

Students' Experiences in Navigating Cognitive Overload During Blended Learning Transitions

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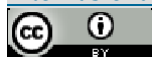
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ABSTRACT

The rapid transition to a blended learning environment has fundamentally changed the student learning experience, often increasing cognitive demands and the risk of cognitive overload. This study explores students' experiences in managing cognitive overload during blended learning transitions, with special attention to learning design, shifts in learning modes, and self-regulated learning strategies. This research uses a qualitative approach, with data collection through in-depth interviews and reflective journals of learning from undergraduate students who participated in mixed lectures in various disciplines. However, students also show adaptive strategies, such as prioritization of learning assignments, selective engagement with learning resources, and the development of metacognitive awareness to manage cognitive demands effectively. The findings of this study confirm the important role of coherent learning design, pedagogical alignment, and institutional support in mitigating cognitive overload in blended learning contexts. This study contributes to the development of educational research studies by providing a deeper understanding of students' cognitive experiences and offers practical implications for educators and policymakers in designing a more cognitively sustainable blended learning environment.

INTRODUCTION

The development of educational technology and the adoption of blended learning models have significantly changed the landscape of higher education in the last decade. Blended learning, which systematically integrates online and offline learning, offers greater flexibility and engagement for students than traditional learning models alone (Zou, 2025). This model allows students to access a wide range of digital learning resources and diverse face-to-face activities, but on the other hand it also increases the cognitive demands they have to manage independently.

The phenomenon of cognitive overload is one of the main challenges in the context of blended learning. Cognitive load refers to the amount of mental effort a person needs to process, store, and utilize information during learning. When cognitive demands exceed an individual's working memory capacity, their ability to learn effectively can be impaired (Surbakti, Umboh, Pong, & Dara, 2024). In a digital learning environment, where multimedia content, e-learning platforms, and diverse instruction interact with each other, the risk of high cognitive load is becoming increasingly real. Research findings show that the integration of less structured digital content can lead to a high cognitive load, thus negatively impacting student engagement and achievement (Surbakti et al., 2024).

In addition, recent quantitative research also indicates that high cognitive load in the context of blended learning can moderate the relationship between learning engagement and student satisfaction with their learning experience (Jalaludin, 2025). When cognitive load is at a high level, students' psychological engagement mechanisms become less effective in supporting behavioral engagement, which can ultimately reduce their level of satisfaction with learning (Nur Atiqah Jalaludin, 2025).

On the other hand, students' ability to manage their own learning process (self-regulated learning) is an important aspect in navigating the challenges of cognitive load in a blended learning environment. These competencies include the ability to consciously plan, monitor, and evaluate the learning process, including adjusting strategies when facing high cognitive demands (Lobos et al., 2024). Recent research shows that students who have good self-regulation skills tend to be able to manage cognitive load more effectively, so they are able to adapt to the demands of complex and dynamic blended learning (Lobos et al., 2024).

Although some studies have explored the relationship between blended learning, cognitive load, and student engagement in general, there are still limitations in a deep understanding of how students subjectively experience and cope with cognitive overload in the context of blended learning, especially from the perspective of their own learning experiences. Qualitative research that

explores students' narrative experiences is needed to capture the internal dynamics of cognitive processes and learning adaptation strategies used by students contextually.

Based on this background, this study aims to explore students' experiences in managing cognitive overload during the transition to blended learning, focusing on the role of instructional design, changes in learning modes, and learning strategies adopted by students. Thus, this research is expected to make a theoretical and practical contribution to more effective learning strategies and policy recommendations for educators and learning designers in the digital education era.

LITERATURE REVIEW

Blended Learning in Higher Education

Blended learning has become the dominant approach in higher education, especially post-pandemic, in response to the need for learning flexibility and digital technology integration. Recent studies show that blended learning allows for the strategic incorporation of the advantages of face-to-face and online learning to improve the quality of learning (Bond et al., 2021). However, the effectiveness of blended learning is highly dependent on the quality of instructional design and the alignment between online and offline activities. The disintegration between the two learning modes can create a fragmented and confusing learning experience for students (Martin et al., 2022).

Recent empirical research has also revealed that although blended learning increases students' learning autonomy, this approach also demands higher cognitive and managerial skills, particularly in managing time, learning resources, and academic expectations (Rasheed et al., 2020). This condition makes blended learning a context that is vulnerable to the emergence of cognitive overload if not designed systematically.

Cognitive Burden in a Digital Learning Environment

Cognitive load is a central concept in understanding how students process information in a complex learning environment. In the context of digital and blended learning, cognitive load is not only influenced by the complexity of the material, but also by the presentation of information, the use of multimedia, and navigation between learning platforms (Ayres, 2020). Recent studies have shown that learning designs that do not consider working memory limitations can increase extraneous cognitive load, which negatively impacts conceptual comprehension and information retention (Fiorella & Mayer, 2022).

Experiment-based research and surveys also found that students in blended learning often experience high cognitive load due to digital multitasking, excessive notifications, and demands to switch between learning applications in a short period of time (Chen et al., 2021). This reinforces the argument that

blended learning requires an instructional design approach that focuses on reducing irrelevant cognitive loads, while optimizing germane cognitive loads to support meaningful learning processes.

Instructional Design and Cognitive Load Management

Instructional design has a key role in mediating the relationship between blended learning and student cognitive load. The design principles based on cognitive load theory emphasize the importance of clear structure, material segmentation, as well as consistency of learning interfaces to avoid cognitive overload (van Merriënboer & Kirschner, 2020). Recent studies have shown that blended learning designed with coherent instructional flows can lower cognitive load and significantly increase student engagement (Al-Fraihat et al., 2020).

In addition, uncontrolled use of multimedia in blended learning can worsen cognitive load if it is not aligned with learning objectives. Recent research confirms that multimedia integration should be based on the principles of relevance and simplicity, not just technological variation (Lowenthal et al., 2023). Thus, effective instructional design in blended learning focuses not only on technological innovation, but also on cognitive efficiency.

Self-Regulation and Student Adaptive Strategies

In the face of high cognitive demands, the ability to self-regulate (self-regulated learning) is a determining factor for students' success in blended learning. Self-regulation includes learning planning, monitoring understanding, and evaluation of the learning strategies used (Dignath & Veenman, 2021). Recent research shows that students with high levels of self-regulation tend to be better able to manage cognitive load and maintain learning engagement in complex digital learning environments (Broadbent, 2023).

Qualitative studies also reveal that students develop various adaptive strategies to overcome cognitive overload, such as simplifying learning resources, limiting digital content consumption, and improving metacognitive reflection on their learning process (Kara et al., 2022). These findings confirm that students' experiences in blended learning are dynamic and contextual, so they need to be explored in depth through a qualitative approach.

Research Gaps

Although research on mixed learning and cognitive load is constantly evolving, most studies still focus on the relationship of variables quantitatively, such as cognitive load, satisfaction, and learning outcomes. Exploration of students' subjective experiences in navigating cognitive overload, particularly during the blended learning transition period, is still relatively limited. Therefore, this study seeks to fill this gap by exploring student experiences qualitatively, so that it can provide a more comprehensive understanding of cognitive dynamics in mixed learning.

METHODOLOGY

Research Design

This study uses a qualitative approach with a phenomenological design to explore in depth the experience of students in managing cognitive overload during blended learning. The phenomenological approach was chosen because it allows researchers to understand the meaning of the learning experiences experienced by participants based on their subjective perspectives, especially related to the interaction between learning design, cognitive demands, and adaptive strategies developed by students (Creswell & Poth, 2018; Tracy, 2020).

Participants and Research Context

The participants of this study are undergraduate students who attend lectures with a blended learning model at higher education institutions. The selection of participants was carried out using purposive sampling techniques with the following criteria: (1) active students who have participated in blended learning for at least one semester, (2) engaged in a combination of online and face-to-face learning, and (3) willing to reflect on their learning experiences in depth. The number of participants is determined based on the principle of data saturation, which is when the data collected has shown a recurrence of the pattern and no longer produces significant new findings (Guest et al., 2020).

Data Collection Techniques

Data were collected through semi-structured in-depth interviews and reflective journals of learning. Semi-structured interviews were used to explore students' perceptions of the sources of cognitive overload, challenges in blended learning, and strategies used to manage cognitive demands. This technique allows for the flexibility of exploring issues that arise during the interview process, while maintaining the focus of the research (Tracy, 2020).

In addition to interviews, reflective journals are used to capture students' learning experiences in a continuous and contextual manner. Reflective journals allow participants to record their thought processes, emotional responses, and self-regulation strategies that they apply during blended learning, thereby enriching research data longitudinally (Saldaña, 2021).

Research Procedure

The research was carried out through several stages, starting with the preparation of research instruments in the form of interview guidelines and reflective journal writing guidelines. Furthermore, the researcher recruited participants and provided explanations related to the research objectives, data collection procedures, and confidentiality principles. Interviews are conducted online and offline according to the conditions and preferences of the participants, and are recorded with their consent. Reflective journals are collected electronically at predetermined time intervals to ensure consistency and completeness of the data (Creswell & Poth, 2018).

Data Analysis Techniques

The data was analyzed using thematic analysis with an inductive approach. The analysis process began with a verbatim transcription of the interview results and the organization of a reflective journal, followed by repeated reading to gain a thorough understanding of the data. Next, the researcher conducts initial coding to identify relevant units of meaning, which are then grouped into main themes based on their conceptual relevance (Braun & Clarke, 2021).

The analysis is done iteratively by comparing data, code, and themes on an ongoing basis to ensure consistency and depth of interpretation. This approach allows researchers to develop themes that truly represent students' experiences of managing cognitive overload in blended learning (Braun et al., 2019).

Data Validity

The validity of data (trustworthiness) is maintained through the application of several strategies, namely credibility, dependability, and confirmability. Credibility is strengthened through triangulation of data collection and member checking methods, where participants are given the opportunity to verify a summary of the interview results. Dependability is maintained by systematic documentation of the entire research process, while confirmability is strengthened through recording of the researcher's reflections to minimize subjective bias during the analysis process (Nowell et al., 2017).

Ethical Considerations

This research was carried out in accordance with the principles of research ethics. All participants provided informed consent before engaging in the research. Participants' identities are kept confidential through the use of codes or pseudonyms, and participants are given the right to withdraw from the study at any time without academic consequences (World Medical Association, 2013).

DISCUSSION

Cognitive Overload as a Structural Issue in Blended Learning

The findings of this study confirm that cognitive overload in blended learning does not solely come from individual student abilities, but also from structural aspects and learning design. The fragmentation between online and offline learning and the uncoordinated use of platforms create an extraneous cognitive load that distracts students from processing the core material. This condition reinforces the opinion that instructional design that does not take into account the principles of cognitive load theory can increase cognitive load that is not essential to the understanding of the material (e.g., interface navigation, inconsistent instruction) thereby hindering the learning process (Zidi et al., 2025).

In the instructional design literature, cognitive load theory emphasizes the importance of coherent and integrative structure in material delivery, content segmentation, and the reduction of irrelevant complexity to support students'

working memory capacity (Adinda, 2020). The cognitive overload that arises due to the lack of synchronous design between online and offline learning modes reflects the failure to apply these principles in the context of hybrid learning.

Consequences of Cognitive Overload for Learning Quality

The impact of cognitive overload on the student learning process shows that when cognitive demands exceed working memory capacity, students tend to experience a decrease in learning quality. Difficulty concentrating, mental fatigue, and reduced conceptual understanding reported by students indicate that mixed-use learning that is not properly managed has the potential to hinder the achievement of meaningful learning. This is consistent with empirical findings showing that inefficiencies in digital learning design – such as excessive materials, unintuitive interfaces, and high navigation loads – can disrupt student focus and degrade the quality of the learning experience (Zidi et al., 2025).

In addition, cognitive overload has the potential to reduce student engagement in learning activities and lower their motivation to study in depth. Other research shows that in blended learning, students' ability to maintain attention on learning tasks is greatly influenced by how materials and activities are arranged and delivered (Jansen et al., 2023).

Role of Self-Regulated Learning in Managing Cognitive Demands

The results of this study also highlight the central role of self-regulated learning (SRL) in helping students manage cognitive overload. The strategies of research, selection of learning resources, and metacognitive reflection applied by students show that self-regulation functions as a protective mechanism against high cognitive demands in blended learning. These findings are in line with empirical evidence that SRL skills – such as learning planning, learning process monitoring, and evaluation of learning outcomes – increase students' control over their learning process and help them navigate the complex demands of blended learning (Chang et al., 2025).

Other studies have also shown that SRL contributes significantly to student engagement and academic achievement in the context of blended learning, where students take an active role in organizing their own learning process independently and adaptively (Jansen et al., 2023).

Implications for Instructional Design and Institutional Practice

Practically, the findings of this study indicate the need for a more coherent, consistent, and cognition-efficiency-oriented blended learning design. Simplifying learning structures, consistency in using platforms, and clarity of instruction can help reduce students' cognitive load. This reflects the need to apply instructional design principles that pay attention to working memory capacity, material segmentation, and the reduction of irrelevant complexity, which are known as important strategies in cognitive load management (Adinda, 2020).

In addition, higher education institutions need to provide systematic support, such as technical guidance and SRL skills development training, so that students are better prepared to face the demands of blended learning and optimize their learning experience. Improving SRL capabilities can help students deal with the complexity of blended learning more effectively and improve overall learning outcomes (Chang et al., 2025).

Contribution to Research on Blended Learning and Cognitive Load

Theoretically, this study contributes by presenting a qualitative perspective on students' cognitive experiences in blended learning. By separating empirical results and conceptual discussions, the study clarifies the relationship between learning design, cognitive experience, and students' adaptive strategies. These findings enrich the blended learning literature by emphasizing the importance of a student-centered approach to managing cognitive load, while underscoring the importance of integrating cognitive load theory principles into learning design to support instructional effectiveness.

CONCLUSIONS AND RECOMMENDATIONS

This study examines in depth the experience of students in managing cognitive overload while participating in blended learning in higher education. The findings of the study show that the cognitive overload of students is mainly triggered by less integrated learning designs, the use of diverse learning platforms, and the increasing demands of multitasking. These factors cause students to have to allocate additional cognitive resources to understand the structure and techniques of learning, thereby reducing their capacity to process learning materials in depth.

In addition to having an impact on cognitive aspects, cognitive overload also affects the affective dimension of students, such as decreased motivation to learn and increased mental fatigue. This condition encourages students to focus on completing assignments rather than conceptual understanding, which can ultimately reduce the quality of the learning experience.

However, this study also found that students develop various adaptive strategies, including task prioritization, selection of learning resources, and increased metacognitive awareness, as a form of self-regulation in the face of high cognitive demands.

Theoretically, this study strengthens the understanding of cognitive load in the context of blended learning by emphasizing the importance of the interaction between instructional design and students' self-regulation skills. Practically, the findings of this study confirm the need for a more coherent, consistent, and cognition-efficiency-oriented mixed-learning design.

Educators and higher education institutions are advised to simplify the learning structure, ensure alignment between online and offline modes, and provide systematic support in the development of students' self-regulation skills. With this approach, blended learning is expected to become a more cognitively

sustainable learning environment and support the achievement of meaningful learning.

ADVANCED RESEARCH

Each study has limitations; thus, you can describe it here and briefly provide suggestions for further research.

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