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The indirect relationship of media multitasking self-efficacy on learning performance within the personal learning environment: Implications from the mechanism of perceived attention problems and self-regulation strategies

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ABSTRACT

Media multitasking, characterized by simultaneous engagement in multiple media forms, is prevalent among university students within the personal learning environment. However, those who think they are capable of multitasking usually overestimate their ability to perform the actual tasks. This study examined university students' learning performance from the perspectives of their media multitasking self-efficacy, perceived attention problems, and self-regulation strategies using the revised Online Learning Motivated Attention and Regulatory Strategies scale. Participants were 696 university students (275 males, 39.51%) in Taiwan. The author developed the media multitasking self-efficacy scale through open-ended interviews and pilot tested the measures using an exploratory factor analysis. The confirmatory factor analysis verified the uni-factor structure of the instrument. Second-order confirmatory factor analysis validated the two orthogonal higher-order constructs of perceived attention problems and self-regulation strategies as well as their subscales. Results from the multilevel structural equation model revealed significant negative indirect relationship between media multitasking self-efficacy and learning performance via both students' perceived attention problems and self-regulation strategies. Study findings have implications for prevention and intervention of university students' media-related attention problems and poor regulation strategy use within the personal learning environment.

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1. Introduction

The Internet has expanded the boundaries of higher education and made it more accessible and cost-effective (Perna et al., 2014). For example, the Personal Learning Environment (PLE) premised on social media (e.g., Facebook or Twitter) enables students to share, communicate, and collaborate with others for both formal and informal learning (Dabbagh & Kitsantas, 2012; Gillet, Law, & Chatterjee, 2010; Lee & Wu, 2012). Despite the rich informational resources and social opportunities it offers (MOOCs: Massive Open Online Courses, YouTube, wikis, etc.), the PLE is a self-directed environment (Kop & Fournier, 2011) and, therefore, requires that students self-regulate their attention to achieve good learning results (Gillet et al., 2010; Johnson & Sherlock, 2014). Attention occurs prior to cognitive information processing. How learners can stay focused and

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remain engaged, therefore, is fundamental to the onset of major cognitive learning activities (Petersen & Posner, 2012). To be more specific, learners' awareness of and willful control/regulation of their attention are essential for achieving a focused attention (Reisberg & McLean, 1985).

Grounded on theories of attention and metacognition, Wu (2015) explored university students' meta-attention, that is the awareness and regulation of their attention, during online learning using the scale of Online Learning Motivated Attention and Regulation Strategies (OL-MARS). He found that student academic achievement and learning-related outcomes were negatively associated with perceived media-related attention problems and positively associated with self-regulation strategies within the PLE. Although the results suggest that the OL-MARS seems an effective tool to monitor students' awareness and regulation of their attention, the scale needs to be extended to fully reflect perceived attention problems (PAP) and self-regulation strategies (SRS). In this study, we regarded PAP and SRS as broader constructs of engagement in multitasking, because higher PAP and poor SRS reflect students' awareness of their attention problems and poor regulation to focus on a single task.

Failure to regulate attention can lead to concurrent engagement in multiple media applications that are irrelevant to learning (e.g., texting, online chatting, non-homework-related Internet use). This phenomenon has been referred to as media multitasking and is widely prevalent among university students (Carrier, Rosen, Cheever, & Lim, 2015; Junco & Cotten, 2012; Karpinski, Kirschner, Ozer, Mellott, & Ochwo, 2013). However, multitasking has been found to be negatively correlated with learning performance (Bowman, Levine, Waite, & Gendron, 2010; Junco, 2012; Kirschner & Karpinski, 2010; Kraushaar & Novak, 2010; Rosen, Carrier, & Cheever, 2013) possibly due to the limited capacity of our cognitive resources (Rosen, Lim, Carrier, & Cheever, 2011; Wood et al., 2012; Wu & Peng, 2016).

People's media multitasking self-efficacy (MMSE) may be the culprit of their attention problems and multitasking behavior. According to Bandura (2006), "perceived self-efficacy is concerned with people's belief in their capabilities to produce given attainments" (Bandura, 2006, p. 307). In the same vein, people with higher MMSE may engage in more media multitasking. However, those who think that they are capable of multitasking may overestimate their ability in performing the actual multiple tasks at once (Sanbonmatsu, Strayer, Medeiros-Ward, & Watson, 2013).

Moreover, the mechanism between MMSE and actual learning performance is still unclear. Therefore, this study aims to fill this gap by examining the indirect relationship between MMSE and learning performance via PAP and SRS. We postulated that if people obtain higher MMSE, it is likely that they will engage in more multitasking activities (evidenced in higher PAP and poorer SRS), which in turn is correlated with poorer learning performance within the PLE. This indirect relationship will be tested in the study.

1.1. Research purposes

Drawing on the theories of attention (Petersen & Posner, 2012), meta-attention (Wu, 2015), and metacognition (Schraw & Sperling Dennison, 1994), this study aimed to (a) validate the theoretical and measurement structures of media multitasking self-efficacy and meta-attention using confirmatory factor analyses (1st-order and 2nd-order CFA), and to (b) explore the indirect effects of MMSE on learning performance in the PLE through the pathways of meta-attention constructs. In the following sections, we provided the theoretical framework and reviewed relevant literature regarding the proposed hypotheses.

1.2. The theoretical framework of meta-attention within the PLE

To avoid distraction and to stay focused on online learning, selective attention plays an important role (Broadbent, 1958; Dayan, Kakade, & Montague, 2000). Learners need a good understanding of their attention state as well as good strategy use to regulate their attention. These two components are parallel to the knowledge and regulation components in metacognition (Schraw & Sperling Dennison, 1994). A plethora of studies have investigated how metacognition, conceptualized as awareness/knowledge of one's cognition (Lee & Wu, 2013; Wu, 2014) as well as regulation of one's cognition (Hathorn & Rawson, 2012; Kauffman, Zhao, & Yang, 2011; Lee, 2015), can contribute to online learning. Nevertheless, before being engaged in a learning activity, students need to direct their attention to the online task and stay focused. Therefore, meta-attention, that is students' awareness of their attention and regulation of their attention, is critical to the start and continuation of the learning activity (Wu, 2015). Within a PLE, awareness of attention may be conceptualized as perceived attention problems (PAP), which reflects students' perception of their media-related attention problems. On the other hand, regulation of attention may be conceptualized as self-regulation strategies (SRS), which reflects students' strategy use to regulate their attention. PAP and SRS can be seen as broader constructs of engagement in multitasking, because higher PAP and poorer SRS reflect students' awareness of their distracted attention and poor attention regulation to focus on a single task.

The subscales in the PAP construct are derived from theories of attention (Petersen & Posner, 2012; Posner & Boies, 1971; Posner & Petersen, 1990). From a cognitive point of view, attention includes three subsystems: (a) The executive control system selects the target information for further processing, (b) the orienting system directs learners' attention to sensory stimuli, and (c) the alerting system keeps learners alert and vigilant for priority events. Each of the subsystem can correspond to a subtype of PAP. Within the PLE, we propose that three typical questions guide PAP: (a) "Do I know that I tend to select and process information irrelevant with online learning?" (b) "Do I know that I am easily attracted to social media notifications or

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