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In-class Multitasking among College Students

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IN-CLASS MULTITASKING

Abstract

The use of mobile devices in class has become a common scene on the college campus. The negative effects of in-class multitasking behaviors have been identified in many educational settings, including colleges. This study investigates the factors that drive college students to multitask and seeks to understand the relationship between learning engagement and multitasking behaviors in the classroom. This study also explores whether polychronic traits relate to multitasking behavior. A total of 282 survey samples were collected from college students in Taiwan. The results confirmed our hypotheses: (1) Students' multitasking motivation, including social and emotional needs, positively relates to their in-class multitasking. (2) Polychronic traits positively relate to in-class multitasking. (3) Learning engagement negatively relates to in-class multitasking behavior. (4) Polychronic traits negatively relate to learning engagement. (5) Low course difficulty level relates to more frequent in-class multitasking behaviors. The implications of the study are also discussed.

Keywords: Learning engagement, multitasking, multitasking motivation, polychromic traits

In-class Multitasking among College Students

Owing to the increasing popularity of information technology, the use of mobile devices in the education environment is becoming increasingly common. Studies on multitasking have been an important research issue ever since. For example, Srivastava, Nakazawa, and Chen (2016) focused on how different cultural or demographic variables affect multitasking. Adler and Benbunan-Fich (2015) determined how multitasking impacts students' academic performance. Parry and le Roux (2019) examined the impacts of multitasking on cognitive control and Chen and Yan (2016) investigated the multitasking effects on learning efficiency.

Multitasking is where people deal with more than one task at the same time (Wood, Zivcakova, Gentile, Archer, De Pasquale, & Nosko, 2012). Rubinstein, Meyer, and Evans (2001) indicated that multitasking is a rapid shift among different tasks. This divided attention accompanied by multitasking impairs memory and performance, and learning efficiency and effectiveness declines significantly (Gaspelin, Ruthruff, & Pashler, 2013). With the rapid advancement in information communication technology (ICT), people multitask more frequently using mobile computing devices in daily life. The prevailing phenomenon of multitasking poses challenges to education at all levels. Tassone, Liu, Reed, and Vicker (2017) found that students with higher grade point average (GPA) multitask less in class. Burak (2012) found that although students are aware of the negative impact of in-class multitasking on learning performance, the number of multitasking activities continues to rise. Therefore, establishing the factors underlying students' in-class multitasking behavior is an important educational issue and worth studying.

On the other hand, people are different and not everyone enjoys multitasking due to their natural tendency. Some people prefer to do many things at a time (polychronicity) while others like to focus on one thing at a given time (monochronicity). The monochronicity/polychronicity

tendency could be an important variable in explaining students' multitasking behavior. Accordingly, this study examines how polychronicity tendency affects college students' in-class multitasking.

Learning engagement is important to successful learning. Research as identified a significant positive relationship exists between learning engagement and academic performance (Fredricks, Blumenfeld, & Paris, 2004; de Castro, Sridharan, Watty, & Safari, 2020). De Castro et al. (2020) found that among the college students surveyed, 90% reported texting in class and almost all (99.6%) have seen others doing so. The prevailing phenomenon of mobile device use in the school life of young people makes it difficult for them to stay engaged in classroom activities (Junco & Cotton, 2012; Carrier, Rosen, Cheever, & Lim, 2015; Mathew, 2015).

There is substantial evidence that cognitive workload increases due to increasing the difficulty of a task. Vahedi, Zannella, and Want (2019) found students would engage in ICT use when they feel that they would not miss any new class content, or when they feel bored or disengaged. Brouwer, Hogervorst, van Erp, Heffelaar, Zimmerman, and Oostenveld (2012) determined that workload increases with the difficulty level of an n-back task. Thus, this study investigated the relationship between perceived course difficulty level and in-class multitasking behavior.

In summary, this study explores plausible causes and motivations underlying in-class multitasking among the current cohort of university students. Variables including students' learning engagement, the psychological motivation underlying multitasking activities, polychronicity traits, and course difficulty levels are investigated.

Literature Review

Multitasking

Today's students are called the digital or Net generation. They are highly skilled and engaged in digital media and the Internet for personal, educational, and social purposes on a daily basis (Dahlstrom & Bichsel, 2014). They visit the Internet via their mobile computing devices and engaged in multitasking activities in class (Parry & le Roux, 2019; le Roux & Parry, 2017; Vahedi et al., 2019; Wood et al., 2012). Rosen, Carrier, and Cheever (2013) found that students spent on average less than 6 minutes on a task before switching to a media-based activity. This in-class multitasking has become a prevailing phenomenon in higher education and may be in part due to the comparatively loose classroom management in colleges. As the use of mobile computing devices has proliferated in academic settings, higher education institutions and their faculties face new challenges (Vahedi et al., 2019).

In-class use of mobile computing devices for multitasking can cause students to be inattentive and hinder learning performance. Multitasking is also the major cause of distraction. When people perform two or more tasks, their concentration is split, which is referred to as divided attention. Research has found that divided attention negatively affects the quality and quantity of information processing, encoding, storing and as a result, hinder learning outcomes (Tassone et al., 2017; Waite, Lindberg, Ernst, Bowman, & Levine, 2018; Kuznekoff, Munz, & Titsworth, 2015; Gingerich & Lineweaver, 2014).

Research on how multitasking impacts academic performance is well established (e.g., May & Elder, 2018; Mathew, 2015; Carrier et al., 2015). Sana, Weston, and Cepeda (2013) found that off-task multitasking behaviors in class hinder classroom learning for users and nearby peers. Van

der Schuur, Baumgartner, Sumter, and Valkenburg (2015) reviewed 56 studies to determine the relationship between media multitasking and three domains of youths' functioning: cognitive control, academic performance, and socioemotional functioning. They identified a small to moderate negative relationship between media multitasking and all three aforementioned variables. Judd and Kennedy (2011) collected data on 526 medical students' activities in 6619 sessions and analyzed their computer usage logs. They found that a majority engaged in multitasking behaviors. In addition, Kraushaar and Novak (2010) found that 70% of university students would use a laptop for non-academic purposes, and these account for 42% of the entire course time. Furthermore, Kessler (2011) interviewed 500 college students and noted that 73% admitted that they could not learn without using media, and 38% reported that they could not go more than 10 minutes without checking their media devices. The study suggested that the majority of college students are addicted to media use.

On the other hand, proponents of media use in the classroom suggest that multitasking can increase working efficiency. For example, Fried (2008) found that in-class laptop use in a large lecture course to access the Internet for academic purposes can increase students' learning motivation and engagement. Barak, Lipson, and Lerman (2006) conducted a study on classroom observation and revealed that strategic use of laptops can increase student interactions as well as student and teacher interactions. May and Elder (2018) suggested teachers should regard mobile computing devices as learning resources and should strategically combine teaching with technology. Elliott-Dorans (2018) argued that banning laptop use in the class may not help students' academic performance.

In summary, although most findings on in-class multitasking indicated a negative impact on learning, some studies identified a positive impact. Our study explores plausible causes and motivations underlying in-class multitasking among the current cohort of university students.

Multitasking Motivation

There is rich research on multitasking. Studies focus on the impact of multitasking on cognitive control (Parry & Le Roux, 2019), working performance, and efficiency (Sana et al., 2013; Kuznekoff et al., 2015; Waite et al., 2018). Nevertheless, relatively few studies examine factors that relate to in-class multitasking behaviors. Wang and Tchernev (2012) asserted that emotional needs (i.e., not feeling bored, entertainment, relaxation) and social needs (connecting to others) are factors underlying multitasking behaviors and fulfilling emotional needs is the strongest motivation to multitask. Ames (2013) established most students' multitasking behaviors are related to social activities. Kononova and Yuan (2017) studied the types of motivation to multitask and empirically classified eight categories, including passing time, relaxation, hedonic, socialization, and efficiency.

Summing up from Wang and Tchernev's (2012) and Kononova and Yuan's (2017) findings, the current study chooses social and emotional needs as indicators of multitasking motivation and proposes the following hypothesis:

H1: Multitasking motivation, including social and emotional needs, is positively related to multitasking behavior.

Polychronic Traits

Van der Schuur et al (2015) suggested individual differences a future research direction for multitasking studies. The current study therefore selected polychronic traits as the indicator of

individual differences and investigated its relationship with in-class multitasking. Hall (1959) first investigated and described polychronicity. The author described two contrasting ways of handling time: polychronic and monochronic. Polychronicity was originally studied at the cultural level, but research has turned to investigate it at the individual level (e.g., Schell & Conte, 2008) to describe individual differences in task switching and time usage. Monochronicity is defined as doing one thing at a time whereas polychronicity is described as doing many things in parallel. Conte and Jacobs (2003) suggested that polychronicity is relatively stable over time for individuals. Polychronicity is a construct that falls on a continuum, ranging from one end, extremely monochronic, to the other end, extremely polychronic. Lindquist and Kaufman-Scarborough (2007) developed a Polychronic-Monochronic Tendency Scale (PMTS) to measure an individual's preference for performing single or multiple tasks at a time. Grawitch and Barber (2013) found polychronicity is a significant predictor of multitasking performance. Kirchberg, Roe, and van Eerde (2015) confirmed a positive relationship between polychronicity and multitasking. Based on the above literature, this study proposes the following hypothesis:

H2: Polychronic traits is positively related to students' in-class multitasking.

Learning Engagement

Learning engagement is an important indicator of whether students are active during the lecture and includes three dimensions: behavioral, emotional, and cognitive engagement (Fredricks et al., 2004). Behavioral engagement refers to having positive behavior, such as active listening to the lecture. Emotional engagement refers to having an affective response, such as being inspired during class. Cognitive engagement focuses on psychological investment, such as using effective learning strategies. Vahedi et al. (2019) suggested that integrating ICTs into the classroom

may help to turn them from a means for distraction into a valuable tool for engaging students in active learning.

Fredricks et al. (2004) and de Castro et al. (2020) found learning engagement can positively predict students' learning outcomes. It is logical to assume that those who are less engaged in the learning activity in class will be more inclined to be distracted and involved in multitasking than their counterparts. We therefore propose the following hypothesis:

H3: Students' learning engagement negatively relates to students' multitasking.

Furthermore, students with polychronicity traits tend to switch between different tasks. They prefer to do more than one thing at the same time and are referred to as multitaskers. Jackson (2008) indicated that multitaskers usually skim the surface of the information of one event and move on to the next stream. They also suggested that multitaskers pay attention but only partially. Sanbomnatsu, Strayer, Medieros-Ward, and Watson (2013) demonstrated that undergraduates who reported themselves as high multitaskers had lower working memory capacity than their counterparts. The current study proposed that due to limited working memory capacity, media multitaskers with high polychronic traits will be less engaged in learning. We therefore formulated the following hypothesis:

H4: Polychronic traits are negatively related to students' learning engagement.

In addition, low course difficulty level is positively related to the degree of cognitive workload. A lower course difficulty level consuming lighter cognitive workload will likely spare students' energy to engage in in-class multitasking. Furthermore, a low course difficulty level

would probably lead to a learner's low intrinsic learning motivation and in distraction involving in-class multitasking. Therefore, this study proposes the following hypothesis:

H5: Low course difficulty level relates to increase in-class multitasking behavior.

Method

Data were collected via a cross-sectional online survey. The instruments were derived from the literature to ensure they have acceptable reliability and validity. Instruments were translated from English to Mandarin Chinese and three researchers checked the semantics and corrected possible semantic problems. A total of 40 college students participated in a pre-test to check the reliability and validity of the questionnaire. The finalized questionnaire was delivered through an online survey. Multitasking motivation, learning engagement, polychronic traits were measured on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Participants were asked to report their in-class multitasking frequency on a Likert-type scale ranging from 1 (never) to 5 (very often).

The multitasking behavior includes the following categories: social media, e-mail, YouTube, instant message, and Internet search/browsing. A total of seven items adapted from Kononova and Yuan (2017) were employed to measure motivations to multitask, with four and three items measuring emotional (hedonic) and social motivations, respectively. Higher scores indicate stronger multitasking motivation. A total of six items adapted from Reeve and Tseng's (2011) Learning Engagement Questionnaire were employed to measure students' emotional and behavioral learning engagement. Lastly, five items adapted from PMTS (Lindquist & Kaufman-Scarborough, 2007) were used to measure polychronic/monochronic traits, with higher scores indicating higher polychronic traits. The course difficulty level was measured by three items. A

sample item is "I find this course easy." The higher the value, the easier the course is perceived to be. Background variables including gender, grade levels, and academic college affiliations were also collected.

A total of 305 convenience samples were drawn from the Internet and 282 were valid. The descriptive statistics and correlation matrix are presented in Table 1. Values shown on the diagonal are the squared root of average variance extracted (AVE) (from .75 to .91) indicating an acceptable level of convergent validity. Values on the off-diagonal are correlation coefficients, indicating moderate correlations among variables. *t*-statistics results revealed no gender differences in all variables. The resulting model is presented in Figure 1.

Table 1

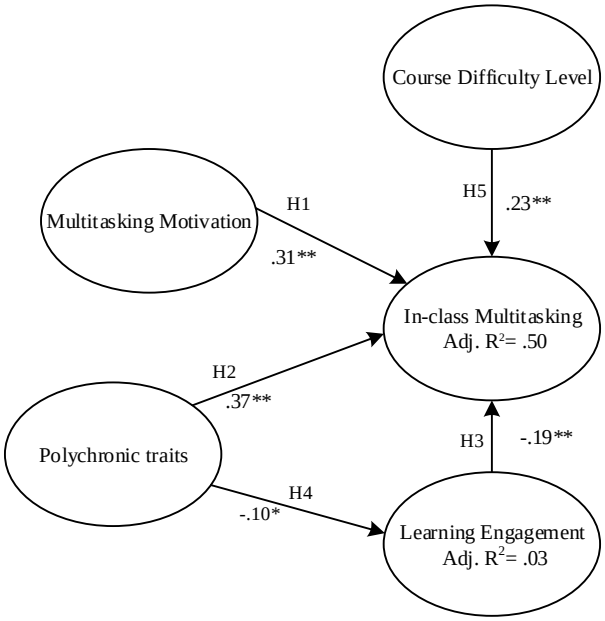
Descriptive Statistics and Correlation Matrix

	M	SD	1	2	3	4	5	6	7	8
1 Gender	1.49	.48	--							
2 In-class multitasking	14.22	4.01	.09	.75						
3 Multitasking motivation-emotional needs	14.35	4.36	.09	.54**	.90					
4 Multitasking motivation-social needs	10.31	2.43	.10	.42**	.81**	.84				
5 Multitasking motivation	24.66	6.50	.09	.52**	.96**	.92**	.84			
6 Learning engagement	21.22	5.23	.01	-.21**	-.13**	-.15**	-.14**	.81		
7 Course difficulty level	3.25	.91	.14*	.58**	.58**	.50**	.57**	-.12*	.78	
8 Polychronic traits	15.68	4.77	.11	.62**	.61**	.52**	.60**	-.10	.11	.90

Note. *: $p < .05$; **: $p < .01$. Gender: 1, male; 2, female.

Figure 1.

Multiple Regression Analysis Results



Note: * < .05, ** < .0

According to Table 1, there is a moderate to high correlation between polychronic traits and multitasking motivation (r = .60, p < .01), which confirmed that people are motivated in different ways based on personality traits. Multiple regression analysis established that 50% of the in-class multitasking variance can be explained by multitasking motivation, polychronic traits, learning engagement, and course difficulty level. Polychronic traits is the most significant predictor (β = .37, p < .00; H2 is supported), followed by multitasking motivation (β = .31, p < .00; H1 is

supported), course difficulty level (β = .23, p < .00; H5 is supported), and learning engagement (β = -.19, p < .00; H3 is supported). The significant negative relationship between polychronic traits and learning engagement (β = -.10, p < .1) confirmed H4. In conclusion, all five hypotheses are supported.

The significant positive relationship between students' multitasking motivation and in-class multitasking (H1) confirms that motivation is an effective predictor of behavior. The significant positive relationship between polychromic personality and in-class multitasking (H2) indicated that students who prefer to engage in multitasking in daily life would multitask more in class. Our results also confirmed that the lower the student's learning engagement, the more multitasking behaviors they would exhibit (H3). In addition, the significant negative relationship between polychronic traits and learning engagement implies that those who prefer to multitask would be less engaged in learning and H4 was confirmed. Lastly, the significant positive relationship between the course difficulty level and multitasking behaviors (H5) implies that the lower the course difficulty level, the more likely students engage in in-class multitasking behaviors.

Multiple regression was performed to investigate the effects of two types of multitasking motivation on multitasking. The adjusted R^2 of the regression model is .28 (F = 51.47; p < .00), indicating the statistical significance of the overall regression model. In addition, emotional needs was found to be significant (β = .57, p < .01) whereas social needs (β = .04, p > .05) was not. This indicates emotional needs is a comparatively more powerful driver in multitasking. It implies that students who scored high in emotional need, including entertainment and relaxation, tend to engage in more in-class multitasking behaviors.

Conclusions

This study focuses on students' in-class multitasking behavior, specifically, their usage of mobile devices during class. The purpose is to understand the role multitasking motivations, students' learning engagement, polychronic traits, and the course difficulty level played in student's in-class multitasking.

Our results indicate that students' multitasking motivation can positively predict their in-class multitasking. It implies that when students have stronger emotional needs in multitasking, they tend to multitask more during the lecture. Secondly, course difficulty level can positively predict students' multitasking. In other words, students sitting in classes they find easier tend to engage in more multitasking behavior than those in more difficult classes. Furthermore, polychronic traits can positively predict students' multitasking, which means that students who prefer to perform more than one task in daily life engage in more in-class multitasking. Finally, students' learning engagement can negatively predict multitasking behavior, which means those who score low in learning engagement tend to multitask more.

Implications and Recommendations for Future Research

Teachers in different educational institutions have established several regulations for use of mobile devices such as mobile phones, tablets, and laptops, in class to prevent students from multitasking. One major multitasking motivation is social connection. Hence, merely banning students from using mobile computing devices cannot solve their multitasking behavior. It is better to discuss the policies of in-class mobile device use with students so that they understand the pros and cons of multitasking in the class and to give them a chance to trade off themselves, rather than just merely banning it without further explanation. In addition, teachers should enhance student engagement by enriching course content, redesigning course material, and upgrading instructional

tools. Instructors should also understand and carefully adapt learning material to students' prior knowledge level to ensure the learning content is appropriately challenging and appealing to students. By doing so, this will help students' stay engaged in the class.

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