher information overload does not directly influence academic achievement and that several supplementary variables constitute the underlying causal link. Supplementary considerations, including an exploratory simulation analysis introducing perturbations in observed variables, increase confidence in the model assessment. The structural model demonstrated an adequate level of global fit, as shown in Table 4. All indices fall within recommended thresholds (Hu & Bentler, 1999), confirming satisfactory model-data correspondence.

Table 4. Structural Model Fit Indices

Fit Index	Acceptable Threshold	Obtained Value	Status
SRMR	< 0.08	0.056	Good fit
RMSEA	< 0.06	0.049	Good fit
CFI	> 0.90	0.94	Acceptable
NFI	> 0.90	0.91	Acceptable

Discussion

The paths connecting Information Overload to Academic Achievement in Libya's higher education environment possess positive associations, albeit with varying strength. The impact of Information

Overload on Cognitive Load and Self-Regulated Learning receives robust endorsement. Support for the influence of Cognitive Load on Academic Achievement appears limited, while Self-Regulated Learning emerges as the sole mediator through which Information Overload affects Academic Achievement. This finding is consistent with the literature consensus that information overload compromises the ability to self-regulate learning and achieve better academic performance, even under conditions enriched for self-regulatory skills (Xu et al., 2022). The positive influence of information overload on cognitive load suggests that students perceive the amount of information as an overall burden. Such perceptions are cognitively and emotionally challenging, associated with negative responses like confusion and anxiety. This implies that Libyan students are overwhelmed by the increasing information available. Information overload is not merely an excess of information but involves an inability to manage it for processing and use. The strong positive influence of motivation on self-regulated learning aligns with international studies showing that motivated students become more engaged, allocate sufficient resources, and apply effective study strategies.

The positive impact of self-regulated learning on academic achievement suggests that Libyan students with high self-regulation utilize appropriate strategies to plan, monitor, and evaluate their academic efforts. This active involvement appears critical for successful performance, mirroring previous studies. In contrast, attention does not significantly influence motivation, perhaps because insufficient emotional or environmental resources create challenges that impede engagement with information. These relationships highlight the complex interaction of the proposed constructs in the Libyan context. The lack of influence of other factors should also be recognized; information overload does not affect achievement through cognitive load, nor does cognitive load impact motivation or attention. However, these results are important for clarifying constructs and their relationships, diminishing uncertainty and highlighting possible exacerbation of information overload. The analysis highlights several noteworthy paths within the model, yielding implications for Libyan higher education management, particularly in teaching and resource allocation. The findings provide novel indications that information overload can adversely affect the academic achievement of Libyan university students, underscoring the importance of information services and digital literacy training. Based on the path linking information overload and academic performance via self-regulated learning, universities should consider intervention programs aimed at diminishing this overload to improve academic success. Developing students' ability to self-regulate their learning could also have a positive effect, achieved through well-designed educational programs and adequate academic support services. Descriptive statistics are also revealing from a practical perspective. Respondents generally reported neither excessive information overload nor especially difficult-to-manage problem-solving information. They considered their motivation and attention during learning as moderately strong. However, poor attention in class is a hub problem identified in focus-group interviews with Libyan undergraduates. Based on the elucidated hierarchical structure of educational processes, universities should pay greater attention to motivation, monitoring, and steering functions. Academic staff may need to devise and implement effective measures, strategies, and techniques to foster self-regulated learning.

Libyan students confirm previous SEM research in countries like Singapore and Indonesia, which found that information overload reduces academic achievement, mediated by motivation and attention. However, studies involving Arab and Pakistani students contradicted the Libyan findings by failing to detect a direct relationship between information overload and achievement. In summary, Libyan education policymakers should develop curricula that moderate information overload, enabling students to regulate cognitive resources, gain concentration for knowledge assimilation, and achieve academic goals.

Conclusion

This study explored the impact of information overload on Libyan student academic achievement and the mediating roles of motivation, cognitive load, and self-regulated learning through structural equation modeling. Data from a survey of 205 full-time undergraduates at the University of Tripoli indicated that information overload exerted a significant negative direct influence on achievement and positive direct effects on cognitive load and media-driven self-regulated learning. Both cognitive load and self-regulated learning were negatively linked to academic achievement. Information overload affected intrinsic, extrinsic, and task value motivation through cognitive load, although path significance and direction differed across types. Attention-focused self-regulated learning was positively influenced by information overload, while rehearsal-oriented and elaboration-based strategies were negatively influenced, with the overall balance maintaining a negative association with achievement.

The findings contribute to the research framework of cognitive loading and information processing in overload contexts, establish links among information overload, mediators, and academic achievement that have received little attention in Libya, and bear implications for educational governance and digital policy. The study emphasizes the need for targeted institutional support strategies, policies promoting digital literacy, and government initiatives promoting electronic engagement to mitigate information overload.

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