



Mind wandering, control failures, and social media distractions in online learning



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ABSTRACT

Mind wandering often leads to performance and accuracy errors during activities that are demanding and require concentration. Students are often asked to concentrate on demanding tasks in their studies, and by the nature of this principle, off-task thinking would inherently be prohibitive to their success. Further, the distracting nature of social media and technology may greatly increase the likelihood of mind wandering when students are engaged in online learning, requiring them to engage with said technology. To examine the relationships among working memory, interest, mind wandering and performance, 126 participants from a large Midwestern state university completed three complex span tasks, responded to mind-wandering probes while watching two online lectures and rated interest in the lecture topics. Higher levels of mind wandering predicted lower levels of academic performance. Lower levels of working memory capacity predicted higher levels of mind wandering and lower levels of academic performance. Higher levels of topic interest predicted lower levels of mind wandering. A novel mind wandering probe, thinking about or using another technology, accounted for 29% of all off-task thinking.

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1. Introduction

Mind wandering is a shift from an ongoing activity to task-unrelated thoughts. These drifting thoughts are quite common; we mind wander 30%–50% of the time on our daily lives (Levinson, Smallwood, & Davidson, 2012; McVay & Kane, 2012b). And this common mind wandering experience can result in deficits. When tasks require concentration or are cognitively demanding, wandering to task-unrelated thoughts (TUTs) often leads to performance and accuracy errors on the primary activity (e.g. McVay & Kane, 2009; McVay & Kane, 2012b; Unsworth & McMillan, 2013). Therefore, investigating individual differences in mind wandering and the impact on performance is particularly relevant in an educational setting because of the inclination for the mind to wander and the resulting performance deficits. The goal of this study was to examine individual differences in mind wandering, working memory capacity, interest, and performance in an online classroom.

1.1. Mind wandering in education

Researching mind wandering in online education fills the gap between this study and previously studied contexts for off-task thinking. Now that much of post-secondary education takes place online, in the current study we hoped to understand how mind wandering, interest, and working memory interact to impact student learning. Most critically, our key questions and predictions are based on the *Control Failures X Concerns* theory of mind wandering that was proposed by McVay and Kane (2009; 2010). According to this theory, when people have a control failure “off-task intrusions are automatically generated from a continuous stream of thought on the basis of current concerns of the individual and cued by the environment” (McVay & Kane, 2012b, p. 326). In an online environment, one possible distractor is the technology itself. Junco (2012) and Wood et al. (2012) demonstrated that multitasking with social media and related technologies led to poorer academic performance. Thus, one unique prediction from this theory that we explore is that students engaged in online learning activities will experience mind wandering in relation to personally relevant technologies, and in turn, this mind wandering will relate to poor performance in the class.

As one would expect, mind wandering is frequent in traditional

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classrooms and research in classrooms supports this conclusion (e.g., Lindquist & McLean, 2011; Unsworth, McMillan, Brewer & Spillers, 2012). Students that listened to an in-class lecture (Lindquist & McLean, 2011) and students that watched a video lecture in a classroom (Risko, Anderson, Sarwal, Engelhardt, & Kingstone, 2012) reported higher rates of off-task thought also performed worse on course exams and content quizzes. Only one other study, that we were able to find, investigated mind wandering in online learning (Szpunar, Khan, & Schacter, 2013), presenting an opportunity to further research is this online academic context.

Technology use in classrooms also contributes to distraction; laptop-use, interactions with mobile devices, and Facebook® during in-class lectures created deficits in academic performance (Fried, 2008; Junco, 2012; Wood et al., 2012). Ophira, Nassb, and Wagner (2009) proposed that not only did technology multitaskers have difficulty attending to essential information and accurately switching tasks, they were also unaware of the deficits created by their multitasking. Given the distracting nature of mobile technologies, social media and the lack of awareness in the detriments of technology multitasking, the current study introduced a new mind-wandering probe to capture experiences where subjects were drifting off-task and thinking about or using another technology, such as texting or checking Facebook®.

The idea here is that technology is likely a common environmental cue that may be especially relevant for students who are enrolled in an online course and hence are interacting with technologies while trying to stay on task. To evaluate this prediction, it is critical to supplement task-unrelated thought (TUT) probes with a question pertaining to off-task thoughts about technology (which could account for a substantial portion of TUTs in findings in online education contexts). Off-task intrusions are fodder for mind wandering that undermine task performance. Accordingly, this study evaluated individual differences in mind wandering while subjects watched video lectures in an online course and analyzed how various factors (with a focus on technology-relevant TUTs) influenced academic performance.

1.2. Mind wandering and working memory

The relationship between WMC and mind wandering is well established, and the principle that those with a higher WMC are less prone to mind wandering during a demanding task has been consistently demonstrated (see Kane & McVay, 2012 for a review). These individuals with a higher WMC are better able to maintain task goals and avoid distractions from irrelevant information; therefore, they experience fewer errors neglecting goals related to the primary task (Engle, 2002). Critically, the difficulty of maintaining a goal in the face of distracting information pertains to the control failures that are partly responsible for mind wandering according to the *Control Failures X Concerns* theory (Kane & McVay, 2010). Thus, we chose to include WMC as a predictor of mind wandering, as it is clear that WMC does account for unique variance in mind wandering.

1.3. Interest

An implication of the *Control Failures X Concern* theory is that any factor that reduces control failures – i.e., that engages students so that they stay on task – will decrease mind wandering. One individual-difference factor that presumably will impact the frequency of control failures is students' interest in the course content. Consistent with this possibility, Unsworth and McMillan (2013) reported a relationship between interest and WM in a laboratory study. Namely, they examined individual differences in mind wandering, WMC, and interest and their relationship with reading

comprehension. Subjects completed operational span (OSPAN), reading span (RSPAN) and spatial span (SSPAN) tasks, read the half of one textbook chapter and received six mind-wandering probes during the reading task. Subjects then completed a reading comprehension test. Following the comprehension test, subjects answered two questions on interest (How interested were you in the topic of the text? and How interested are you in this topic in general?). As expected, subjects with high WMC mind wandered less than those with lower WMC. WMC was unrelated to interest, but most important for the present study, more interested participants mind wandered less often than did less interested participants.

Thus, the *Control Failures X Concerns* theory and the prior evidence (Unsworth & McMillan, 2013) suggest that interest will be related to mind wandering and hence have at least an indirect effect on academic performance. Note, however, that the prior research was conducted with laboratory materials that students did not choose to read, whereas students in the present study chose to enroll in the online course, presumably because they had some interest in the content. Thus, perhaps interest will not explain variance in mind wandering in this naturalistic context, so evaluating these competing possibilities is also an important goal of the present study.

1.4. The present study

In the present study, we investigated relationships among mind wandering, working memory capacity, and interest and their impact on academic performance in online learning. As reviewed, previous research established that less interest in a topic and higher levels of mind wandering reduced performance during demanding tasks. To examine these relationships, we used an individual differences approach, which is a commonly used to explore relations between mind wandering and other cognitive processes (e.g., Kane & McVay, 2012; Storm & Bui, 2015; Thomson, Ralph, Besner, & Smilek, 2015). This approach allows the researcher to discover the way individuals differ in their behavior and the processes and mechanism that underlie the behaviors. McVay and Kane (2010) reported that “whatever mechanisms are responsible for lapses of attention, then, they appear to be stable across, people, tasks, contexts and time” (p. 326). If McVay and Kane (2010) finding was accurate, then the principles established in previously explored contexts (e.g. reading a chapter in a lab; listening to a lecture in a traditional classroom) would be the consistent with the experiences of those in a fully online classroom. In order to evaluate mind wandering in online learning, participants responded to thought probes while watching two online video lectures; a novel thought probe regarding distractions related to social media (e.g. Facebook®) and mobile technologies (e.g. texting) was presented. Participants also rated their interest in the presented topics (historical introductions to advertising and public relations, respectively) before and after each video. Participants also completed three complex span tasks to evaluate working memory capacity.

In the context of online learning, three novel research questions were evaluated in this study, which were inspired by implications of the *Control Failures X Concerns* theory (Kane & McVay, 2010) for online class performance: (1) Does mind wandering mediate the relationship between WMC and academic performance? (2) Does interest influence mind wandering? and (3) Do potential interactions with social media and technology distract on-task thinking?

2. Methods

2.1. Participants

In total, 153 undergraduates at a large Midwestern state

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