In-Class Laptop Use for Student Learning: A Pilot Study

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While laptops are considered an effective and critical learning tool, the effects of in-class laptop use on student learning remain controversial. Although many recent studies have found that in-class laptop use may produce negative effects in higher education, college students increasingly utilize their laptops in classrooms. To effectively integrate laptop use into lessons, we examined the effects of behavior strategies concerning in-class laptop use by undergraduate students. Throughout the course of a semester, participants were provided visual prompts, including "Red", "Yellow," and "Green" codes, in accordance with class activities. The students' attitudes and perspectives regarding the strategy were surveyed and discussed.

Introduction

Laptops are considered as an effective and critical learning tool, but recent research has found that in-class laptop use may produce negative effects in higher education. For example, college students demonstrated distraction and low academic performance when they were allowed to use laptops in class (Carter et al., 2017; Patterson & Patterson, 2017). As cognitive psychology suggests, multitasking has negative impacts. For instance, laptop use hinders classroom learning because running several programs simultaneously may increase academic distraction (Carrier et al., 2015; Sana et al., 2013). Furthermore, other students (i.e., neighboring peers who do not use their laptops to multitask) are distracted; and their academic performance, too, is negatively affected (Hall et al., 2020). Laptop use for notetaking is also ineffective for student learning compared to traditional methods such as handwriting (Crumb et al., 2022; Mueller & Oppenheimer, 2014).

However, despite the evidence cited above, laptops have become increasingly prevalent in higher education classrooms for several reasons. First, today's college students consume digital information quickly and easily by using computer devices, thus forcing instructors to keep pace with technological advancements (i.e., recognizing the value of technology and integrating it into pedagogy; Santos & Castro, 2021). Second, ownership of tablet PCs or laptops at colleges and universities has increased in the past years, and wireless internet is much

easier to access (Smith et al. 2009). Finally, laptop use can be beneficial for underrepresented groups such as students with disabilities, students of color, and first-generation college students (Gierdowski, 2019). Thus, it seems inevitable that instructors learn how to effectively integrate computer technology into their lessons and coursework.

In response to this challenge, several studies have examined pedagogical approaches to effective use of in-class laptops. For example, within a structured class for laptop use designed by Kay and Lauricella (2011), college students spent more time on academic activities (e.g., note-taking) and less time on non-academic activities (e.g., emails, instant messages, and games). Amelink et al. (2012) suggested including self-regulated learning behaviors to incorporate learning technology into lessons and coursework. Computer-assisted learning can be positive only when students regulate their own learning (Azevedo, 2005). To minimize class disruptions and maximize the effectiveness of in-class laptop use, Efaw et al. (2004) suggested establishing class policies such as No Outside Work in Class and Screens Down During Movies. All these studies indicate that instructors' guidelines for college students may be necessary to effectively integrate in-class laptop use into classrooms. Thus, researchers need to evaluate specific strategies for effective in-class laptop use (Kay & Lauricella, 2011).

This manuscript describes a pilot study that we conducted to examine the effects of visual prompts for in-class laptop use among college students. In this pilot study, we have provided visual prompts as self-management tools. Visual prompts are visual cues or assistance which provide information to increase the likelihood that students will choose correct responses or desired behaviors (Alberto & Troutman, 2013). Many educators utilize such prompts as self-management tools (Hughes et al., 2000; Lancioni & O'Reilly, 2001; Rodi & Hughes, 2000) because they are both simple and easy to implement in class settings. Although visual prompts are a common strategy for managing behaviors in K-12 settings, limited research has been performed regarding their use in higher education settings. The following research questions guided this study: (a) what course structure integrates in-class laptop activities? (b) what are the effects of a color prompt strategy on in-class laptop use by college students?

Method

Participants and Setting

All research activities (e.g., collecting data, delivering intervention) were conducted at one school of higher education. Students enrolled in one session of the Introduction to Special Education course were invited to participate in this study. The course provides an overview of exceptionalities (e.g., intellectual disabilities, learning disabilities, emotional disturbance, ADHD, blindness/low vision, hard of hearing/deafness, etc.) and their associated educational, legal, and social issues. The course is open to all college students who may be engaging with others who have a disability, helping them to increase their understanding of diversity, equity, and inclusion. Students enrolled in the course are mostly freshmen or sophomores, and they come from a variety of programs (e.g., Elementary Education, Middle-grade Education, Deaf and Hard of Hearing, Special Education, Child and Family Studies, English, History, Spanish, Music, Biology, Chemistry, Math, Physics, etc.). The course was designed in an on-campus format, so students' in-person attendance was required in this study.

A total of 23 students in one class participated in the study, but 19 students completed the survey. Of the 19 respondents, 14 students identified as "female", and five of the participants identified as "male." Of the 19 students, 11 participants indicated they were pursuing or planning a K-12 teaching career, while eight students indicated pursuit of other careers.

Color Prompts

The color prompts included "Red", "Yellow", and "Green" codes which were assigned to certain class activities. Specifically, when students were given the green prompt, they used their laptops for student-centered and computer-assisted activities (i.e., group discussion & activities, informal online assessment, and hands-on activities involving laptops). Given the yellow prompt, students used their laptops for notetaking during instructor-centered presentations (with no internet use allowed). Given the red prompt, students were requested to close their laptops for activities not requiring laptop use (e.g., self-evaluation worksheets, watching topic-related videos as a whole group, experiential learning activities).

Procedure

The author's department obtained approval from the University's Institutional Review Board (IRB) to conduct an ongoing assessment of the impact of the course

during regular class instruction. All research activities were conducted during the Spring 2022 semester (January to May 2022). As an instructor, the first author delivered all instructions and provided color prompts. During the first class meeting, the instructor explained the meaning of the color prompts by presenting sample slides and activities. Throughout the semester, the instructor presented instructional slides which were visible on the screen at the front of the classroom. Each slide included a small, circular color prompt in the top right corner. Except in the case of two guest lectures, participants were always provided color prompts throughout the semester. All participants clearly noticed their presence and recognized their meaning. At the end of the final class, the instructor provided a survey link and left the classroom. Using the survey link, the participants completed their surveys anonymously with no instructor present. The survey was not required, and there was neither compensation nor penalty for survey completion.

Survey

The survey contained a total of 14 questions. The first two items were demographic questions (i.e., gender, pursuing K-12 teaching career). The next 10 questions were Likert-type scale response questions which were adapted from previous research and modified for the purpose of this study (Awwad & Ayesh, 2013). Specifically, four questions assessed participants' perspectives toward the use of laptops, and the next four questions asked about the color prompt strategies. The last two items asked students about non-academic activities.

In addition to the Likert-type scale questions, participants were asked two open-ended questions regarding the color prompt strategies (i.e., "Why [or not] did the color prompt help you to use the laptop effectively in class?", "Specify any thoughts on the color prompts strategy [e.g., concerns, strengths, or needs for improvement]").

Treatment Fidelity

The second author (graduate assistant) presented all course classes. She checked to be certain that the color prompts were visible on each slide and confirmed that the color prompts were visible 100% of the time in all classes. She also recorded the amount of time provided under each color prompt to determine whether the time spent on activities categorized under each color code was equally distributed. Except for guest lectures and assessments, the class spent 412 minutes under the Green code, 490 minutes under the Yellow code, and 383 minutes under the Red code.

Results

To the questions assessing participants' perspectives toward the use of laptops, most students agreed with the benefits of laptop use. Specifically, of the 19 respondents, the majority of students (n = 17) agreed somewhat or strongly agreed that they understood the lecture better and interacted more effectively with the instructor when they used their laptops in class (89%). Additionally, 18 students (95%) responded they could perform their class work more efficiently when accessing a laptop, 16 students (84%) responded they were more concentrated or focused on lectures, and 15 students responded they could take notes better (79%).

Regarding the color prompts, 17 students (89%) agreed that the color prompts helped them to use their laptops more effectively in class. Most students also reported making appropriate use of their laptops when given color prompts. Specifically, 89% of students reported that they did not use their laptops when given the red prompt; 79% of students reported that they used laptops only for notetaking when given the yellow prompt; and all students reported they used their laptops only for academic purposes when given the green prompt. In answer to the question assessing students' non-academic activities, seven students (37%) responded that they made some use of the laptop for non-academic activities such as chatting, checking emails, or playing games in class. To the question asking about the instructor's authority over their laptop use, 63% of students (n = 12) agreed that the instructor had authority to control the use of laptops during class time. All Likert-scale questions and student responses are shown in Table 1.

In addition to the Likert-scale questions, students responded to two open-ended questions. The first question asked students to describe the reason why the color prompts helped (or did not help). The majority of students (n=17) reported the color prompts were effective and beneficial for their learning. Eleven students described the benefits gained from clear direction regarding appropriate laptop use (e.g., "It worked because it let me know when I should be on my laptop and when I shouldn't be", "Yes, the color prompt gave me instruction for what level of laptop use is required and that ultimately helped me"). Three students reported that the strategy helped them focus on class ("The color prompt was beneficial to use in class as it would let me know when I had to pay attention, to take notes, and when I had to solely focus on the lesson with my laptop away", "It allowed me to be able to focus on my classmates more during group work"). While most students reported positive effects, two students responded that the color prompts did not help them because they were requested to open and close their laptops

(e.g., “Not really, I didn't like closing my laptop for the videos because the wifi here isn't the best so I would have problems trying to connect it back to the wifi when I had to close my laptop”).

The second open-ended question asked students for their thoughts regarding the color prompt strategy. Eight students reported that the color prompts were a good idea for in-class laptop use. Four students mentioned the efficiency of the color prompts (e.g., “I think the color prompt strategy is very efficient and useful in its current form”). Two students suggested two color prompts instead of three (e.g., “Maybe change the colors to help with students with red-green color deficiency”, “I would prefer either just all laptop use or none at all”). One student described a decrease in confusion (e.g., “I really liked the color prompt, it decreased confusion and anxiety for me during class.”)

Discussion

In the present study, we utilized color prompts for in-class laptop use for college students and surveyed their perspectives on the use of laptops and the color prompt strategy. Most participants (89%) showed a positive attitude toward adopting the color prompts in class, writing positive comments in response to the open-ended questions. The positive outcome from the survey is consistent with the previous literatures supporting the necessity of the class strategy for in-class laptop use (Amelink et al., 2012; Efaw et al., 2004; Kay & Lauricella, 2011)

However, although they considered the color prompts to be of benefit, some students did not agree that instructors had the authority to control their use of laptops during class time. Students also reported appropriate use of their laptops given the three color prompts, but seven students (37%) reported their experience of inappropriate laptop use in class (e.g., chatting, checking emails, or playing games). In other words, even though students mostly followed the directions given color prompts, they still did non-academic activities in class.

Limitations and Future Research Directions

As a pilot study, the limitations inherent in the research design are worth noting. Specifically, no control group was assigned in this study, so no comparative study could be conducted. In this study, only one group of participants responded to only one survey at the end of the semester. Future research may employ robust study design such as randomized controlled trials to measure the effectiveness of the color-prompts interventions at higher education.

Another limitation is the small sample size. There were 23 students, but only 19 completed the survey. Due to the small sample size, this study performed a descriptive analysis only; future research may need to collect enough samples to determine statistical significance.

Furthermore, the study recruited participants from one course, meaning the participants were not randomly selected. Because the researcher was an instructor of the course, students were not voluntary participants. Although completion of the survey was not a requirement of the course (i.e., it did not affect students' grades), the question remains of whether students were affected by the researcher. To minimize the potential extraneous effects, future researchers may not be involved in the courses directly.

This study also assessed students' perspectives rather than their academic performance. In other words, we do not have evidence of participants' actual learning. Although most students reported positive effects and benefits for their learning, it is unclear whether the color-prompted in-class laptop use contributed to their academic performance. In future studies, it may be worth to measure students academic achievement in addition to a self-evaluation survey.

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Table 1. In-Class Laptop Activities Across Topics

Module	Topics Covered	Laptop Use Activity	Tech Used
1	Course Introduction People-first Language	Syllabus hunting	Kahoot!
2	Exceptionality & Special Education	Review Case Study	Blooket Google doc
3	Current Issues in Special Education	Discussion –Inclusion UDL Project	Google doc Padlet
4	Multicultural Aspects of Special Education	ELL vs. LD; Effective instructional strategies for CLD	Group Wiki Padlet
5	Working with Parents and Families/ Collaboration	Review & developing collaborative partnerships	Blooket Google Docs
6	Intellectual Disabilities	Developing a lesson using task analysis	Google Slides
7	Learning Disabilities	Academic support; computer-assisted intervention	iPad & academic apps, Padlet
8	ADHD	Designing interventions for a child with ADHD	Google Docs
9	Emotional and Behavioral Disabilities	Developing a behavior intervention plan	Google Docs
10	Autism Spectrum Disorders	Using communication apps (Proloquo2Go, Go Talk, etc.)	iPad & apps
11	Communication Disorders	Identifying types of communication disorders	Google Jamboard
12	Deaf or Hard of Hearing	Online hearing test	Headsets
13	Blindness or Low Vision	Using apps for blindness	iPad & apps
14	Multiple & Severe (TBI, Deaf-Blindness)	Case Study	Google Docs

Module	Topics Covered	Laptop Use Activity	Tech Used
15	Physical Disabilities & Other Health Impairment (seizure, cerebral palsy)	Case Study	Google Docs

Table 2. Students Responses to Likert-Scale Questions

Question	Strongly Agree	Somewhat Agree	Neither Agree Nor Disagree	Somewhat Disagree	Strongly Disagree
I could understand the lecture better and interact more effectively with the instructor when I use the laptop in class.	12	5	1	1	0
I am able to do my classwork more efficiently when I have access to a laptop.	14	4	1	0	0
I was more concentrated and focused when I can view the lecture notes on my laptop.	12	4	2	0	1
I take better notes when I have access to a laptop.	14	1	4	0	0
Color prompts (Red, Yellow, and Green) on the slides helped me to use the laptop effectively in class.	13	4	1	1	0
Given the Red color, I have not used the laptop at all.	11	6	2	0	0
Given the yellow color, I have used my laptop for note-taking only (no internet use).	11	4	4	0	0
Given the Green color, I have used my laptop for academic purposes only, following the instructor's directions.	16	3	0	0	0
During the class, I have had some use of the laptop for chatting, checking my e-mail, or playing games.	3	4	1	5	6
I think instructors should have the authority to control the use of laptops during class time.	9	3	3	2	2