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Review Article

Empowering College Students to Decrease Digital Distraction Through the Use of Self-Regulated Learning Strategies

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ABSTRACT

Most college students have grown up using technology and consequently, they are proficient with its many uses and applications. The use of this technology provides many benefits to college students' learning, both in and out of the classroom. However, despite the numerous benefits of technology, these digital activities can also lead to much digital distraction. Digital distractions may include Internet surfing, watching movies, checking texts, reading, and sending emails, and perusing social media. These digital distractions often result in limited attention and engagement during class, as well as less learning and academic achievement overall. Digital distraction can result from such factors as anxiety and depression, motivational variables, the need to keep up and the fear of missing out, emotional numbing and procrastination as well as an overreliance on multitasking. It is suggested here that the use of self-regulated learning (SRL) strategies may be effective in assisting college students in avoiding digital distractions, both in and out of the classroom. SRL strategies include forethought, planning, activation; monitoring, control and reflection on the learner's cognition, motivation/affect, and behavior. Through the use of these SRL strategies, college students may be taught to decrease digital distractions and, thus, experience higher levels of learning and academic performance.

Keywords: digital distraction, self-regulation, college students, academic achievement

INTRODUCTION

Most traditional college students have grown up during a time of rapid technological advancement, which has resulted in their being referred to as "digital natives" (Moran, 2016). This generation of college students is accustomed to using smartphones, tablets, or laptops in the classroom. They review class handouts and take notes using laptops or tablets instead of paper and pencil. Further, their learning resources are often posted on a computer-based learning management system such as Canvas or Blackboard. Finally, many college

students complete and submit their course assignments, take their exams, and view their grades online. Thus, in many ways, technology has become essential for today's college students' learning and academic performance both in and out of the classroom.

The McGraw Hill Education Digital Study Trends Survey (2017) reported that 63% of college students used laptops and 55% used cellphones in the classroom to complete their homework or to prepare for their exams. These college students also reported that using technology facilitated their class preparation (48%), increased the efficiency of their studying (47%), helped them to communicate with instructors (47%) and peers (38%), reduced stress related to their schoolwork (35%), and made them feel more confident in their studies overall (30%). Approximately 73% of students indicated that they preferred to use technology in their on-campus classes. More recently, in McGraw Hill Education Digital Study Trends Survey (2021); Ryan (2022) stated that during the COVID-19 global pandemic, there were significant increases in the use of online courses, eBooks and adaptive courseware as college students used online learning more than ever before both in and out of the classroom.

While many benefits of these technological devices for college students' learning and studying have been found, there are also many disadvantages of these technological tools. First, technological devices can be potential distractors during college students' learning and studying (Chen et al., 2014; Herman, 2017). While outlining the pros and cons of technology, Kraushaar and Novak (2010) classified technology use in the classroom into two categories: productive and distractive activities. Productive activities included using course-related computer programs and tutorials, Microsoft Office, PowerPoint, and course webpages, for example. The distractive activities included Internet surfing, watching movies, listening to music, sending, and reading emails or text messages and perusing social media. Collectively, these distractive activities, which stem from electronic devices that prevent students from concentrating on their course-related assignments, have been classified as digital distractions (Agrawal et al., 2017). In the present review, first, we outline the learning challenges associated with digital distractions. Second, the causes of digital distractions will be articulated from the perspective of self-regulated learning (SRL) theories. Finally, we will use Pintrich's (2000) phases of SRL as a framework to suggest SRL strategies that can be used to help learners to decrease digital distraction.

DIGITAL DISTRACTION AND LEARNING

Technology Trends and Digital Distraction in The Classroom

One of the benefits of smart technology is that it provides a convenient and effective way for learners to search, process, store, and retrieve digital data (Scholz et al., 2018). This efficiency, however, also inadvertently influences our behaviors and the way that we process information (Cole, 2013; Napoli, 2011; Sanbonmatsu et al., 2013). Kraushaar and Novak (2010) installed activity-monitoring software on participating students' laptops with permission and monitored students' computer activities during their classes. They found that 62% of the computer activities that undergraduates engaged in during the class were considered distracting, such as texting and Internet surfing. Further, Lukacs (2021) found that 20% of the adolescents that they studied engaged in moderately problematic Internet use. Garcia-Santillan and Espinosa-Ramos (2021) reported that cell phone distraction accounted for 10% of the variance in their study of smartphone addiction.

Tindell and Bohlander (2012) conducted a survey in a small university and found that 92% of participating students reported that they use their cellphone to send text messages during class and 10% of these college students said that they even texted during exams. It is difficult for individuals to concentrate and to focus on task-relevant activities while using their smartphones for these off-task purposes. In addition, the constant information that smart devices bring to us, such as Facebook updates, notifications, emails, and social media news, occupies our attention and reduces our ability to stay focused and productive (Leysens et al., 2016). Research by Seemiller (2017) has asserted that there are two potential problems when students use digital devices during class. First, this behavior exhibits a lack of courtesy for students' colleagues and their instructors. Second, attentional resources are split when learners are trying to multitask, such as when they are trying to text during class. A study by Flanigan and Babchuk (2020) found that while most instructors try

to focus on prevention to decrease digital distraction in their classrooms, many instructors also found this digital distraction engaged in by students to be somewhat frustrating to manage.

So far, we have discussed both the advantages and disadvantages of technology in the classroom. Chen et al. (2014) also asserted that technology can have both positive and negative impacts on student learning. Evidence from the results of previous studies suggests that technology can help to increase student engagement in learning, facilitate interactions between the instructor and students, facilitate collaborations between students, increase levels of student learning motivation, and create active learning environments (Han & Yi, 2019; Herron, 2010; Kim et al., 2019; Wang et al., 2013; Witherby & Tauber, 2019). For example, Herron (2010) implemented an online math program in preservice teachers' classrooms. The online math program allowed students to learn math concepts and to practice their skills at different difficulty levels, which they selected. According to the results, these college students were able to recall specific details of the learning materials, and this online math program helped them to engage in more meaningful learning.

Furthermore, Han and Yi's (2019) study examined smartphone usage in college classrooms. They found that college students had higher levels of smartphone self-efficacy, as they used smartphones as learning tools for online learning, facilitating their interaction with friends and multitasking. Witherby and Tauber (2019) conducted a survey study to compare note-taking behaviors in current and former college students. They found that more recent college students used technology to take class notes and to review class materials, such as PowerPoint slides, significantly more frequently than former college students.

However, with this increased use of technology in college classrooms, especially as the result of the COVID-19 global pandemic, comes an increase in digital distraction as college students not only use digital devices for on-task activities, but also use these devices for off-task activities (e.g., Tindell & Bohlander, 2012). Using an experimental design, Kuznekoff et al. (2015) explored cellphone use in the college classroom. Student participants were randomly assigned to one of nine different groups which included: a control group, four groups instructed to either send or receive either course-relevant texts or course-irrelevant texts, and four groups instructed to either send or receive either course-relevant Twitter messages or course-irrelevant Twitter messages. Student participants were asked to review video lectures and to take notes on the lectures. Participants then reviewed the learning materials and took a posttest based on lecture content.

Evidence from the results indicated that students assigned to conditions of sending/receiving course-irrelevant text messages or course-irrelevant Twitter messages received lower scores on notetaking as compared with those in the control group or those in the groups assigned to conditions of sending/receiving course-relevant text messages or Twitter messages. Further, Flanigan and Titsworth (2020) found that digital distraction had a more pronounced effect on lecture learning than whether students typed or took handwritten lecture notes. Specifically, students in the digital distraction groups recorded fewer lecture ideas into their notes and scored lower on the posttest following the lecture than participants who did not have access to their mobile phones while the lecture was occurring.

DIGITAL DISTRACTION AND ACADEMIC PERFORMANCE

Much prior research has indicated that digital distractions, such as reading and sending text messages, browsing the Internet, or viewing social media severely limit students' attention and engagement during class and adversely impacts their academic performance (Agrawal et al., 2017; Tindell & Bohlander, 2012). Chaklader and Bohlander (2009) conducted an experimental study to examine the effects of text messages during classes on academic learning. According to the results, text messaging frequency during class was negatively predictive of lecture learning.

Further, Demirbilek and Talan (2018) examined the use of non-lecture related text messages and social media in the classroom on student performance. Student participants were randomly assigned into three groups: control, text message, or Facebook groups. Students in the control group were not allowed to use any technology in the classroom. College students in the text message group interacted with a research assistant by receiving and sending off-task text messages using any digital devices during the class, while those in the Facebook group were asked to complete a list of tasks on Facebook during the class. All students were then asked to complete pre- and post-tests, including an achievement test. Evidence from the results indicated that

students in the control group received higher posttest scores than those in either the text message or the Facebook groups following the lecture.

Parry and le Roux (2018) published similar findings based on their survey research. Students who self-reported using social media during lectures also self-reported lower academic performance. Taken together, the findings from the studies reviewed within this section thus far provide corroborating evidence that digital distraction during class negatively impacts student attention, engagement, learning and performance. However, the results of a regression analysis conducted using a population of college students in Saudi Arabia demonstrated a positive relationship between academic performance and the use of social media networks (Alshalawi, 2022). Thus, there remains a paucity of corroborating research into the rich complexities of the effects of social media and digital distraction in general on academic performance. It is suggested here that one place to start this investigation into the effects of digital distraction on learning and performance is by investigating the factors that influence digital distraction.

FACTORS THAT INFLUENCE DIGITAL DISTRACTION

The results of recent research in this area have posited several factors that have been shown to influence digital distraction. These factors include learner emotions such as anxiety and depression which can lead to procrastination; academic motivation, the need to "keep up" and the "fear of missing out" (i.e., FOMO), emotional numbing and the erroneous belief that multitasking and task-switching are possible and do not negatively impact learning. Each of these factors are reviewed in the following subsections.

Anxiety and Depression

Chellappan and Kotikalapudi (2012) conducted a study to investigate the relationship between college students' levels of depression and their Internet-surfing behaviors and found a high correlation between these two factors. College students who had higher levels of depression or anxiety tended to have higher Internet usage, especially activities such as watching movies, listening to music, and checking emails. This high Internet usage could be explained as a tool for social comfort as well as a distraction from their depression, loneliness, anxiety, or worries (Becker et al., 2013; Davis et al., 2002; Dhir et al., 2018; Shensa et al., 2018). However, it is important to note that high Internet usage also led to procrastination behaviors, such as avoiding important assignments or preparing for examinations (Chen et al., 2014). In other words, college students who are depressed or anxious may spend too much time surfing the Internet and engaging in emotional numbing to avoid the pressure of completing their academic requirements. Further, Internet usage by learners with depression or anxiety has been shown to have a negative impact on academic performance and can even lead to addictive behaviors.

Motivational Variables

Learner motivation has also been demonstrated to correlate with digital distraction. Tameja et al. (2015) found that students' intrinsic and extrinsic motivation, class engagement, and interest in the class materials were all correlated with their attention. Specifically, students who have lower levels of intrinsic and extrinsic motivation, less engagement in class activities, and who lack interest in the materials are less likely to pay attention to the class and are more likely to be digitally distracted. Students are also more likely to be digitally distracted if the learning materials are tough, boring, or not at all interesting to the learner. Further, when learners are bored, or unmotivated, they are more likely to procrastinate and to engage in unnecessary behaviors (Brady et al., 2022).

In addition, the way that instructors present the learning materials also has an impact on maintaining student attention (Chen et al., 2014). Thus, maintaining learner motivation is a critical factor in preventing digital distraction. Further, McGloin et al. (2017) found that having a mastery approach achievement goal orientation was negatively associated with off-task device usage, while having a mastery avoidance achievement goal orientation was positively associated with off-task device usage. Interestingly, the results of this research also found that on-task behaviors were positively associated with laptop usage, while off-task behaviors were positively associated with smartphone usage.

The Need to "Keep Up" and the "Fear of Missing Out"

Digital information is highly perishable, hence making digital distraction even more prevalent among college students (Wong et al., 2021; Wu & Cheng, 2019). Digital information spreads quickly, and therefore the information can become obsolete within minutes. Given that college students are at an age where they feel the need to be informed and to fit in, they often feel the need to quickly respond to all of the notifications that they receive so that they will not be left behind by their peers who may have viewed the information earlier than them (Wong et al., 2021; Wu & Cheng, 2019).

The social value of information can be based on how quickly one views and shares it. College students often feel a sense of immediacy for reading this information. Therefore, college students are constantly distracted by notifications since they want to be socially connected and valued among their peers due to this modern form of peer pressure. Further, many college students feel compelled to keep up with their peers on social media. There is also significant pressure for college students to post an "idealistic" life on social media. However, without the ability to delay gratification and the necessary discipline, college students may end up sacrificing more important activities and obligations such as their academic learning and performance for the sake of these digital distractions that they receive on their digital devices.

The fear of missing out or "FOMO" is another reason why digital distraction is prevalent among college students. FOMO is defined as the anxiety that one experiences whenever they are not involved in the rewarding experiences of others. For example, one may feel left out when they are not in touch with the updates posted by their favorite celebrities, and therefore they may constantly be found checking their social media feeds to see if there are any updates (Cárdenas-Robledo & Peña-Ayala, 2019; Dhir et al., 2018; Vilkova & Shcheglova, 2021). College students may also feel anxious when members of their social circles get the information before them, making them feel like outcasts since they have missed out on the information that matters to them.

Further, college students may fear that their friends are gathering and that they have not been invited. However, they can keep up with the social activities of their peers digitally. Unfortunately, FOMO can be consuming as it often causes college students to be constantly distracted by their digital devices, even at times when they are supposed to be concentrating on more important tasks, such as academic assignments. To overcome the impulse to respond to digital distractions, college students need to have strong social support from their family members and friends. These social support structures can provide a feeling of security and belonging so that even when they miss out on the digital posts, they will not feel left out or that they lack some social value among their peers (Li & Zheng, 2018; Palalas & Wark, 2020).

The Erroneous Belief that Multitasking and Task-Switching is "Efficient"

Another factor contributing to digital distraction is multitasking. Many college students believe that they can effectively accomplish several things simultaneously within a limited time frame by multitasking. However, empirical research has suggested that multitasking reduces their attention span, decreases their ability to concentrate, and reduces accuracy and productivity (Aagaard, 2019; Kraushaar & Novak, 2010; Liu, 2021). Hence, college students who have bought into this glorified belief in multitasking are more likely to engage in multitasking activities, which also lead to more digital distraction as they use technology at the same time. While digital distraction may facilitate multitasking, students are engaged in switching back and forth between the academic task and the digital distraction which can result in less learning (Brady et al., 2022).

Further, in addition to multitasking, many college students also engage in frequent task-switching behaviors. Rosen et al. (2013) observed 263 students' studying for 15 minutes. The results of observations and a questionnaire indicated that participants averaged less than six minutes on a task before task-switching, most often due to technological distractions such as social media, texting, and a general preference for task-switching. Finally, it was found that those students who accessed Facebook had lower GPAs, while those students who used a relatively high use of study strategies were more likely to stay on-task. In conclusion, it takes a significant amount of self-discipline, self-worth, and self-regulation for today's college students to resist the powerful physiological and social lures of technology so that they may avoid digital distraction to focus on their academic learning and to experience higher academic performance. The question then becomes, how can we help our college-level learners to decrease digital distraction?

THE NEGATIVE IMPACT OF DIGITAL DISTRACTION ON THE COGNITIVE INFORMATION-PROCESSING SYSTEM

It is important for our college-level learners to understand the negative effects of digital distraction on learning. One explanation as to why digital distraction may result in less learning, lower grades and GPAs, and lower academic achievement overall is due to the inherent limitations of the cognitive information-processing system (Atkinson & Shiffrin, 1968). First, to even enter into the cognitive information processing system, new information must be taken in through one or more of the senses, and then processed in the sensory register. Next, it must be moved through both the cognitive processes of attention and perception. If the learner is digitally distracted and is not able to devote adequate attention or to devote the resources to adequately perceive the new information, the new information will not be able to be processed further into the short-term memory.

If the learner is focused, and engages in adequate attention and perception, the to-be-learned information should then be processed into the short-term memory. It is important to point out however that the short-term memory has a limited capacity as well as a limited duration. Specifically, with regards to its capacity, short-term memory is limited to (7+ or –2) bits of information (Miller, 1956), and can only hold information for a duration of about 20-30 seconds. Due to these short-term memory limitations, if the learner is digitally distracted, this will limit both the amount and the duration of time that the information can be processed in the short-term memory. Specifically, Werner et al. (2011) found that those college students with better working memory capacity and better spatial abilities were better at resuming interrupted tasks. Further, Cades et al. (2007) discovered that interruptions that prevented the participant from rehearsing the interrupted task and required more cognitive effort were more disruptive.

Finally, for the new information to be deeply processed, learned, and retained by the learner, it must be encoded into the long-term memory. Some examples of ways in which new information may be encoded into the long-term memory include long-term memory rehearsal, organization, and elaboration. If the learner is digitally distracted, they are not going to be able to engage in these deeper-level encoding processes to learn and retain the new information and thus, this information may not be able to be processed into the long-term memory. Thus, based on the cognitive demands of the cognitive information-processing system; it is critical for college students to devote 100% of their attention, perception, short-term memory capacity as well as their long-term memory encoding to learning new information and course material. Additionally, metacognition serves to guide the flow of information through the entire cognitive information-processing system. If the learner is digitally distracted, they may have less cognitive resources to successfully monitor the flow of information through the entire cognitive information-processing system which can also negatively impact learning and academic performance.

Cognitive load theory (e.g., Sweller, 2020) also offers support for the fact that the processing of complex information may require a reduction in working memory load. However, when college students are digitally distracted, it is not possible for the learner to engage in these complex cognitive processes because this digital distraction is using some of the limited short-term memory capacity. Thus, we must help the college learner to enact cognitive strategies and to avoid digital distraction for optimal learning and achievement to occur. Specifically, if the limited processing capacity of this system is focused on digital distractions, it will be difficult for the learner to effectively learn and retain new information. This limited capacity of the short-term memory also offers a theoretical explanation as to why multi-tasking and task-switching are ultimately ineffective during learning and studying. Thus, the question then becomes, “how can college students effectively decrease digital distractions so that they can effectively learn and retain the to-be-learned information and to succeed academically in a world in which technology is central to every facet of their learning?”

SELF-REGULATED LEARNING

It is suggested here that fostering SRL may serve as one effective approach that can be used in assisting college students to decrease digital distractions and to experience deeper learning and better academic achievement. Several definitions of SRL have been posited over the course of the last forty years. In one of the initial definitions of SRL, Zimmerman (1986, 1989) defined the self-regulated learner as one who is a

metacognitively, motivationally, and behaviorally active participant in their own learning. Further, Zimmerman and Martinez-Pons (1986) initially suggested that SRL strategies include such methods as: organizing information, using self-consequences, information seeking, and using rehearsal and memory aids. Bandura's (1986) theory suggested that SRL included the three phases of self-observation, self-judgment, and self-reaction. Thus, the reviewed conceptions of SRL have suggested that the self-regulated learner uses effective strategies to plan, engage in, monitor, and revise their own learning processes. For the purposes of the present research, SRL is defined as a series of active learning strategies in which the learner plans and sets goals for their learning, uses appropriate strategies to accomplish these goals, and monitors and evaluates their progress throughout the entire learning process.

While applying theory into practice, SRL plays a critical role in educational progress. From the perspective of social learning theory, self-regulation results from a triadic reciprocal interaction of personal, behavioral, and environmental processes (Bandura & Walters, 1977; Hadwin et al., 2018; Schunk & Di Benedetto, 2020). Previous studies have found that SRL is positively associated with motivation, academic performance, learning, achievement (Ariani, 2016; Azevedo & Cromley, 2004; Brady et al., 2021; Galla et al., 2019; Hoyle & Dent, 2018; Hromalik & Koszalka, 2018), the depth of thinking and understanding (Jenson, 2011, as cited in Reyna et al., 2019), and can also help students to focus on the learning process (Ottenhoff, 2011, as cited in Reyna et al., 2019).

In one of the initial models of SRL, proposed by Winne and Hadwin (1998), SRL unfolds over four loosely sequential phases. First, the learner searches their external environment and uses their internal memory to gather information about the learning context. Next, in the second phase, the learner develops goals for their learning and drafts plans to accomplish those goals. In the third phase, the learner enacts strategies to successfully accomplish the goals. Finally, in the fourth stage, the learner oversees and monitors their success, and makes changes for future goal attainment. It is important to note that during the first three phases, the self-regulated learner constantly monitors information regarding the demands of the context and the strategies that are used, and the learner makes significant changes to their strategies in phase four, if necessary (Winne & Hadwin, 1998).

Similarly, in another one of the initial models of self-regulation, Zimmerman (2000) proposed a cyclical model that takes place across three primary phases of learning: forethought, performance, and reflection. According to this model, first, during the forethought phase, the self-regulated learner engages in planning and goal setting, and these must be accompanied by such motivational beliefs as self-efficacy and positive expectations. Second, during the performance phase, the self-regulated learner enacts their performance which entails monitoring their cognitive and emotional strategies along with the task demands and using effective learning and study strategies. In the final phase, reflection; the self-regulated learner engages in reflection during which the learner makes causal attributions about their learning, reviews the strategies that they have used, and based on this information; self-administers rewards, engages in appropriate emotions, and revises goals as necessary based on performance. Thus, in both of these initial models of SRL, the self-regulated learner is active through all phases of the learning process, from initial assessment and goals to reflection and revision.

DIGITAL DISTRACTION AND SELF-REGULATED LEARNING

The theoretical research presented so far has shown that according to the cognitive information processing system, in order to succeed academically; the learner must initially attend to the to-be-learned information. Next, the information must be moved move into the short-term memory and finally, this new information must be encoded into the long-term memory for it to be effectively learned, applied, and retained. Further, for this deep-level learning to occur, the learner must engage in several SRL strategies including goal setting, the enactment of effective strategies, as well as self-reflection, revision, and metacognition. Thus, effective learning requires deep-level cognitive information processing and the use of SRL strategies. However, when college students are digitally distracted, they are unable to effectively process new information through the cognitive information-processing system.

The digital world demands the attention and focus of college students through the different activities that they have to undertake. For example, while using their computers for research purposes, college students

may find themselves distracted by notifications from other applications, some of which may be useful but many of which may not be useful (Alghamdi et al., 2020; Wu & Xie, 2018). Therefore, college students need to develop self-regulation and self-control to help them to overcome and resist the digital distractions that may arise while undertaking productive learning activities using technology, in an effort to achieve their set goals efficiently and on time. It is suggested here that SRL strategies may serve as one means of helping college students to remain focused even when many distractions are demanding their attention. By using SRL strategies, the learner can essentially ignore the distractions that may come from digital devices. In other words, students can use digital devices for the needed purpose without being distracted to use other digital features that may be more enjoyable on the same devices through the use of SRL strategies.

Digital Distraction and Self-Regulated Learning Strategies for College Students

In modern classrooms, ubiquitous access to digital devices, including computers, laptops, tablets, and smartphones, is prevalent in higher education. These technological devices are necessary to facilitate students' learning in the digital era (Hwang et al., 2008; Kay, 2008; Ragan et al., 2014; Samson, 2010; Taneja et al., 2015). However, the intrusiveness of these digital devices has created many challenges for college students' learning, including digital distraction, inattention, cyber-slacking, anxiety, escapism, a lack of class engagement, and apathy towards course-related materials (Chan et al., 2009; Gerow et al., 2010; Taneja et al., 2015).

Anthonysamy et al. (2020) suggest three basic SRL strategies to reduce digital distraction in the classroom. The first strategy focuses on personal regulation, including metacognitive and motivational regulation. Students need to realize and understand the impacts of the digital distraction and be willing to use these technological devices for productive activities only. The second strategy focuses on behavior regulation including self-observation and self-judgment. Students can monitor how much time they use these digital devices on off-task activities and use reinforcement strategies to help refrain from engaging in digital distraction. The last strategy focuses on environmental regulation, such as using enactive experience, social modeling, and environmental structuring to reduce digital distraction. In this case, college students can physically distance themselves from their digital devices such as cell phones while studying, for example. Thus, engaging in deep-level cognitive processing, and SRL strategies can serve to help the learner to significantly decrease digital distractions throughout the learning processes while increasing learning and achievement.

HOW COLLEGE STUDENTS CAN USE SELF-REGULATED LEARNING STRATEGIES TO DECREASE DIGITAL DISTRACTION

Based on a synthesis of research into the challenges associated with digital distraction, and the benefits of SRL, it is suggested here that college learners may use a variety of SRL strategies to manage digital distraction throughout the learning process. Generally, these SRL strategies may include: planning, prioritizing, environmental structuring, goal-setting, organizing the learning task, time management, engaging in positive thoughts and self-efficacy, engaging in effective task-specific strategies, self-monitoring to track productivity, setting boundaries, creating a schedule, using a reward system, monitoring, seeking help when necessary, engaging in accurate causal attributions, and revising strategies as necessary based on task demands and feedback.

As mentioned earlier, according to one of the initial models of SRL, proposed by Winne and Hadwin (1998), SRL unfolds over four loosely sequential phases. First, the learner searches their external environment and uses their internal memory. Next, in the second phase, the learner develops goals for their learning and drafts plans to accomplish those goals. In the third phase, the learner enacts strategies to successfully accomplish the goals. Finally, in the fourth stage, the learner oversees and monitors their success.

Somewhat similarly, in another one of the initial phase models of self-regulation, Zimmerman (2000) proposed a cyclical model that highlights three primary phases of learning: forethought, performance, and reflection. According to this model, first, during the forethought phase; the self-regulated learner engages in planning and goal setting. Second, during the performance phase, the self-regulated learner enacts their performance which entails monitoring and using their cognitive and emotional strategies. In the final phase,

reflection; the self-regulated learner makes causal attributions about his/her learning. Thus, in both of these initial models of SRL, the self-regulated learner is active through all phases of the learning process, from initial assessment and goals to reflection and revision. More recently, Brady et al. (2022) elucidated Zimmerman's (2000) three-phase model as an organizational framework suggesting ways in which college students could manage their digital distractions. Specifically, they outlined forethought strategies that included preparing for an academic task, performance strategies that are useful for engaging in an academic task, and finally, self-reflection strategies that can be used for reflecting on an academic task.

The present research is grounded in Pintrich's (2000) SRL model. According to Pintrich's (2000) model, SRL is comprised of four phases: (i) forethought, planning, and activation, (ii) monitoring, (iii) control, and (iv) reaction and reflection. Further, each of these four phases has four different areas of regulation: cognition, motivation/affect, behavior, and context (Panadero, 2017).

Forethought, Planning, and Activation

With regards to the first phase, forethought, planning and activation; Pintrich (2000) suggested that *cognition* entailed target goal setting, prior content knowledge activation, and metacognitive knowledge activation. It is suggested here that in this forethought phase, challenges related to cognition may include having a lack of target goals, having little or no prior content knowledge or little or no metacognitive knowledge, all of which may lead to digital distraction. Potential SRL strategies that may be used to help decrease digital distraction in the forethought phase in the cognitive area may include setting goals, using a planner, and reviewing information to increase prior knowledge.

Further, in the forethought, planning and activation phase, the second area in which college students could experience challenges is in the area of *motivation*. Here, students may adopt a performance avoid achievement goal orientation, have low self-efficacy, overinflate the difficulty of the task, or have low task interest, all of which may lead to digital distraction as a coping mechanism. College students could be trained to adopt more mastery achievement goal orientations, and to increase their self-efficacy through practice, positive reinforcement, and self-talk. The third area in which college students may experience challenges related to their learning in this forethought phase is in the area of *behavior*. Specifically, college students may not set aside enough time to successfully complete the task, for their learning and studying in general. One SRL strategy that may be helpful to college students in this case would be learning a time management strategy such as mapping out their day, hour by hour to ensure that they have allocated enough time for their studying. Digital distraction may be particularly detrimental to effective time management. In conclusion, some of the challenges related to the forethought, planning and activation phase have been outlined, as well as some of the potential SRL strategies that may be used to help college students to regulate their *cognition*, *motivation/affect*, and *behavior* during these forethought, planning and activation phases and to decrease digital distraction.

Monitoring

According to Pintrich's (2000) SRL model, the second phase is monitoring. Pintrich (2000) suggested that with regards to *cognition,* monitoring entails metacognitive knowledge and judgments of difficulty. It is suggested here that monitoring challenges related to cognition may include underestimating the difficulty of an assignment, and not realizing that you do not understand or comprehend the material. SRL strategies that may be used to help college students to better monitor their cognition include rereading text information and using practice tests. With regards to this second phase, monitoring, challenges related to monitoring *motivation/affect* may include a lack of awareness of motivational issues such as a lack of intrinsic motivation, or an overreliance on performance goals, or external attributions, all of which could lead to digital distraction. College students could be trained to use SRL strategies such as developing more intrinsic motivation through choice or autonomy and using more of a learning achievement goal orientations and internal attributions. Finally, with regards to *behavior*, college students may experience monitoring challenges related to their behavior such as a lack of awareness of their needed effort, time and help needed to successfully complete a task. Thus, to help them with their behavioral monitoring, college students could be trained to use the SRL strategies of effort regulation, time management and help-seeking which can all serve to help college students to decrease digital distraction.

Control

With regards to the third phase in Pintrich's (2000) SRL model, control; Pintrich (2000) suggests that with regards to *cognition,* college students may experience challenges selecting the most effective cognitive strategies based on the demands of the task. Specifically, college students may need to be trained to use task specific SRL strategies. For example, some less skilled learners may not realize that the same study strategies may not be effective for both a multiple-choice test and an essay test. Or, that they may need to study differently for a math test than for an English test. Digital distraction may decrease the cognitive resources that are available for effective learning and studying as college students may focus more on a text discussion or social media posts than using deep-level cognitive strategies that are needed for effective studying. With regards to their *motivation/affect* and control, some college students may not effectively manage their motivation or affect. For example, they may engage in digital distraction as a form of procrastination since it may be more immediately gratifying than studying. This digital distraction may seem more rewarding in the short run but can be more stressful and anxiety provoking in the long run as college students may not achieve their academic goals, or receive their desired grades (Brady et al., 2022). Finally, with regards to controlling their *behavior,* some college students may not realize when they need to increase their effort. When confronted with a choice between persisting and giving up, they may give up. SRL strategies such as physically putting away digital distractions or allowing themselves to only use them after completing certain assignments may be especially useful in helping college students to persist until they meet their goals.

Reaction and Reflection

Finally, there is a fourth phase, reaction, and reflection in Pintrich's (2000) SRL model. With regards to *cognition,* college students must reflect on and make accurate cognitive judgments and assessments regarding their academic performance. It is important that they correctly attribute any lack of success to digital distractions if that is the actual cause and that they use SRL strategies to improve their performance such as limiting the use of these distractions. With regards to *motivation/affect,* it is important for college students to reflect on and develop effective motivational strategies to meet their academic goals, especially if they are not meeting their academic goals due to digital distraction. College students need to use motivational strategies such as developing intrinsic motivation and self-efficacy so that they can successfully complete the task at hand and avoid digital distraction. Finally, with regards to *behavior*, it is important for college students to reflect on their academic performance and to engage in the necessary help-seeking behaviors and to persist in the face of obstacles. Helpful SRL strategies may include adjusting learning strategies in response to task demands and adjusting the use of digital distractions during challenging tasks.

In conclusion, we have used Pintrich's (2000) SRL model as a theoretical framework espousing both the challenges that are faced at each of the four phases: forethought, planning and activation; monitoring, control and reaction and reflection. Further, we have highlighted the areas of: cognition, motivation/affect and behavior. We have suggested potential SRL strategies that can be used during each of these four phases across the areas of cognition, motivation/affect and behavior to help college students to address these learning challenges and to avoid digital distractions. It is suggested here that college students can engage in effective SRL strategies at each phase to help them to decrease digital distraction and to experience academic achievement. A summary of the SRL strategies that may be used to address learning challenges related to the forethought, monitoring, control and reaction and reflection phases may be seen in **Table 1**.

CONCLUSION

While there are numerous benefits of technological devices for college students' learning, it is undeniable that digital distraction has also become a prevalent intrusion in the college classroom and on college learners' learning and studying (Aaron & Lipton, 2018; Agrawal et al., 2017; Flanigan & Babchuk, 2020; Goundar, 2014; Seemiller, 2017; Taneja et al., 2015; Tesch et al., 2011). This digital distraction can result in a loss of classroom learning and perhaps even affect the learner's academic performance and achievement. It is suggested here that one approach to helping college students to develop the self-control and self-discipline needed to resist digital distraction is through the use of SRL strategies. In the present research, Pintrich's (2000) SRL model

Table 1. Phases and areas of SRL: Challenges that can lead to digital distraction and SRL strategies that can be used to decrease digital distraction (Adopted from Panadero, 2017; Pintrich, 2000)

Phases	Areas	Cognition	Motivation/affect	Behavior
Forethought, planning, & activation	Challenges that can lead to digital distraction	• Lack of target goals • Little or no prior knowledge • Little or no metacognition	• Performance avoids goal orientation • Low self-efficacy • Low interest	• Poor focus/attention
	SRL strategies that can be used to decrease digital distraction	• Setting goals • Using a planner • Reviewing information	• Mastery goal orientation • Increase self-efficacy	• Time management • Removing digital distractions
Monitoring	Challenges that can lead to digital distraction	• Underestimating task difficulty • Lack of comprehension monitoring	• Low intrinsic motivation • External attributions	• Failure to seek help
	SRL strategies that can be used to decrease digital distraction	• Rereading • Using practice exams	• Developing intrinsic motivation • Internal attributions	• Effort regulation • Help seeking
Control	Challenges that can lead to digital distraction	• Inability to select effective strategies • Inability to maintain attention	• Procrastination • Inability to delay gratification	• Lack of environmental structuring • Decreased effort
	SRL strategies that can be used to decrease digital distraction	• Strategy training	• Delay of gratification	• Adjust effort based on difficulty • Need to use self-control for devices
Reaction & Reflection	Challenges that can lead to digital distraction	• Failure to self-evaluate	• Failure to reflect on motivational dispositions	• Failure to engage in help-seeking when needed
	SRL strategies that can be used to decrease digital distraction	• Accurate self-evaluation	• Accurate attributions	• Limit distractions

was used as a theoretical framework as it highlights four phases of the learning process: forethought, planning and activation; monitoring, control and reaction and reflection.

The present article sought to elucidate the growing body of literature on digital distraction, to highlight the challenges derived from digital distraction amongst college students, and to propose some possible suggestions to help alleviate the challenges associated with digital distraction such as missed instruction and decreased academic performance. It is suggested here that the use of SRL strategies may provide one approach to helping college learners to decrease their digital distraction and to increase their academic learning and performance. In conclusion, college students, instructors, and educational professionals should work together to foster college students' SRL strategies to reduce non-academic digital distractions both in and out of the classroom and to help college learners to be able to engage in the deep-level cognitive processing required for optimal learning, retention, and academic achievement.

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