Reducing Cognitive Overload for Students in Higher Education: A Course Design Case Study

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As faculty, we teach complex subjects across various disciplines to adult learners who bring unique knowledge, experiences, and motivations. In instances where the subject matter is taught too quickly, is vague, or is above the learners' level of existing knowledge, students can be left feeling overwhelmed and frustrated, and ultimately experiencing cognitive overload. Cognitive overload diminishes both student's capacity to learn and overall academic success. All faculty—particularly faculty who teach challenging topics—need to consider their role in managing students' cognitive load. We begin by introducing cognitive overload, student learning and engagement, and teaching effectiveness. Next, we introduce our conceptual framework which guided the development of our course. From there, we examine strategies and techniques that undergraduate and graduate level faculty can integrate within their classrooms. Finally, we outline implications and tools to (1) decrease cognitive overload, (2) enhance student learning, and (3) expand knowledge pertaining to cognitive overload while offering direction for future research.

Keywords: cognitive overload, higher education, course design, teaching, student learning

INTRODUCTION

Faculty are responsible for sharing their knowledge and subject matter expertise with students while ensuring students learn as effectively as possible. As faculty, our attention is often aimed at the content we teach (with less attention directed toward how we teach). Our focus on teaching content potentially causes us to overlook instances of cognitive overload on students. Over our years of teaching, we have learned that if our course designs are not carefully and intuitively developed, students devote excessive cognitive processing on our course structure and correspondingly struggle with assigned content and tasks. These experiences have challenged us to critically reflect on (1) course design factors which have impeded student learning outcomes and (2) consider course design strategies which may reduce cognitive overload in students. The reflections and subsequent course revisions offer preliminary evidence which suggests a few, relatively minor, changes to course designs can have a significant influence on reducing cognitive overload.

This paper aims to consider how cognitive overload can be reduced for our students through the integration of reduction strategies used by faculty. We begin by discussing the history and significance of managing cognitive load in higher education. Next, we describe how a cognitive load conceptual framework informed our process toward identifying and implementing cognitive overload reduction strategies. We then introduce strategies identified and offer a discussion regarding their appropriateness and feasibility. Finally, we conclude with implications for faculty when decreasing cognitive overload in our students. By scrutinizing the relationship between course design and cognitive load, faculty and students stand to benefit.

Background

Cognitive load theory (CLT), with origins in psychology, describes the overall mental effort used by students when learning new material. Sweller (1988) defined cognitive overload as the amount of information that can be held at one time by working memory; Sweller (1988) proposed that teaching methods ought to be effective and should not cause memory overload because working memory has limited capacity. Overload is also considered the misalignment between student capacity and load (National Council for Curriculum and Assessment, 2010). Research indicates the brain can only process cognitively a handful of items at once. More specifically, according to the crucial work of Miller (1956), the brain can only process cognitively 5–9 items at a time. Any more than that, we become overwhelmed, often discouraged, and reach a point of cognitive overload. Further, cognitive overload happens when the brain receives too much information at one time from various channels. As a result, the learner may feel overwhelmed, frustrated, and/or stressed leading to a decease or even an absence in their learning.

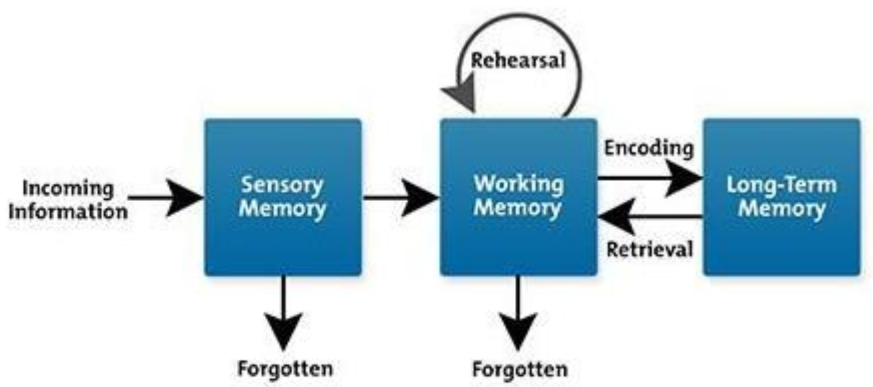
CLT is a tool for considering how the human brain processes pieces of information. Sweller (1998) claimed that the working memory of humans is limited and unable to handle large amounts of information all at once. CLT argues a person's working memory has a limited amount of space; thus, how information is presented as well as the extent to which cognitive overload is reached will determine how well a person comprehends it (Ginns, 2006; Ragland & Reck, 2016). Three categories of cognitive load exist—intrinsic load, extraneous load, and germane load. Schwonke (2015) indicated, as long as the learner's working memory is not overloaded by how the information is presented, he or she can effectively absorb and retain the information received.

CLT assumes the human's working memory and information processing are limited; this assumption suggests that cognitive overload results from a cognitive load surpassing the learner's cognitive capacity (Sweller, 1988). Further, CLT presumes that learning will be maximized when instruction is in sync with human cognition (Paas, Renkl, & Sweller, 2003). Additionally, working memory is limited when it comes to information-processing capacity; if the capacity is exceeded, cognitive overload will exist and learning will be hampered (Baddeley, 2003; Clark, Nguyen, & Sweller, 2006; Cowan, 2010; Miller, 1956). Therefore, CLT offers strategies for instructional designers related to working-memory load management, which is essential for effective learning and performance (Kalyuga, 2011). According to the Medical College of Wisconsin Office of Educational Improvement (2022), CLT labels memory as sensory, working, and long-term (see Figure 1 below). Sensory memory acts as a filter that nets-out the majority of what is happening within our environment and allows specific information to go to the working memory for further processing. Working memory usually processes several pieces of information at once; additionally, working memory either disregards or classifies those pieces of information to be stored in the long-term memory. Long-term memory stores the pieces of information in structures (i.e., schemas); the schemas then arrange those pieces of information depending on how humans utilize them; the more frequently humans utilize the schemas, the simpler it is to recall them and the more advanced they become (Medical College of Wisconsin Office of Educational Improvement, 2022).

Despite the desire to teach as much information as possible, faculty are constricted by students' capacity to process new knowledge. For example, some students may only be able to absorb a certain amount of information within a given period; thus, educators are highly encouraged to tailor their teaching plans accordingly to be in sync with students' capacity and ability. Otherwise, many students may not reap any benefits or fall short of gaining new knowledge. At the same time, faculty in the Association to Advance Collegiate Schools of Business (AACSB) accredited programs are bound to external guidelines that dictate, to some extent, how and how much information is taught over a semester. Some of the external guidelines may outline specific content that needs to be covered as well as depth of coverage. Therefore, educators may notice themselves attempting to find a balance among depth, scale, and academic rigor; the educator ought to decide which content is worth covering more than other content and figure out the level of depth for content covered. Further, the educator may be able to maximize the benefits of his or her decision by considering the educator's expertise, the student's initial knowledge, and the student's cognitive load. Essentially, faculty ought to function within a practical, dynamic system that celebrates and encourages pedagogical success and acknowledges and considers external limitation.

As instructors activate prior students' knowledge, or chunks of information, instruction is focused on the correct level in the existing gap between learners' knowledge and what instructors need to learn (Medical College of Wisconsin Office of Educational Improvement, 2022). Effective course design plays a crucial role in decreasing the cognitive overload of the learners; it assists the learners to focus on the task at hand instead of exerting time and energy attempting to figure out what they have been asked to do. Further, effective instructional design reduces the gap among the present state and the goal sought (Medical College of Wisconsin Office of Educational Improvement, 2022). For instance, dividing problems into small parts makes it easier for the students to comprehend versus tackling a complex, large problem simultaneously (Medical College of Wisconsin Office of Educational Improvement, 2022).

FIGURE 1
MODEL OF HUMAN INFORMATION PROCESSING



Adapted from Atkinson, R.C. and Shiffrin, R.M. (1968). "Human memory: A Proposed System and its Control Processes'. In Spence, J.T. The psychology of learning and motivation, (Volume 2). New York: Academic Press, pp. 89–195.

The Medical College of Wisconsin Office of Educational Improvement (2022) described the various loads as follows: (a) intrinsic load is constant and relates to the inherent struggle of processing information despite how it is presented, (b) extraneous load pertains to the method in which the information is presented and how easy or challenging for the learner, and (c) germane load involves the effort required to utilize mental capacity and memory in order to organize information into schemas, enabling the transfer of new information into long-term memory. Schema acquisition signifies an important step in gaining and utilizing the knowledge learned, and performance represents the result of the information processed. CLT emphasizes the connection between load types and corresponding learning, while highlighting schema acquisition and automation (Schwonke, 2015). Additionally, CLT considers the integration of information sources to reduce cognitive load in order to ensure learning outcomes are optimized. Novel information is processed considering existing schemata, permitting the classification of problems and objects into categories (Sweller, 1994). Further, CLT considers intrinsic load related to the difficulty of learning content, influenced by learners' prior knowledge and experience in related domains (Kalyuga, 2011). Prior knowledge minimizes processing demands and facilitates additional schema acquisition by permitting the learner to treat many concepts as single pieces of information in the form of highly integrated schemata (Schwonke, 2015).

Furthermore, the degree of interaction among pieces of information and learners' prior knowledge gained determines the complexity level of the instruction with which intrinsic load is correlated (Kalyuga, Chandler, & Sweller, 1998; Sweller, 2010b). When learners have minimal prior knowledge of the subject being taught, pieces of information are more difficult to comprehend on their own; intrinsic load is high when element interactivity is also high (Leahy & Sweller, 2005; Sweller, 2010a). For acquiring-schema purpose, students ought to expend some mental energy for schema acquisition in order to be able to process the load (Hadie et al., 2018). This mental effort is referred to as 'germane load,' and is part of intrinsic load since it was not distinguishable from intrinsic load (Kalyuga, 2011; Leppink, Paas, van Gog, van der Vleuten, & van Merriënboer, 2014). Therefore, a type of intrinsic load that is relevant to learning is the learner's capacity to deliberately devote his or her existing cognitive resources to process intrinsic load (Hadie et al., 2018). On the other hand, extraneous load relies on how the information is transferred to the learners; thus, it is frequently linked to how teachers deliver instructional content (Sweller, 2010b). Low-quality instruction frequently the cause of high extraneous load (Sweller & Chandler, 1994); therefore, extraneous load ought to be removed during lectures to ensure more working-memory capacity to process information (Hadie et al., 2018). Moreover, wasted mental effort is reduced and mental resources are utilized to process information when CLT-based education is used (Clark et al., 2006). By averting cognitive overload, allocating mental resources improves learning (Clark et al., 2006; Kalyuga, 2011).

Significance

Effective teaching (i.e., teaching effectiveness) plays a significant role in enhancing student learning. Subject matter expertise, learning environment, and student demographics may vary depending on academic disciplines and student and educator backgrounds. Further, faculty are responsible for transmitting large amounts of knowledge and expertise to their students within a relatively short time—which can be challenging. Therefore, faculty should be mindful of signals students may show, when they are overwhelmed cognitively, to help alleviate cognitive overload in our students. Keeping cognitive overload in mind, it is crucial for faculty to seek to enhance student learning, argued as a procedure in which experience leads to changes in behavior or knowledge (Sirney, 2019). Comprehending the factors required to get the knowledge in and out, or influence a change in behavior, may help enhance learning (Sirney, 2019). Baddeley (1992) noted that working memory limitations should be considered when designed learning environments.

As such, it is critical for educators to consider students' cognitive capacities. Otherwise, an alignment would not exist among learning outcomes and teaching objectives, and learners would be overwhelmed; thus, the learning process would not succeed (Houichi & Sarnou, 2020). When too much information is shared, learners' ability to intake and process knowledge declines, resulting in students discarding information beyond what they can process. Beyond the amount of information, the complexity of the information can influence cognitive overload. Topics which are more information-based and easy to process, such as class on how to make a special sandwich, are unlikely to lead to cognitive overload; however, a 300-level statistics course, which introduces many new concepts to students thus making it more complex in nature, may contribute toward cognitive overload in learners. Finally, speed at which information is shared can impact student learning. Subject matter where development of rote knowledge is the goal, such as a history course requiring students to learn important historical dates, can be especially challenging for students if the dates and significance of the dates is presented faster than students can process the information. In essence, each example represents a threshold where, once a student's brain becomes overloaded, their learning experience is hindered.

If a student seems to have shallow learned knowledge, receiving complex information could result in cognitive overload because the student's cognitive ability is less than the load. Various reports exist of the prevalence of curriculum overload in nations around the globe. According to Le Metais (2003), England, Netherlands, Wales, China, Philippines, Japan, New Zealand, and Australia have overloaded curriculum (INCA, 2003). Additionally, Tanzania, Kenya, Zambia, Malawi, Angola, and Zimbabwe experience overload in their curricula (Ndjabili, 2004). As for the primary school sector, the causes of curricula overload consist of the curriculum's size, the curriculum, the volume of the curriculum, lack of time needed, and changes such as socioeconomic technological changes (Majoni, 2017).

Cognitive overload impairs learning and hinders many learners from accomplishing the tasks at hand (i.e., coursework); thus, resulting in a lack of overall academic success for those learners. Cognitive overload can also play a role in student learning while teaching challenging topics; it is likely that students who experience cognitive overload may not perform well on assessments compared to those who had not experience cognitive overload. Achor et al. (2022)'s study investigated the impact of cognitive overload on the performance of students; the study found that significant impact of cognitive overload on mean performance scores exists in social studies, and concluded cognitive overload has an impact that is statistically significant on student's mean performance scores.

Many practices aimed at reducing cognitive overload at a micro level, such as chunking assignments into various parts and offering clear assignment instructions, have been discussed and implemented in great detail in educational contexts. Likewise, providing clear assignment instructions helps to minimize extraneous load and permits learners to focus on the content. However, less attention has been given to reducing cognitive overload by re-examining how an entire course is structured. Effective course design is an essential component of managing students' cognitive load and requires faculty to examine how factors which influence cognitive overload can be directly assuaged through more intentional course structures. From a macro level, faculty who teach courses specifically aimed at reducing overload could foster a conducive learning environment that facilitates cognitive processing, paving the way for increasing student learning and promoting impactful educational experiences for learners.

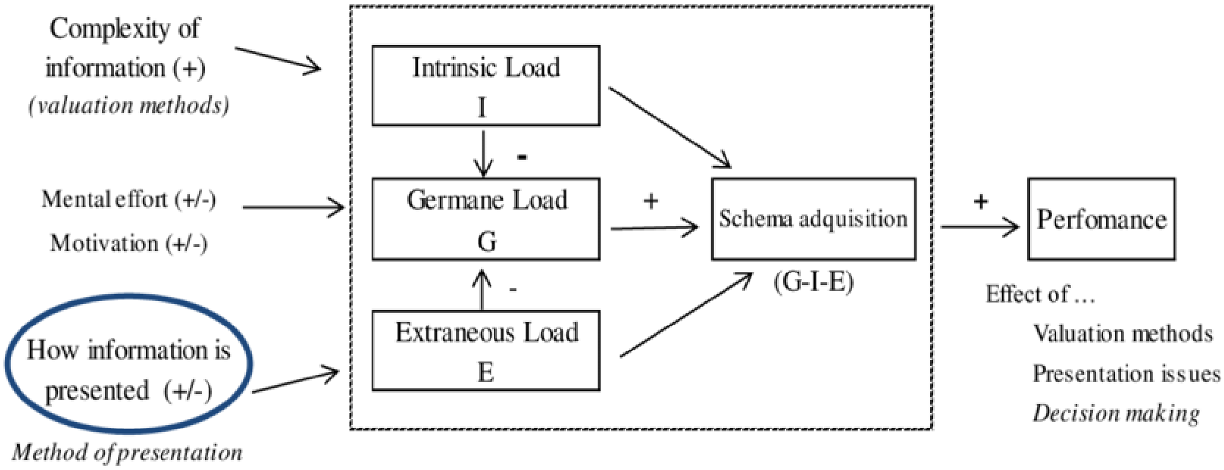
Conceptual Framework

Sweller's (1988) cognitive load framework informed our strategies for reducing our students' cognitive overload (see Figure 2). The framework depicts CLT's fundamental mechanisms, highlighting the relationship between intrinsic, extraneous, and germane loads. The components are interconnected in order to impact the learners' cognitive load. Intrinsic load is the innate complexity of subjects studied by learners and is determined through learners' previous knowledge gained and content's complexity. For instance, a complex research proposal can be divided into smaller, manageable parts to decrease intrinsic load which permits learners to process information in small parts. Extraneous load is the means of which information is presented to learners. Ineffective instructional design can cause the learners' extraneous load to increase; thus, creating difficulty for learners to concentrate on the content. Therefore, simplifying the design of the course through organizing materials methodically and limiting unnecessary information paves the way for decreasing extraneous load which in turn permits learners to focus on coursework completion and submission. Germane load is the mental effort necessary in order to process information and combine it into current knowledge structures. Focusing on student success and support, such as offering students personalized assistance and useful resources enhances germane load through assisting students to arrange and retain new information.

The relationship between the preceding components is vital in order to reduce cognitive load. Faculty can enhance cognitive efficiency through decreasing intrinsic load and extraneous load, permitting learners to dedicate more effort to germane load (i.e., mental effort necessary to process information and combine it into current knowledge structures). This approach ensures that learners effectively grasp and remember information, enhancing learning outcomes.

Figure 2 places emphasis on managing intrinsic load, extraneous load, and germane load to reduce cognitive overload. This framework serves as a basis for our proposed cognitive overload reduction strategies: (1) improve motivation by making content relevant (motivation), (2) start with what learners know (complexity of information), (3) build assignments with detailed guidelines and corresponding support, (4) create a low-stress learning environment (mental effort), and (5) incorporate scaffolding learning (how information is presented). These strategies seek to reduce cognitive overload, boost student learning, and enhance student performance through fostering a supportive learning environment. Integrating the strategies within the framework of CLT permits faculty to create a learning environment, which decreases students' cognitive overload and improves student learning.

FIGURE 2
FRAMEWORK OF SWELLER'S (1988) COGNITIVE LOAD THEORY



Reducing Cognitive Overload

Strategy 1—Start With What Learners Know

To reduce cognitive overload and decrease the complexity of information, educators ought to assess what learners know through pre-assessments and/or visual representations (i.e., concept maps). Next, educators should (a) review the input to understand the learners' prior knowledge and (b) build on their prior knowledge through connecting new information, shared by an educator, to recognized concepts. For instance, if teaching a lesson on advanced financial accounting, an educator should review basic financial accounting principles which learners have previously learned in financial accounting principles courses. This approach helps learners (a) incorporate new information, shared by an educator, with existing knowledge, and (b) increase their retention and comprehension. Further, dividing up complex information into more manageable chunks can reduce learners' cognitive load. Effective course design, which considers cognitive load, can considerably enhance learning outcomes (Sweller, Ayres, & Kalyuga, 2011). Educators can produce an effective learning environment by gradually introducing new concepts to learners. By starting with what learners know, faculty ensure the complexity of information presented—particularly early—is low.

Strategy 2—Create a Low-Stress Learning Environment

Creating a low-stress learning environment is vital for reducing learners' cognitive overload. Educators can begin through nurturing an encouraging classroom environment where learners feel comfortable raising concerns, sharing points of views, and asking questions. For instance, in an Organizational Leadership course, an educator could utilize the think-pair-share activity technique, where learners (a) reflect on their thoughts when provided a prompt, (b) discuss their thoughts with a classmate, and (c) provide report outs with the whole class. This practice boosts learners' active participation and creates a low-threat situation for students to safely share ideas with a classmate or within a small group without fearing judgment from the entire class. Further, an educator can integrate regular, shorter breaks through the lecture; planned breaks can help learners process information effectively and make them more focused. The preceding techniques produce a favorable learning environment and reduce students' stress in class.

Strategy 3—Improve Motivation by Making Content Relevant

To boost student motivation, it is vital to (a) ensure course content is as applicable and relevant as possible to their personal and work lives, and (b) connect course content to actual applications. By doing so, leaners (a) recognize the value of learning, (b) engage in content, and (c) their cognitive overload decreases due to connecting new information to their previously learned knowledge. Educators can incorporate case studies to offer particular meaning and importance for learners (i.e., to connect with learners' personal experiences). For example, in a human resources course, demonstrating how managing careers of employees relates to students' career planning can help make the course content more practical and relevant to learners. Further, project-based learning boosts student motivation by making content relevant utilizing practical applications, promoting deeper comprehension, and encouraging student engagement; this method of instruction allows learners to see the value of their studies and thus enhances their intrinsic motivation (Shin, 2018).

Strategy 4—Create Assignments Which Include Detailed Guidelines and Assistance

In order to build effective, purposeful assignments that reduce students' cognitive overload, educators should offer clear, detailed guidelines in their courses. Educators should include several components within their assignments to include the assignment's (a) purpose and background, (b) description of requirements, (c) corresponding rubric, and (d) due dates and submission requirements, as well as (d) supporting materials, resources, or examples of previous submissions, if available. For example, when assigning a research paper, an educator should outline applicable stages involved such as selection of topic or research question, performance of preliminary research, evaluation of sources, development of thesis statement, and submission of drafts; additionally, educators can set clear expectations through providing rubrics; a rubric may include detailed grading criteria and furnish examples of quality work to demonstrate what success looks like (Washington State University, n.d.). Further, an educator can provide applicable, supportive resources such as writing seminars and assign office hours for personalized assistance. This method provides clear expectations for assignments and ensures assignments are presented in a manner which address student learner concerns.

Strategy 5—Incorporate Scaffolding

Beyond starting a course by presenting content that adult learners are already familiar with, faculty are encouraged to incrementally build off that information. In this case, faculty transition into new content by first reiterating what had been covered and intentionally addressing how subsequent content is related. According to Wood et al. (1976), scaffolding includes (1) attaining interests of learners (i.e., recruitment), (2) simplifying learners' tasks through the reduction of number of acts necessary to reach a solution (i.e., reduction in degrees of freedom), (3) lagging or regressing of learners to other aims, considering limits in their capacities and interests (i.e., direction maintenance), (4) marking particular features of tasks, which are relevant (i.e., marking critical features), (5) solving problems, with the assistance of an instructor, should be less stressful (i.e., frustration control), and (6) demonstrating a solution to a task (demonstration). As Baddeley (2012) and Cowan (2010) noted, CLT reminds us that the capacity of our working memory is limited. When capacity is reached, learning may not happen since insufficient cognitive resources are available to process and encode the information into the long-term memory. Therefore, student learning, facilitated by an educator, may be more or less effective based on (a) how the information being presented affects the working memory and (b) how the information interrelates with the long-term memory (Evans et al., 2024).

For instance, in a mathematics course, faculty would start with presenting basic problem-solving techniques before introducing more complex equations. Faculty would use visual aids and interactive tools to reinforce learning and provide immediate feedback. Another practical example is in a literature class, where students might struggle with analyzing complex texts. Educators can generate an encouraging environment, which reduces learners' cognitive overload and enhances their comprehension by presenting information gradually, systematically, and incorporating scaffolding learning effectively.

DISCUSSION

The preceding course design strategies demonstrate how effective course design may (a) reduce cognitive overload, (b) reduce excessive cognitive processing, and (c) boost student engagement in higher education. The strategies outlined serve as a foundation toward accomplishing the goal of reducing cognitive overload. These strategies highlight the importance of thoughtful course design in higher education. When educators emphasize reducing cognitive overload, they produce an encouraging learning environment that allows learners to stay focused on the course content instead of focusing on the course structure; this particular approach enhances student learning and increases engagement. Learners are more likely to stay engaged in the course content when they are not overwhelmed by complicated course structures and confusing assignment instructions. Moreover, learners enrolled in well-designed courses may perform better academically since they can process information more efficiently. For this reason, faculty should design courses which aim to reduce student overload, improve learning, and boost engagement. Furthermore, the mixture of our preceding strategies assures that learners can effectively process information; thus, resulting in (a) an improved academic performance and (b) a purposeful learning experience.

These strategies have been integrated into the Authors' courses and serve as a valuable depiction of how they are designed. We integrate the first strategy by assessing learners' previous knowledge through pre-assessments to ensure new content builds on what learners previously know. We incorporate the second strategy through fostering a supportive classroom environment, recognizing learners' efforts to encourage desired outcomes. As for the third strategy, we link course material to practical applications to make it relevant to learners' lives and careers. Regarding the fourth strategy, we offer step-by-step instructions and detailed rubrics and share office hours to provide more personalized support. For the fifth strategy, we divide up complex projects into more manageable sections and steadily decrease support as learners enhance their skills. One example of executing the fifth strategy occurs through our research methods course. In the class, we divide up a complex research proposal into separate research briefs and subsequently combine the research briefs into one document that makes up the research proposal. The research proposal consists of many sections; the students complete a few at once before combining the research briefs into one document that makes up the research proposal. By dividing up the project into sections, the assignment becomes more manageable and enhances learners' overall learning by allowing them to focus on a few sections at once. This strategy can also (a) reduce learners' overall stress level and (b) provide deeper understanding.

These strategies for reducing cognitive overload were identified through an exhaustive period of reflection and collaborative discussion between authors. Through this method, we have acquired anecdotal evidence to suggest student learning and engagement has improved with integration of each strategy in our courses. Educators can apply these strategies in their classroom to foster an effective learning environment for learners. Additionally, educators can noticeably decrease cognitive overload through enhancing motivation, beginning with what learners previously know, generating a low-stress learning environment, and incorporating scaffolding learning. Our strategies aim at vital issues, including cognitive overload, alignment of course objectives and learner capacities, complexity of information presented, and educators' knowledge transmission. As for the first issue, which is cognitive overload, hinders learners' ability to learn; the strategies regulate cognitive overload through offering clear instructions and breaking up complicated information. Concerning the issue of aligning course objectives and learner capacities, the strategies highlight (a) comprehending learners' previous knowledge and (b) strengthening that knowledge in order to ensure efficient integration of new information and effective learning. Regarding the issue of complexity of information presented, educators can foster a low-stress learning environment and utilize scaffolding techniques that help learners efficiently process information. Educators are tasked with transferring large amounts of knowledge within a short period which can cause many learners to be overwhelmed. The proposed strategies encourage educators to systematically introduce new concepts and incorporate actual applications in order to enhance student engagement and improve student comprehension and retention.

Faculty can start with integrating these strategies through (a) assessing learners' previous knowledge to customize course material effectively, (b) producing a low-stress environment to decrease the feeling of anxiety while encouraging open dialogue, (c) creating relevant content to boost motivation, (d) offering necessary tools and support for assignments, and (e) scaffolding learning to make complex projects more manageable. Faculty are encouraged to ensure relevant resources exist to address learning challenges before integrating these strategies. Finally, faculty should consider developing a clear grasp of learners' academic needs so as to facilitate a smoother knowledge transmission process.

Implications

This paper attempts to address calls for research examining classroom strategies that reduce students' cognitive overload (Evans et al., 2024; Hadie et al., 2018). Course designs utilizing the described strategies should reduce anxiety for students, improve feelings of support and welcomeness, and ultimately enhance their learning. The strategies allow students to focus their cognitive energy on processing information and subsequently completing assignments, as opposed to exhausting mental energy on (a) a disorganized course structure, (b) vague instructor expectations, and (c) ambiguous assignment instructions.

The strategies are significant due to their capability to produce a favorable learning environment, which (a) increases learner academic performance and (b) reduces learners' cognitive overload. The strategies align with other approaches related to reducing cognitive load, such as offering clear instructions and chunking information. Educators can help students avoid becoming overwhelmed by avoiding complex course structures and through incorporating these strategies. As we consider earlier arguments, the strategies outlined are a critical opportunity to reduce student overload. Each strategy considers learners' cognitive capacities. Therefore, alignment among cognitive load theory and instructional methods suggests that learners can grasp and recall information—as long as it is properly presented—resulting in an impactful academic experience and enhanced academic performance.

Examining cognitive overload and cognitive load theory is crucial for faculty to meaningfully reduce the number or frequency at which students feel overwhelmed. Crowded course designs result in decreased student engagement, emphasizing the importance of addressing cognitive overload. Through comprehending cognitive overload theory, faculty can obtain insights to (1) further understand cognitive overload, (2) decrease learners' cognitive overload, and (3) enhance overall learning.

Decreasing cognitive overload in higher education is vital because it allows learners to comprehend and absorb course material more effectively and improve learning experiences. Learners' retention enhances when they are not overwhelmed by unnecessary information; as a result, learners' frustration decreases. Further, reducing cognitive overload can boost learners' motivation to succeed in their coursework. As for faculty, decreasing cognitive overload assists them in making their teaching more efficient, leading to effective instruction.

Our tested course design model offers early evidence toward reducing student overload in higher education; thus, a negative relationship exists between cognitive overload and course design. As the course design is further enhanced, learner's cognitive overload is decreased. Applying our practices through this framework while designing a course has a potential to (a) present the information and material clearly and effectively to the learners, (b) assist the learners to process new information successfully, and (c) create a conducive learning environment focused on enhancing student performance and boosting engagement, collaboration, and participation; thus, reducing the learners' cognitive overload.

For Research

As this is a conceptual paper with strategies proposed from a conceptual framework and anecdotal evidence, we recognize opportunities for further exploration. First, each proposed strategy can be tested for correlations between intent behind the strategy and corresponding cognitive overload reduction in students. These tests are encouraged to be implemented for undergraduate students across disciplines. Second, evaluation of how integration of each strategy and corresponding cognitive load on students is encouraged. Studies examining student perceptions of contributing factors toward managing and mitigating cognitive overload are warranted. Findings may reveal unanticipated insights faculty can consider when managing cognitive overload in students.

Limitations

We identified a few limitations to integrating the proposed strategies. As faculty are often partially influenced by accreditation constraints in how and what they teach, widespread integration of some of our proposed strategies may be challenging. Resistance from faculty in relation to changing the curriculum and/or course structure may exist due to the (a) refusal to make a change and (b) familiarity of current topics; overpowering this resistance to change (i.e., limitation) may require certain training focused on curriculum redesign and/or course overhaul. Additionally, class size may impair the ability to fully engage every student and offer one-on-one assistance, resulting in less meaningful interactions; utilizing technology and seeking the help of a teaching assistant may remedy the limitation. Further, online courses may particularly cause obstacles relating to students' corresponding lack of engagement, time management, and attention to detail. To counter this limitation, it is essential for faculty to (a) build interactive activities that promote collaboration among students, (b) set early course expectations including assignment due dates, and (c) ensure a well-designed, interactive course exists.

CONCLUSION

As faculty, our ability to reduce our students' cognitive overload can significantly impact their learning experience. To do so, we ought to bridge the gap between cognitive overload and student learning and engagement, and ensure a conducive, safe learning environment exists through encouraging diverse perspectives and listening attentively to various points of view. As described previously, our tested course design model provides early evidence toward reducing student overload. The implementation of our practices aims to present the material clearly to learners, fostering an encouraging learning environment. Our approach is designed to enhance performance and engagement, paving the way for reducing learners' cognitive overload. In addition to effective course design, well-designed assignments can play an important role in enhancing performance and engagement; sharing the assignment purpose can (a) decrease some of the students' cognitive load, (b) offer encouragement to begin the assignment, and (c) pave the way for successful assignment completion. Further, the role of faculty extends beyond solely teaching a course; we ought to ensure deep learning exists and provide meaningful learning experiences for students. Our strategies for reducing cognitive overload provide faculty with a perspective toward successfully designing and teaching their courses with an aim to enhance student learning and performance.

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