

An Examination of Laptop-Based Off-Task Behaviours
in Secondary School Classrooms

by

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Abstract

The purpose of this study was to examine factors that affect secondary school students' off-task behaviours in laptop-based classrooms. Quantitative and qualitative data were collected from 224 secondary school students from four private schools in Canada (156 males, 65 females, 3 no response). The perceived advantages of laptop use in the classroom were access to information online, the use of technology during class, and the use of specific programs and applications during course work. The perceived disadvantages of laptop use in the classroom by students were being distracted by peers and engaged in off-task behaviours. The factors that appeared to influence off-task laptop-based activities were subject area, instructional method, and gender. Gender differences were found in students' on-task activities and off-task activities. Females reported engaging in on-task activities significantly more than males. Females also engaged significantly more frequently in social media compared to males, whereas males played games significantly more often than females. More in-depth research, perhaps in the form of interviews and discussion groups, needs to be conducted on how subject area and instructional method might influence secondary school students' off-task behaviours.

Keywords: laptop; off-task behaviours; secondary school; distraction; gender differences

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1. Introduction

1.1 Overview

Ubiquitous access to laptops is becoming more prevalent in primary, secondary and tertiary school systems and represents a potentially important resource for education (Hwang, Tsai, & Yang, 2008; Kay, 2007; 2008). Extensive research on student use of laptops in the classroom has been conducted in higher education (e.g., Fang, 2009; Gaudreau, Miranda, & Gareau, 2014; Glenn, 2010; Hu, 2007; Junco, 2012a, 2012b; Young, 2006). Advantages of laptop use included increased student performance, better communication among students and teachers, and improved learning experiences (Aguilar-Roca, Williams, & O'Dowd, 2014; Awwad & Ayesh, 2013; Barak, Lipson, & Lerman, 2006; Kay, 2011; Kay & Lauricella, 2011a; Ragan, Jennings, Massey, & Doolittle, 2014). Challenges of using laptops in class included distractions from peers and device, and the implementation and management of devices (e.g., Bowman, Levine, Waite, & Gendron, 2009; Junco, 2012a, 2012b; Rosen, Carrier, & Cheeva, 2013). In addition, a number of studies have examined off-task behaviours and academic performance (e.g., Aguilar-Roca et al., 2012; Efav, Hampton, Martinez, & Smith, 2004; Oliveira, 2013).

To date, while several researchers have focused on secondary school students' on- and off-task laptop behaviours (e.g., Colley & Comber, 2003; Grimes & Warschauer, 2008; Mouza, Cavalier & Nadolny, 2008; Papastergiou & Solomonidou, 2005; Tallvid, Lundin, Svensson, & Lindström, 2015), the majority of research on student laptop use in classroom has concentrated on higher education. Research conducted at the secondary level did not incorporate students' own perceptions of laptop use in class, nor did the studies focus on

multiple indices of student learning with laptops (e.g. off-task behaviours and distractions, and perceived advantages). However, ubiquitous access to laptops by secondary students has grown significantly as more schools are moving toward the use of laptops and Bring Your Own Device (BYOD) programs (Hwang et al., 2008). Thus, the purpose of this study is to examine the use of laptops in secondary school environments, focusing on perceived advantages, specific on and off-task behaviours, factors that influence these behaviours, and suggestions for maximizing advantages and minimizing distractions.

A number of gaps exist in the research on investigating the use of laptops in the classroom. First, although thorough research on the advantages and challenges of using laptops in the classroom has been examined in higher education (Fried, 2008; Gaudreau et al., 2014; Kay & Lauricella, 2011a; 2014; Kraushaar & Novak, 2010; Lindroth & Bergquist, 2010), secondary school students' perspectives have not been explored. Second, while research has been conducted on the effectiveness and advantages of integrating technology into the secondary school classroom and teaching (see for example, Bonifaz & Zucker, 2004; Efaw et al., 2004; Hu, 2007; Oliveira, 2013), limited research has been conducted on the actual activities that the secondary students engage in during class time. Third, even though the specific tasks that higher education students engage in on their devices has been explored (Gaudreau et al., 2014; Judd & Kennedy, 2011; Junco, 2012a, 2012b; Ragan et al., 2014), the factors that influence the students' desire to go off-task in the first place has not been researched. Finally, though gender differences in respect to attitude, competence, and use has been researched extensively (Colley & Comber, 2003; Kay, 2007, 2008; Kay & Lauricella, 2011b; Rideout, Foehr, & Roberts, 2010), these differences have not been examined with respect to laptop use in secondary school classrooms.

1.2 Research Goal

The primary research goal of this study was to explore and analyze off-task laptop-based activities of secondary school students in the classrooms. Four key questions were addressed:

1. What do secondary school students see as the perceived advantages of having a laptop in class?
2. What specific off-task laptop-based activities do secondary school students engage in during class time?
3. What factors influence secondary school students' off-task behaviours during class time?
4. What suggestions do secondary school students have for maximizing advantages and minimizing distractions when using laptops in the classroom?

2. Literature Review

2.1 Overview

A comprehensive review of the literature from 2000 to 2015 on the use of laptops in the classroom revealed four key themes including advantages of using laptops, challenges of using laptops, off-task activities, and factors influencing off-task activities. Before discussing each of these themes, I will operationally define on-task, off-task, and multitasking activities.

2.1.1 Key Definitions

Based on a review of the literature, the following definitions will be used for on-task, off-task, and multitasking. **On-task** activities are directly related to the task or instruction given by the teacher during class (e.g., taking notes during a lecture, looking up a definition or resource) (Ragan et al., 2014; Wilson & Korn, 2007). **Off-task** activities are not directly related to the task or instruction given by the teacher during class (e.g., instant messaging (IM), gaming, social network sites, and completing work for other classes would be considered off-task activities) (Gerow, Galluch, & Thatcher, 2010; Taneja, Fiore, & Fischer, 2015). **Multitasking** can be defined as the interruption of an activity by switching back and forth between tasks (e.g., taking notes then checking Facebook, then responding to email) (Abaté, 2008; Dzubak, 2008).

2.2 Advantages of Using Laptops in the Classroom

Many of today's secondary school students do not know of a life without the use of digital technology (Lord, 2014). The plethora of technology available to students infiltrates many facets of their daily lives including school (Cooper, 2006; Mouza et al., 2008). In

recent years a number of schools across the world have adopted 1:1 laptop programs where a school requires each student to have a laptop or similar device with them in class (Penuel, 2006; Tallvid et al., 2015). A review of the research revealed at least five key advantages of using laptops in the classroom including improved student engagement, increased student motivation, better communication and interaction, change in learning in the classroom and improved academic performance.

First, a number of researchers have observed increases in student engagement when laptops are used in the class. Efaw et al. (2004) reported that classroom laptop use stimulated undergraduate students to work harder and produce higher quality work. Smyser (2010), an Assistant Academic Specialist and Lab Director at Northeastern University in the United States, allowed students in her class to bring laptops and found that student engagement in the lesson dramatically increased and student absences plunged. A number of studies revealed that higher education students who used laptops in the class had greater focus and attention (Awwad & Ayesh, 2013; Kay & Lauricella, 2011c; Kraushaar & Novak, 2010; Samson, 2010).

Second, increased motivation to learn when laptops were used in class by students was also noted by several researchers. Students who used laptops have been found to be more motivated during lessons and attend class more consistently (Efaw et al., 2004; Gaudreau et al., 2014). Grimes and Warschauer (2008) reported that 84% of teachers believed the use of laptops raised middle school student interests, and 79% felt that students worked harder at their studies.

Third, there is some evidence to suggest that the use of laptops in the classrooms can improve communication and interaction among students (Fitch, 2004; Kay &

Lauricella, 2014; Lindroth & Bergquist, 2010; Samson, 2010; Stephens, 2005). Fitch (2004) observed improved interaction among undergraduate students and instructors when technology was used in the classroom. Samson (2010) noted that, as a result of the use of LectureTools (a suite of programs design for larger classes), higher education students were more likely to ask questions during class and engage with the instructor more often. Stephens (2005) noted that the use of laptops in higher education labs lead to a better quality of interaction between the instructor and students. Similarly, Lindroth and Bergquist (2010) reported improved peer interactions and communications among undergraduate students. Kay and Lauricella (2014) also reported students in higher education who used laptops in the classroom benefited from improved communication with their peers, as well as the ability to instant message their peers for clarification of information taught in the class.

Fourth, research suggested that learning is different or changes when laptops are used in the classroom. Ragan et al. (2014) found that undergraduate students spent 34% of their time on their laptops taking notes. This increase in note taking by higher education students was similarly observed by other researchers (Aguilar-Roca et al., 2012; Awwad & Ayesh, 2013; Gaudreau et al., 2014; Kay & Lauricella, 2011c; Lindroth & Bergquist, 2010; Skolnik & Puzo, 2008). Rodrigo (2011) observed that the main advantage of using digital technology in higher education classrooms was the opportunity for students to engage in new and creative ways of learning (use of mobile technology and apps that make use of text and visual materials). Similarly, Barak et al. (2006) reported an advantage for students using subject-specific software during class, and Kay and Lauricella (2011c) reported benefits to learning when online surveys, videos, and case studies were engaged in by

students on their device. Grimes and Warschauer (2008) reported that the use of laptops in the classroom has contributed to an increase in self-pacing of learning. Penuel (2006), in his review of 1:1 laptop programs, reported increased productivity by students in the classroom. Mouza et al. (2008) found using laptops in secondary schools allowed for teachers to have a greater understanding learning styles and needs, along with providing a breadth of technological skills for students to learn.

Finally, one significant impact from the advantages of using laptops in class is in improved academic performance. Gaudreau et al. (2014) reported that use of laptops in class leads to greater academic success for undergraduate students. Efaw et al. (2004) also noted that higher education students who used laptops during class scored considerably higher on their examinations compared to students who used more traditional methods such as note-taking with pen or pencil. Smyser (2010) added that undergraduate student laptop use improved the grades of students during in-class activities.

Although not all studies found advantages with laptop use in class, those that did explained that benefits occurred through the use of a structured system. Rodrigo (2011) and Ragan et al. (2014) both argued that providing a structured environment for integrating laptops is required to ensure the pursuit of on-task activities. Kay and Lauricella's (2011c) research indicated that use of a structured approach (integrating laptops/digital devices into the course and lesson) resulted in higher student participation in on-task activities and behaviours (note taking and other similar lesson-related activities).

Conversely, Hu (2007) outlined the case of a Liverpool secondary school that found laptops did not have any impact on student performance or achievement. Similarly, some

researchers have also reported that student performance is not affected when laptop-free zones are implemented in classrooms (i.e. specified sections of the classroom where students cannot use laptops/digital devices). Researchers also report that student performance is not affected with student engagement in specific activities such as Facebook or IM (Aguilar-Roca et al., 2012; Junco, 2012a).

2.3 Challenges of Using Laptops in the Classroom

2.3.1 Device and Peer Distraction

One of the challenges of including laptops in the classroom is the possible distraction that it poses to students. Lord (2004) cited student distraction as one of the main challenges that teachers face in higher education classrooms. A review of the literature revealed two categories of distractions involving the device itself and peers.

The first challenge with devices in the classroom is distraction posed by the device itself. A number of researchers have observed that some inherent features of laptops are distracting (Aguilar-Roca et al., 2012; Fried, 2008; Griffith & Roberts, 2015; Judd & Kennedy, 2010). Aguilar-Roca et al. (2012), in their study of undergraduate students, explained that the source of this distraction was often the sound produced from keyboard keys tapping. Fang (2009) explained that phones, for example, were distracting in class because of the sounds from ringtones and vibrations. Judd and Kennedy (2010) explained that the capabilities of modern technology (access to internet and programs) may even facilitate student engagement in off-task activities (email, web surfing, IM). Similarly, Griffith and Roberts (2015) argued, in their study of undergraduate students, that the “world in their hands” ability of laptop use by students could open the door to off-task behaviours by students. Additionally, Fried (2008) reported that the inherent distracting

nature of laptops (the clicking of keys, light emitted from the screen) has been linked to a decrease in academic performance and speed of completion of work.

Another challenge associated with laptop use in the classroom is the distraction that it can pose to other students in the classroom. When a student engages in any type of activity on their laptop/digital device, it has the potential to distract not only the user themselves but also nearby students. Jassawalla, Sashittal, and Malshe (2009) reported that undergraduate students were distracted when they could see other students in the classroom engage in off-task activities or cyber-slacking. Aguilar-Roca et al. (2012) added that student curiosity about what other students were doing on their laptops was a distraction. Gerow et al. (2010) explained that, as a result of what their peers might be doing on their laptop, other students might find it difficult to focus on their academics as the distracting activities of their peers are in competition with the lesson of the instructor. Bowman et al. (2010) added that the level of distraction experienced by an individual can be dependent on the amount of attention and focus required by the source of the distraction.

2.3.2 Implementation and Management

The implementation and management of using laptops in the classroom can also present a challenge. There are four key issues that have been reported by researchers: unstructured use, educational and entertainment tools, restriction, and banning.

The unstructured use of laptops in the classroom can be defined as a teacher opting not to directly or meaningfully incorporate laptops into the lesson (Fried, 2008; Kay & Lauricella, 2011c; Ragan et al., 2014). Fried (2008) explained that the distraction caused by laptops can occur as a result of use in an unstructured environment. In her study of

laptop use in higher education students, Fried (2008) argued that students need to be informed by instructors of the possible distractions posed by using laptops in class. Ragan et al. (2014) claimed that free use of laptops by students during class provide them an unlimited source of distractions. Kay and Lauricella (2011c) similarly argued that instructors who choose to ignore laptop integration in class can lead to students to decide for themselves how they will use laptops during class time.

Another challenge with using laptops in the classroom is the dichotomy between using a tool for both education and entertainment (Bowman et al., 2009; Fewkes & McCabe, 2012). American Psychological Association (2009) stated that the challenge for educators in the classroom is the “distinction between entertainment and true intellectual engagement” (p. 456). This distinction is heavily ingrained with the idea of whether to allow technology into the classroom and to decide what impact it could have. Fewkes and McCabe (2012), who conducted a study on the use of Facebook as an educational tool in a post-secondary classroom, found that in order for Facebook to be implemented as a learning tool in the classroom, teachers needed to have an understanding of how students were using social media so that they could effectively implement its use in the classroom. Similarly, Contreras-Castillo, Pérez-Fragoso, and Favela (2006) reported that higher education students would engage in social networking for social purposes even when the course instructor designated social networking as part of the course.

A challenge with implementing laptops in class is restricting laptop use. Restriction, in this context, means allowing student use of laptops in the classroom but limiting the frequency of use (Grimes & Warschauer, 2008; Ragan et al., 2014; Skiba, 2011). For example, Ragan et al. (2014) argued that allowing for unfettered access to laptops affords

students the opportunity for an infinite source of distractions. Grimes and Warschauer (2008) discussed student input on improving rules governing laptop/digital devices in the classroom and remarked that some students requested stronger administrative control of device use so that their classmates would not play games, or distract them. Skiba (2011) advocated for leveraging laptop use in the classroom as an alternative to banning it all together.

A final challenge faced with the implementation and management of laptops in the classroom is outright banning them from class. Some teachers are banning the use of laptops and devices in their classroom because of student off-task activities and distraction from the lesson at hand (Lord, 2004; Parry, 2011; Skiba, 2011). For example, Fang (2009) cited a law school's decision to ban laptops in the classroom as a means of ensuring that students would be less distracted by their peers and more engaged in the lesson. However, a complete ban on the use of laptops in the classroom would appear to be counter-productive given the research that espouses the advantages behind laptop use and learning (Fang, 2009; Lord, 2004; Parry, 2011; Skiba, 2011).

There are some researchers, though, who argue that we are beyond the point of no return, that technology has become so ingrained in our culture that we need to embrace it rather than ban it (Abaté, 2008; Skiba, 2011). Some researchers maintain that banning the use of technology could also be seen as not trusting students to be accountable for their learning (Fang, 2009; Kay & Lauricella, 2011c; Young, 2006).

2.4 Off-Task Laptop-Based Activities

2.4.1 Type of Activities

Researchers have reported that students engage in a variety of off-task behaviours on their laptops during class. Ragan et al. (2014) observed that higher education students would spend approximately two-thirds of the class time engaging in off-task behaviours on their laptops. Jacobsen and Forste (2011) similarly reported that 62% of higher education students in their study used their devices for off-task activities while in class or while working on other academically related tasks (homework, working on assignments). Skolnik and Puzo (2008) reported that over half of all the higher education students in their study used their laptops for non-academically related activities (email, surfing the web, and gaming). A review of the literature revealed four categories of off-task activities on laptops: communication, searching for information, entertainment, and illicit activities (Aguilar-Roca et al., 2012; Awwad, Ayesh, & Awwad, 2013; Barak et al., 2006; Fried, 2008; Hu, 2007; Kay & Lauricella, 2014; Ragan et al., 2014; Turkle, 2008). Each of these will be discussed in turn.

A number of researchers have found that students engage in communication-based off-task activities including social media sites and email while in class (Aguilar-Roca et al., 2012; Awwad et al., 2013; Barak et al., 2006; Fried, 2008; Kay & Lauricella, 2014). Awwad et al. (2013) surveyed female engineering, science, and IT university students' laptop activities during class and found that a majority were frequently using their device for social media and email. Aguilar-Roca et al. (2012), Barak et al. (2006) and Kay & Lauricella (2014) reported that higher education students used social media during class time. Fried (2008) also reported on student engagement in instant messaging and email during class

time. Turkle (2008) argued that the idea of sending out an email during class is so commonplace now, that students no longer feel the need to attempt to conceal their off-task activity.

Researchers also reported students engaging in off-task activities by using their laptops to search for information during class (Fried, 2008; Kay & Lauricella, 2014; Ragan et al., 2014). Fried (2008) and Kay and Lauricella (2014) both reported that higher education students would engage in the off-task activity of surfing the web during class time. Ragan et al. (2014) added that undergraduate students surfing the web for personal reasons accounted for almost 40% of all off-task activities.

Several researchers reported students using their laptops to play games during class (Awwad et al., 2013; Barak et al., 2006; Fried, 2008; Hu, 2007; Kay & Lauricella, 2014; Tallvid et al., 2015). The study by Kay and Lauricella (2014) revealed that higher education students would sometimes play games on their laptop during class. Awwad et al. (2013), Barak et al. (2006) and Fried (2008) likewise found similar results of higher education students playing games on their laptops. Hu (2007) cited incidents of secondary school students using their laptops during class to play games. Tallvid et al. (2015) indicated that 30-50% of junior high school students (grades 7-9) reported “on occasion or daily” playing games on their laptop in class.

Lastly, some researchers reported that students would engage in illicit off-task activities on their laptop during class (Hu, 2007; Kay & Lauricella, 2011a). Hu (2007) reported that some secondary school students engaged in illicit activities such as cheating on tests (sending answers, passing notes), downloading pornography, and hacking into the servers of nearby businesses. Similarly, Kay and Lauricella (2011a), in their study of higher

education students, reported that 16% of students indicated that they were distracted or very distracted by seeing pornography on another student's device in class.

The decision of a student to engage in off-task activities may be partially explained by Csikszentmihalyi's (1990) Flow Theory. Flow Theory can be described as a psychological state when an individual is so engrossed in a positive experience that they experience "flow" – sometimes referred to as "being in the zone" (Csikszentmihalyi, 1990). Rosen et al. (2013) explained in their research on laptop use and off-task behaviour that if a strong positive experience occurs when someone uses media, a person would be more inclined to stay in the positive experience to the point of ignoring attention in other activities. Flow Theory then may offer a possible explanation why students remain engaged in off-task activities rather than in on-task activities with the lesson at hand.

2.4.2 Multitasking

Colloquially, multitasking is considered as a desirable skill – an ability to accomplish several tasks at once (Abaté, 2008). However, Abaté (2008) explained that multitasking involves engaging in multiple activities by interrupting one activity to shift to another activity. The tasks though are not being performed simultaneously and ultimately the efficiency of each task, when they are classified as cognitive, is reduced. A review of the literature revealed two key themes of multitasking and laptop use in the classroom: theories explaining multitasking and the frequency of multitasking behaviours.

Multitasking had been explored by a number of researchers in order to understand what occurs in the brain when an individual engages in multitasking behaviours (Burak, 2012; Carrier, Cheever, Rosen, Benitez, & Chang, 2008; Paas, Renkl, & Sweller, 2003; Pashler, 1998; Samson, 2010). Pashler (1994) argued that maintaining focus and attention

on the task at hand, rather than engaging in multitasking activities can have a positive effect on working memory capacity in addition to enhancing motivation and attention in class. Similarly, Burak (2012) explained that multitasking causes a cognitive bottleneck, which results in time loss. This time-loss impedes the successful and efficient completion of tasks as the brain attempts to decide which task takes priority. This bottleneck could lead to students deciding to actively choose to engage in multitasking or task switching over participating in a single activity – whether on-task or off-task (Carrier et al., 2008). However, Samson's (2010) study of undergraduate students noted that students believed that multitasking was not a hindrance to their engagement or concentration in the lesson at hand.

Several researchers have explored the mechanics of multitasking and the associated cognitive load. When a student multitasks, there is a decrease in performance associated with the time it takes to engage in each of the tasks (Bowman et al., 2010; Judd & Kennedy, 2010; Kraushaar & Novak, 2010; Ophir, Nass, Wagner, & Posner, 2009).

Abaté (2008) explained that the time lost during the period when the brain is adjusting itself between tasks increases depending on the complexity and novelty of the task. Similarly, Rubenstein, Meyer, and Evans (2001) conducted a study (general population) that also found that the complexity of the task can increase the time lost when the brain switches between tasks.

The frequency of student multitasking behaviour on laptops during class had been studied by a number of researchers (Bowman et al., 2010; Burak, 2012; Judd & Kennedy, 2011; Kraushaar & Novak, 2010; Ragan et al., 2014; Rideout et al., 2010; Sana, Weston, & Cepeda, 2013). Researchers have identified a number of instances where multitasking

occurs in the classroom. Rideout et al. (2010) claimed that the “computer is the epicenter of media multitasking,” and reported that 7th to 12th-grade students spent 40% of their time engaged in at least one other task while on their computer. Bowman et al. (2010) reported higher education students’ multitasking behaviours while using instant messaging to lead to a decrease in academic performance. Burak (2012) noted multitasking to be prevalent among higher education students and cited specific activities including Facebook and instant messaging. High frequency of multitasking by higher education students was also reported by Kraushaar and Novak (2010), Ragan et al. (2014), and Sana et al. (2013). However, Judd and Kennedy’s (2011) results indicated that multitasking does not occur as frequently as cited in previous studies. This disparity may have been as a result of the participants being first and second-year medical students who may be more focused on studying.

In summary, most research suggests that engaging in off-task activities (of which multitasking is a subset) can be a detriment to students as it impacts their cognitive ability to engage in and retain information, distracts them from the lesson, and can even lead to a decrease in academic performance.

2.4.3 Effect of Off-Task Behaviours

Some authors have argued that the cognitive cost associated with engaging in off-task behaviours can have a toll on student academic performance (Burak, 2012; Fried, 2008; Junco, 2012a, 2012b; Kraushaar & Novak, 2010; Ravizza, Hambrick, & Fenn, 2014). Burak (2012) found that multitasking with laptops and phones during class by undergraduate students lead to a decrease in academic performance. Academic performance was measured by the grade point average (GPA) of the student, though

Burak's (2012) results do not indicate how much of a decrease in academic performance occurred. Fried's (2008) study reported similar results in student off-task activity on devices during class lead to poorer academic performance. Junco (2012a) reported that the duration of time spent by higher education students using Facebook was related to a decrease in academic performance. Specifically, Junco (2012a) found that post-secondary students who frequently used Facebook suffered a loss of 0.12 points from their GPA for every hour and half of use above and beyond the participant average of 106 minutes of Facebook use a day. Kraushaar and Novak (2010) found similar results where higher education students who frequently engaged in multitasking behaviours during class for long periods achieved lower academic performance. Ravizza et al. (2014) noted that the use of Internet in class for off-task activities was associated with lower exam marks as well as classroom performance. Ravizza et al. (2014) argued that university students in their study seem oblivious to the relationship between their engagement in off-task activities on their laptop and performance on tests and exams.

Several researchers reported that students who engage in multitasking laptop activities are more likely to see a drop in their GPA, because their focus and attention is being directed by unrelated school activities (Bowman et al., 2009; Burak, 2012; Gaudreau et al., 2014; Oliveira, 2013; Sana et al., 2013). Burak (2012) conducted a survey of university students from various programs and found that students' GPA declined as a result of continued multitasking activities on their laptops in class. Bowman et al. (2009) found, in their study of undergraduate students, that students took significantly longer to complete an academic task when multitasking. Sana et al. (2013) noted that students who multitask perform more poorly academically. Additionally, the researchers found that

students who were in the view of classmates who were multitasking also performed more poorly academically (Sana et al., 2013).

While a number of researchers do agree on the cognitive and academic cost associated with engaging in off-task behaviours and activities on laptops (see for example Judd & Kennedy, 2010; Junco, 2012b; Gaudreau et al., 2014), Bowman et al. (2010) noted variability in how cognitive performance is impacted. The degree of cognitive and academic impact can be dependent on the features of the technology being used as well as the individual's state of mind (Carrier et al., 2009; Fang, 2009; Junco, 2012b). In other words, the actual activities that the student is engaging in can affect the cognitive impact.

2.5 Factors Influencing Off-Task Behaviours

Several researchers have investigated what leads students to engage in off-task activities (e.g., Carrier et al., 2009; Judd & Kennedy, 2010; Junco, 2012b; Spink, 2013). Five key influences were revealed including a culture of distraction, lack of attention or boredom with the lesson at hand, instructional methods, subject area, and gender.

2.5.1 Culture of Distraction

One possible factor leading to student off-task behaviour could be a culture of distraction in the classroom. Griffith and Roberts (2015) posited that technology essentially gives students "the world in their hands" thereby leading to a propensity to engage in off-task activities. Some researchers have argued that the teenage demographic when paired with technology use in class, can enable distraction (Abaté, 2008; Skiba, 2011; Turkle, 2011). While distraction is of course not unique to teenagers, technology seems to be a larger part of their lives (Turtle, 2011). The laptop, the applications, and the web are almost like an extension of the student (Turtle, 2011). Moreover, students even feel guilty

or remiss if they are not updating their social media sites and posting photos and videos (Turkle, 2011). A teenage student may then feel the need to engage in an off-task activity to assuage these emotions.

However, some researchers claim that students born after 1980 (also known as the Net Generation) find multitasking to be an easy, natural process (Carrier et al., 2008). Similarly, Abaté (2008) concluded that despite the foreseeable disadvantages inherent in multitasking, the younger generation can more effectively multitask as they have been raised doing it.

2.5.2 Attention

Another possible factor influencing students' decision to engage in off-task behaviours is boredom or lack of interest in the lesson. Csikszentmihalyi (1990) explained that boredom can be understood as a process of finding a more interesting or fun task to engage in. As such, if a student becomes bored or otherwise loses attention in the lesson, they may attempt to reach a cognitive state of enjoyment, or *flow*, which could occur through an off-task activity. Similarly, Lindroth and Bergquist (2010) termed the escape from the lecture as entering a state of "mental absence." However, the researchers concede that while laptops are not the sole cause of the loss of focus, they help enable more off-task behaviours.

The loss of focus or attention has also been researched to understand what causes a cognitive shift to another task (Bowman et al., 2009; Rosen et al., 2013; Wilson & Korn, 2007). Bowman et al. (2009) explained that attention could be affected by an individual's voluntary decision to distribute their cognitive ability to a different task. Research conducted by Gerow et al. (2010) described a cycle in which a student's tendency to be

cognitively absorbed by digital technologies would lead them to “cyber-slack,” which in turn leads the same student to report favourable perceptions of the internet and digital technologies. Other researchers have argued that a cognitive disruption occurs causing students to make a conscious decision to engage in off-task activities (Rosen et al., 2013).

Rosen et al. (2013) found that, on average, middle to post-secondary school students (ages 12-24) were only able to stay on-task for approximately 6 minutes before they switched tasks. However, Wilson and Korn (2007), in a review of the literature on student attention span, did not support the notion of a limited 10-15 minute attention span for students. While Wilson and Korn (2007) explained that students’ attention span does tend to wane, the reasons behind it were more dependent on the individual student. For example, a student could be responding to physical discomfort, the disparity in preferred instructor teaching style, or a limited working memory capacity (Wilson & Korn, 2007).

Taneja et al. (2015) explored four causes of students’ lack of attention during class time: intrinsic motivation, extrinsic motivation, class engagement, and apathy towards the course material. They reported that these four causes of students’ lack of attention during class time can be further exacerbated, or even induced, as a result of using laptops and digital technology in the class (Taneja et al., 2015).

2.5.3 Instructional Method

The instructional method used by a teacher may also be a factor influencing off-task behaviours by the student. The impact of instructional method may be partially dependent on the reason a teacher has for including the technology in the classroom (Bonifaz & Zucker, 2004). For example, Lord (2011) argued that a student’s intention to engage in off-

task activities might be dependent on whether the workload is manageable, the content is confusing, or the instructions are poor.

Csikszentmihalyi's (1990) explained that if a student were in a state of flow during the lesson, they might fall out of flow if the task became too challenging. If the student does not feel in flow with the lesson, they could seek alternatives to recapture the feeling of flow.

Csikszentmihalyi added that certain instructional methods increased flow (e.g., group work) while other methods (e.g., lecture and video presentations) interrupted flow (Beard, 2015). Lindroth and Bergquist (2010) argued, in their study of higher education students, that there needs to be a more concerted effort on the part of instructors to integrate laptops (and associated technologies) into the class to prevent off-task and other inappropriate behaviours by the students from taking place. Kay and Lauricella (2011a) similarly echoed this argument - better integration of laptops into the lesson should engage students in more positive learning experiences and behaviours.

2.5.4 Subject Area

No research in higher or secondary education to date has specifically studied off-task behaviours in relation to subject-area. However, Gaudreau et al. (2014) found that higher education students from the faculty of science were less likely than liberal arts students to use laptops during class for social media use, taking notes, or surfing the web for purposes unrelated to the course. Grimes and Warschauer (2008) reported on the frequency of laptop use by secondary school students in class or preparing homework for language arts, social studies, science, and mathematics. However, the purpose of the study was the implementation of laptops in the school, not the impact that laptops would have in individual subject areas. Csikszentmihalyi (1990), in his work on Flow Theory, noted that

mathematics, science, and social studies are more likely to cause anxiety and boredom for students. His research though did not include the use of laptops by students in these classes. Kay and Lauricella (2011a) speculated that some subject areas may not have clear affordances of the use of laptops in the classroom

2.5.5 Gender

A last possible factor influencing off-task laptop activities is gender. A number of researchers have explored male and female attitudes, behaviours, and use regarding technology (see for example Colley & Comber, 2003; Joiner et al., 2005; Kay, 2007; 2008; Kay and Lauricella, 2011b; Rideout et al., 2010). Kay (2008), in an extensive review of the literature on gender and technology use, reported that there were small or no differences between males and females with respect to attitude, behaviours, and use of technology in elementary, secondary and tertiary school environments. Colley and Comber (2003) reported similar results.

One of the main differences between males and females regarding off-task laptop activities is the type of activity chosen. For example, males were more likely to play video games on their laptop than females (Barker & Aspray, 2006; Colley & Comber, 2003; Joiner et al., 2005; Kay, 2007; 2008; Li & Kirkup, 2007; Papastergiou & Solomonidou, 2005; Rideout et al., 2010; Sanders, 2006; Tallvid et al., 2015). On the other hand, females were more likely to use the computer for communication (email, social networking) than males (Joiner et al., 2005; Kay, 2007; Rideout et al., 2010).

Regarding frequency of use, Rideout et al. (2010) study of 8-18-year-olds' media use noted that males tend to use media at home for a longer time each day compared to females. However, this difference only started to appear in teenagers. Rideout et al. (2010)

also observed that boys were more likely than girls to multitask. Kay and Lauricella (2011b) observed that undergraduate female students were more likely to engage in on-task laptop behaviours compared to males. While gender may not necessarily be an indicator of whether a student *will* engage in off-task activities on their laptop, it may be a factor influencing *which* off-task activity will be selected.

2.6 Methodological Issues

An examination of the methodologies of previous researchers revealed at least three limitations including studies focusing on frequency but not cause of off-task behaviours, the narrow scope of evaluation scales, and lack of research on instructional method and subject area. Each of these limitations is discussed in turn.

Most studies on the use of laptops in the classroom investigated the frequency of specific off-task behaviours engaged in by students but did not look at that factors that influence those off-task behaviours. For example, Bowman et al. (2010) looked at the frequency of multitasking when students used instant messaging while reading a passage, but did not consider the factors that influenced messaging. Rosen et al. (2013) examined Facebook use and multitasking, but focused on frequency and duration of multitasking and not factors that might have caused this behaviour. Fewkes and McCabe (2012) similarly explored the possible use of Facebook as a learning tool in class, but they did not discuss why students would use Facebook in an off-task manner in class.

Some researchers focused on one or two specific off-task behaviours in their study of student laptop behaviours, instead of a more comprehensive scale (Gaudreau et al., 2014; Kraushaar & Novak, 2010). For example, Gaudreau et al. (2014) investigated university students' laptop behaviours during class, but only included a limited range of

specific on-task and off-task activities. The researchers did not ask about multitasking behaviours nor asked students to provide other examples of their behaviours on laptops during class. Kraushaar and Novak (2010) explored university students' multitasking behaviours on their laptops during class. However, they only categorized their questions into productive and distractive behaviours. As with Gaudreau et al. (2014) multitasking frequency was reported, but students were not asked about their individual behaviours.

Lastly, there is a lack of research exploring the influence of instructional method or subject area in relation to off-task laptop-related behaviours. There is, however, limited research (Csikszentmihalyi, 1990; Gaudreau et al., 2014; Grimes & Warschauer, 2008) that suggests the possibility of a relationship between subject area and laptop-based off-task behaviours.

2.7 Research Questions

Four key research questions were addressed in this study:

1. What do secondary students see as the perceived advantages of having a laptop in class?
2. What specific off-task laptop-based activities do secondary school students engage in during class time?
3. What factors influence students' off-task laptop-based behaviours during class time?
4. What suggestions do secondary school students have for maximizing advantages and minimizing distractions when using laptops in the classroom?

3. Method

3.1 Philosophical Approach

The method in this study used a pragmatic perspective. The pragmatic approach is not limited to any one specific theory - it attempts to use which ever theories or approaches will help in understanding what is being investigated (Creswell, 2014). The pragmatic approach is more action research oriented than theoretical, as it looks specifically at what is going on in the classroom and what might have contributed to it. The research approach used in this study, then, is also positivistic because data was collected and used to draw connections between outcomes and effects (Creswell, 2014).

All data were obtained from a survey, which included quantitative and qualitative questions to better understand the participants' activities and behaviours in class. The "what" and "how" questions were addressed by the quantitative data, the "why" questions were examined using qualitative data. This rationale is consistent with a pragmatic and positivistic approach.

3.2 Research Design

The current study used a mixed methods approach. A convergent model of merging quantitative and qualitative data was employed (Creswell, 2014). Using a single data collection method would be insufficient to glean a thorough understanding (Cohen, Manion, & Morrison, 2011). The qualitative data helps to explain and provide context to the quantitative data.

Quantitative data came from a nonexperimental design in the form of a survey. A survey was chosen in order to better understand the participants through numerical

descriptions of their activities and behaviours (Creswell, 2014). Quantitative data was collected from a nine-point semantic differential scale based questions derived, in part, from Kay and Lauricella's (2010) Laptop Use Scale. These questions focused on the frequency of laptop-based activities and behaviours.

Qualitative data came from three open-ended questions within the survey and were analyzed using a content analysis (Weber, 1990; Zhang & Wildemuth, 2009). A content analysis was chosen to better understand the participants' perspectives as represented through a thematic organization.

3.3 Context

The study was conducted by distributing online surveys to four Canadian Accredited Independent Schools (CAIS) in Ontario, Quebec, and British Columbia.

School A, located in a suburban area in British Columbia with a population of approximately 76 000, is a co-educational private school with about 500 JK to 12 students costing approximately \$18 000/year in tuition. School A has a "bring your own device" (BYOD) program that requires students in grades 5-12 to bring a laptop to class. Their BYOD program has mandated laptop requirements of their students in grade 8 since 2005.

School B, located in a rural area in British Columbia with a population of approximately 8000, is a co-educational private school with about 480 grade 8-12 students, with tuition rates ranging from \$24 000 (day students) to \$44 000 (boarding students). School B has a BYOD program, mandated since 2009.

School C, located in an urban area in Ontario with a population of approximately 183 000, is a co-educational school with about 750 grade 7-12 students, with tuition rates ranging from \$26 000 (day students) to \$60 000 (boarding students). School C was the

first school in Canada to implement a 1:1 laptop program and has required students to bring a laptop to class since 1998.

School D, located in a suburban area in Quebec with a population of approximately 20 000, is a male-only school with about 570 JK to grade 11 with a tuition of \$20 000/year. School D has a BYOD program, mandated since 2003.

3.4 Participants

Two-hundred and twenty-four secondary students (156 males, 65 females, 3 no response) participated in this study. Thirty percent (n=61) of participants were enrolled in an all-male school whereas 70% (n=145) came from co-educational schools. Seventy-one percent of the participants (n=156) were male and 29% (n=65) were female. Students were: 13 years old (n=6, 3%), 14 years old (n=25, 12%), 15 years old (n=52, 24%), 16 years old (n=66, 31%), 17 years old (n=45, 21%), or 18 years old (n=20, 9%). The mean age of the participants was 16 years old ($SD = 1.24$). With respect to grade, 24% (n=51) were enrolled in grade 9, 31% (n=66) in grade 10, 30% (n=64) in grade 11, and 14% (n=30) in grade 12. Table 1 presents a summary of each school where data was collected. Note that only 206 participants could be matched to one of the four host schools.

Table 1 - Participant School Demographics

Item	N		School Enrollment	School Type
School A (BC)	20	(9%)	500	Co-Ed
School B (BC)	121	(59%)	480	Co-Ed
School C (ON)	4	(2%)	750	Co-Ed
School D (QC)	61	(30%)	570	Male-Only

3.5 Data Collection

Participants completed an online survey comprised of 12 questions. The survey included questions about instances of off-task and on-task laptop behaviours in class (Appendix B).

3.5.1 Scale Questions

3.5.1.1 *Demographics*

The survey asked three close-ended questions directly related to the demographics of the participant (gender, age, and grade level - Appendix B, Items 1 to 3).

3.5.1.2 *On-Task Activities*

Participants were asked to rank how frequently they engage in on-task activities during class (Appendix B, Item 4).

3.5.1.3 *Off-Task Activities*

Participants were asked to rank the frequency with which they engage in various behaviours on their laptop during class. This question had eight different behaviours (as well as an “other (please specify)” option): emailing, instant messaging, social media/network use, surfing the web (Appendix B, Item 6).

3.5.1.4 *Factors that Effect Off-Task Behaviour*

Participants were asked to rank how helpful their laptop was in a variety of different subject areas including language courses (for example English, French), math courses, science courses, social studies courses (for example history, law), and an “other (please specify)” option (Appendix B, Item 7). Participants were then asked to rank how often they would get distracted by another student’s laptop in class (Appendix B, Item 8). Finally, participants were asked to rank how often they would get distracted when a certain instructional method was used. Four instructional methods were listed: lecture, independent work, group work, and student presentation (Appendix B, Item 9). All of the ranking questions used a 9-point semantic differential scale comprised of: never, almost never, rarely, on occasion, sometimes, often, frequently, almost always, and always.

3.5.2 Open-Ended Questions

There were three open-ended questions that asked the participants to provide their perceptions of laptop use and efficacy in the classroom. The first question asked the participants what they see as the advantages of laptop use in class (Appendix B, Item 5). The second question asked participants how they could make laptops less distracting in class (Appendix B, Item 10). The last question asked the participants how they could make laptops more beneficial in class (Appendix B, Item 11).

3.6 Procedure

Twenty-nine CAIS schools across Canada were contacted and asked whether their students would be willing to participate in the study. For a school to be considered for the research, a laptop or similar digital device would be required for each student in the classroom. Four CAIS schools (14% response rate) agreed to have their students asked to be participants. The contact at each of the four schools was sent a copy of the student consent/assent letter (see Appendix A) as well as the student survey (Appendix B). After completing the consent letter, the schools were sent a link to the online survey, along with a letter of introduction (see Appendix A) for the school to disseminate to their students. Each student would then decide whether they wished to complete the survey by providing his/her consent (if of the age of majority) or his/her assent (if not of the age of majority, in which case their parents/guardians would also need to consent). Over a period of 11 weeks (April 9th – June 30th, 2015), 224 participants filled in the survey. Each survey took approximately 10 minutes to complete.

3.7 Data Analysis

3.7.1 Quantitative Analysis

Table 2 outlines the research questions, the data used to answer each of the research questions, and the analysis to be conducted. Quantitative data was analyzed using frequency analysis, comparison of means, and independent t-tests.

Table 2 - Data Analysis

Research Question	Data Used to Answer Research Questions	Data Analysis Conducted
1. What do secondary school students see as the perceived advantages of having a laptop in class?	<ul style="list-style-type: none"> Qualitative and quantitative data from student survey (Appendix B, Items 4 and 5) 	<ul style="list-style-type: none"> Frequency analysis, comparison of means, Cohen's d, independent t-test Analyzing responses using Content Analysis
2. What specific off-task laptop-based activities do secondary school students engage in during class time?	<ul style="list-style-type: none"> Quantitative data from student survey (Appendix B, Item 6) 	<ul style="list-style-type: none"> Frequency analysis, comparison of means, Cohen's d, multivariate test
3. What factors influence secondary students' off-task behaviours during class time?	<ul style="list-style-type: none"> Quantitative and qualitative data from student survey (Appendix B, Items 7-11) 	<ul style="list-style-type: none"> Frequency analysis, comparison of means, Cohen's d, independent t-test, multivariate test Analyzing responses using Content Analysis

3.7.2 Content Analysis

A content analysis was used to analyze responses to the open-ended questions. This analysis involved the researcher attempting to understand a participant's "social reality in a subjective but scientific manner" (Zhang & Wildemuth, 2009, p. 308). Each student response varied in length from a few words to a few sentences. Weber (1990) noted that the text unit being analyzed needs to be short or difficulties in the coding process could develop. Longer responses from students were divided into smaller segments when appropriate.

The first step of the content analysis procedure was to read all of the responses to each question to gather a general impression. All responses were reviewed a second time to identify preliminary themes. The identification of preliminary themes involved

recording each apparent theme as well as tallying the frequency of each theme. A third reading of the responses then occurred to check for accuracy and frequency, as well as to further condense and categorize the responses into themes and subthemes. This three-step process was used for each of the open-ended questions.

4. Results

4.1 Perceived Advantages of Laptops in Class

Survey question. Students (n=149) were asked how often they engaged in on-task behaviours on their laptops during class (Appendix B, Item 4). On a nine-point scale, the mean was 6.6 ($SD = 1.9$) indicating that students were “frequently” on-task when using their laptops. Almost 80% of the students reported that they “often, frequently, almost always, or always” engaged in on-task laptop behaviours during class. Only, 10% of students reported that they “never, almost never, or rarely” engaged in on-task behaviours.

Open-ended question. Students were asked what they perceived were the advantages of using laptops in the classroom (Appendix B, Item 5). As indicated in Table 3, four main themes were revealed by the data including access to information online (n=61 comments, 58%), use of technology (n=30, 28%), programs, software, apps (n=12, 11%), and not helpful (n=3, 3%).

Table 3 - Advantages of Laptops in the Class

Theme	Sub-Theme Label	n	%
Access to Info Online	Access to resources, information, research	61	58%
Use of Technology	Easier, faster to learn	13	12%
	Faster to type/take notes than write, easier on the hand	10	9%
	More interactivity, new mediums to learn	4	4%
	Headphones/earbuds help with distraction	3	3%
Programs, Software, Apps	Ability to access dictionary, thesaurus, etc.	7	6%
	Use/share work for group work more easily	3	3%
	Proper formatting assignments	2	2%
Not helpful	Not useful, not necessary	3	3%

With respect to “accessing information online,” sample responses included:

“It is incredibly useful to search information on the topic at hand. I cannot overstate how much I rely on my computer for understanding information.”

“We can access information at our fingertips. It is quite amazing actually!”

“It allows you to have all access to information you may need during class. My teachers frequently use online studying games and tools for vocabulary. Research is much easier.”

Regarding the “use of technology”, several themes emerged including taking notes, easier and faster learning, increased interactivity, and eliminating distractions with headphones. Sample comments included:

“The laptops allow for more technology, better research and a more interactive experience” (increased interactivity)

“I like typing more than hand writing because my hands hurt after a while plus my hand writing isn’t always clean.” (note taking)

“Faster note taking, [f]aster writing (faster then[sic] using pencil), easier to get ideas down quick.” (easier and faster learning)

“The laptops allow for more technology, better research and a more interactive experience.” (better learning)

On the third theme, “programs, software, apps”, the following sub-themes were observed: ability to access reference programs (such as dictionary and thesaurus), share work with a group, and formatting assignments properly. Sample responses included:

“iMovie. Presentations. Google docks[sic]. Textbooks. THESAURUS!” (ability to access reference programs)

“I would shudder when thinking of researching through millions of books when with one search on EBSCO or Google and you have found the information!☺” (ability to access reference programs)

“When working in group work it allows you to share your documents with the group easily (ex: google docs). This allows you to work together outside of class time.” (share work with a group)

“It allows us to format projects to our specifications.” (formatting assignments properly)

The fourth theme, “not helpful,” articulated by only three students, suggested that laptops were not particularly helpful. For example, one student claimed:

“Laptops in my opinion are not necessary for class time and no student should bring them to school, generations in the past have gone through life without having a laptop and I think we can do the same.”

4.2 Off-Task Laptop-Based Behaviours

Students were asked to indicate the frequency in which they engaged in various off-task activities (Appendix B, Item 6). As shown in Table 4, the most frequent off-task behaviour was emailing – almost three-quarters of all students emailed “on occasion or always.” The next most frequent off-tasks activities were surfing the web and interacting with social networking sites with roughly 50 to 60% of students reported engaging in these activities “on occasion or always.” Finally, almost one-third of students responded that they instant messaged or played games “on occasion or always.”

Table 4– Off-Task Activities During Class

Item	Mean¹	SD	Never²	On Occasion³	Always⁴
Email	5.1	2.1	26%	35%	39%
Surf the Web	4.7	2.3	35%	24%	40%
Social Media/ Networking Sites	3.9	2.3	48%	27%	25%
Instant Message	3.1	2.0	68%	18%	14%
Play Games	2.7	1.9	70%	20%	10%

¹Nine point Likert Scale (1 – Never to 9 – Always)

²Includes Never, Almost Never, and Rarely

³Includes On Occasion, and Sometimes

⁴Includes Often, Frequently, Almost Always, and Always

4.3 Factors that Influence Off-Task Behaviour

4.3.1 Subject Area

Students were asked to indicate how helpful their laptops were for a variety of subject areas (Appendix B, Item 7). As indicated in Table 5, social studies and language were the top two courses where laptops were rated as being helpful “on occasion or always” by most students. The third highest subject area was the category “other courses.” This category included arts-based courses (such as Fine Arts, Drama, and Photography n=21) technology-based courses (such as Woodwork, Programming, and Graphic Design, n=4) and Physical Education (n=4). Students (n=5) also responded that they used their laptops for non-subject specific tasks (such as homework, extra-curricular activities, browsing the internet) 14% of the time. Over 80% of students found laptops “on occasion

or always” helpful in Science courses. Finally, mathematics was rated the least helpful with almost seven out of ten students reporting that the laptop was never helpful.

Table 5 - Laptop Helpfulness in Courses

Item	Mean¹	SD	Never²	On Occasion³	Always⁴
Social Studies Course	7.5	1.9	4%	14%	82%
Language Course	7.2	1.7	4%	15%	81%
Other Course	6.6	2.4	15%	23%	62%
Science Course	5.6	2.3	18%	33%	49%
Math Course	3.3	2.3	66%	20%	14%

¹Nine point Likert Scale (1 – Never to 9 – Always)

²Includes Never, Almost Never, and Rarely

³Includes On Occasion, and Sometimes

⁴Includes Often, Frequently, Almost Always, and Always

4.3.2 Distraction from Other Students

Students ($n=190$) were asked to indicate how often they were distracted by another student’s laptop activity in class (Appendix B, Item 8). On a nine-point scale, the mean was 3.7 ($SD = 1.8$) indicating that students, on average, were distracted by another student’s device use “on occasion.” Half of the students reported that they were “never, almost never, or rarely” distracted by a peer’s device. One-third of students were distracted by a peer’s device “on occasion or sometimes.” Lastly, 16% of students reported being distracted “often, frequently, almost always, or always” by a peer’s device.

4.3.3 Instructional Method

Students were asked how often they were distracted and started using their laptop when certain instructional methods were used in class (Appendix B, Item 9). As indicated in Table 6, almost 85% of students reported that they were distracted “on occasion or

always” and used their laptops when they were doing independent work. About half of the students responded that they were distracted “on occasion or always” during each group work and lecture. One-third of students responded that they were distracted “on occasion or always” during student presentations.

Table 6 - Distraction and Instructional Method

Item	Mean ¹	SD	Never ²	On Occasion ³	Always ⁴
Independent Work	4.5	2.2	16%	34%	50%
Group Work	4.0	2.2	48%	30%	22%
Lecture	3.8	2.4	52%	24%	24%
Student Presentation	3.0	2.1	70%	17%	13%

¹Nine point Likert Scale (1 – Never to 9 – Always)

²Includes Never, Almost Never, and Rarely

³Includes On Occasion, and Sometimes

⁴Includes Often, Frequently, Almost Always, and Always

4.3.4 Gender

On-task Activities. An independent t-test was conducted for differences between males and females in their frequency of engaging in on-task activities. Females (n=48) engaged more frequently in on-task behaviours than males (n=101). There were significant differences between males ($M=6.4$, $SD=2.0$) and females ($M=7.1$, $SD=1.5$) in the frequency with which they engaged in on-task behaviours, equal variances not assumed ($t=-2.5$, $df=121.8$, $p < .01$). According to Cohen (1988, 1992), this is a medium effect size ($d=-0.39$).

Off-task Activities. A Hotelling’s T-test revealed that there were significant differences between males (n=100) and females (n=44) with respect to off-task behaviours

($p < .001$). As indicated in Table 7, females used social media significantly more frequently than males ($p < .01$, Cohen's $d = 0.49$) and males played games significantly more frequently than females ($p < .01$, Cohen's $d = 0.59$). According to Cohen (1988, 1992), these are medium effect sizes.

Table 7 - Gender Differences and Off-Task Activities

Item	Males		Females		F
	M	SD	M	SD	
Email	4.9	2.0	5.5	2.1	2.2
Surf the Web	4.8	2.3	4.6	2.4	0.3
Social Media	3.5	2.3	4.6	2.2	7.0*
Play Games	3.0	2.0	2.0	1.3	8.7*
Instant Messaging	2.9	2.0	3.4	2.0	1.8

* $p < 0.01$

4.4 Maximizing Advantages and Minimizing Distractions

4.4.1 Increasing Laptop Benefits

Students were asked how they could make laptops more beneficial in the classroom (Appendix B, Item 11). As indicated by Table 8, eight themes were revealed by the data: restriction and enforcement (n=22 comments, 21%), better engagement (n=22, 20%), teacher impact (n=19, 19%), and use of programs, software, apps (n=12, 12%), unsure (n=10, 9%), self-control, restraint (n=9, 8%), no change (n=9, 8%), and distraction (n=3, 3%). The most significant themes were restriction and enforcement, better engagement, and teacher impact. Collectively, the three themes represented over 60% of all student responses.

Table 8 - How to Make Laptops More Beneficial

Theme	Sub-Theme Label	N	%
Restriction and enforcement	Block more sites, restrict sites	11	10%
	Only use them when needed for a specific activity	4	4%
	Limit Wi-Fi access	3	3%
	Stricter guidelines for use	2	2%
	Teacher supervision with laptop use (screen share too)	2	2%
Better Engagement	More frequent use of laptops	10	9%
	More engaging content	9	8%
	Some free time/fun time	3	3%
Teacher Impact	Teacher comfortability with student laptop use	5	5%
	Better teacher education on laptop use	4	4%
	More communal class use (explore a site together, use class polls)	4	4%
	Specific sites to be used, not open-ended	3	3%
	Supplement lectures with online activities	3	3%
Use of Programs, Software, Apps	Use of specific apps	5	5%
	Access to class programs	4	4%
	E-copies of the textbook	3	3%
Unsure	Don't know/unsure	10	9%
Self-control, restraint	Self-control, restraint	9	8%
No change	Fine as they are already	9	8%
Distraction	Prevent distraction from other	2	2%
	Get rid of them – they are distracting	1	1%

For the “restriction and enforcement” theme, students responded with comments focusing on blocking and restricting certain sites, limiting Wi-Fi access, stricter guidelines for laptop use, and more teacher supervision. Sample comments from this theme included:

“Online restrictions to some websites would be efficient in a theoretical work ethic sense, but the students would be irritated by these limitations.” (blocking and restricting certain sites)

“Really bare done on laptops and make sure no one is using them and if they are take them away. Unless they are doing something productive.” (stricter guidelines for laptop use)

“I think not making Wi-fi[sic] readily available to students while in class would definitely make everyone more productive.” (limiting Wi-Fi access)

“[B]y being supervised when using them and the teacher supervising your screen.” (more teacher supervision)

The second theme, “better engagement,” included responses such as wanting more frequent use of laptops, more engaging content in class, and having fun/free time on the laptop. Sample comment included:

“[U]se them more often and trust that the kids will use the time as a work block” (more frequent use)

“[W]e could use them more in hands-on activities in a group or by yourself” (more frequent use)

“Maybe focus on things interesting to age group.” (more engaging content)

The third theme, “teacher impact,” included comments on better teacher comfortability and education on laptop use, more communal use of the laptop as a class, specifying which sites to use and supplementing lectures with online activities. Sample comments included:

“Technology could be more useful in class if teachers understood how to use it properly. Along with this, digital device use could be more beneficial if teachers knew what the opportunities for distraction are and could avoid them.” (teacher education on laptop use)

“[L]aptops need to be embraced by the teacher, they need to be taken in with all of their strengths and weaknesses as well.” (teacher comfortability)

“More online tools that would allow the class to collaborate online.” (communal use)

“Have specific instructions including where to go and what to do to keep students more on task.” (specifying which site to use)

The fourth theme, “use of programs, software, apps,” contained responses such as the use of specific programs, access to course programs, and electronic copies of textbooks.

Sample comments included:

“I think if we could turn questions that are asked during class into a poll which can be voted instantaneously and the results shown in front of all the students.” (use of specific programs)

“[M]ake use of extra programs such as photoshop for projects, iMovies, etc.” (access to course programs)

“[H]ave the textbooks on them so that we can not [sic] lose them and they are less heavy in our bags.” (electronic copies of textbooks)

Some students responded that they were unsure how to make laptops more beneficial. Sample responses from the fifth theme, “unsure,” included:

“[N]ot really any way now.”

“Im[sic] not sure. They’re already pretty beneficial.”

“I don’t know if they can be more beneficial. It’s just using them at the appropriate times.”

A small number of students expressed that laptops could be more beneficial in class through more self-control or restraint on the part of the students. Sample comments were:

“Laptops are already beneficial, the challenge is if a person decided to use the laptop for its benefits instead of a distraction.”

“[S]top messing around and stay on task.”

“Yea[h] people will get distracted but if the teacher makes it clear that it is something that it is easy to get distracted on but then the students need to make the choice; do I stay on topic, or do I go on Facebook and then they can pay the price for

their actions. If they are constantly distracted and cannot multi task they will see it reflected in their effort grades as well as class grade. I believe it is up to the student to have the moral strength to know when and when not to be on Facebook or watching videos.”

Some students indicated that laptops were already beneficial in their current capacity and didn't need change. Sample comments were:

“It can't. I can't. A good teacher can.”

“[N]ah I like the[m] the way they are, they force the student to be responsible and smart about his workload.”

“I do not really think you can because they are already quite beneficial therefore if you are using them a lot in the class they are already being used to the full potential.”

The eighth and final theme, involving just three students, focused on simply getting rid of the laptops because they were distracting – either from what their peers were doing on them, or from themselves. Sample comments included

“[G]et rid of them. They are a waste of time and they are distracting. Almost everyone who brings a computer gets distracted by it.”

“No distractions and stay on task – follow what the teacher is teaching.”

4.4.2 Reducing Distractions

Students were asked how they could make laptops less distracting in class (Appendix B, Item 10). As indicated by Table 9, eight themes were revealed by the data: restriction (n=60 comments, 48%), surveillance and monitoring (n=20, 17%), change in the lesson (n=12, 9%), can't make them less distracting or don't know (n=12, 10%), self behaviours (n=9, 7%), change in teaching method (n=4, 4%), change in technology (n=4, 3%), and not distracting (n=3, 3%). The most significant theme was “restriction” as it accounted for nearly 50% of all responses from the students.

Table 9 – How to Make Laptops Less Distracting in Class

Theme	Sub-Theme Label	N	%
Restriction	Block sites	21	17%
	Only to be used during certain times in class	13	11%
	Close the lid, close lid when not in use	12	10%
	Have a box for laptops, cell phones	4	3%
	Don't bring them to class	4	3%
	No access to internet	3	2%
	Prevent use during certain activities (lectures, lessons, presentations)	3	2%
Surveillance or monitoring	Better surveillance of screens, screens face teacher	15	13%
	Prevent students from seeing each other's screen	5	4%
Change in the lesson	Make lesson more interesting, engaging	4	3%
	Use laptops more, better integration	4	3%
	Change/enforce workload for class (require work to be done by end of class)	4	3%
Can't make them less distracting/don't know	You can't	7	6%
	Don't know/unsure	5	4%
Self behaviours	Self-control, responsibility for learning, will power	9	7%
Change in teaching method	Don't punish, teach to use them properly	2	2%
	Give more freedom	2	2%
Change in technology	Make device less distracting	4	3%
Not distracting	Not distracting	3	3%

Student comments from the first theme, “restriction,” included blocking websites, specifying when laptops could be used in class and closing the lid during the rest of the time, having a box to keep laptops when not in use, not bringing laptops to class, and not having access to the internet. Sample responses from the restriction theme included:

“I can make my laptop/digital device less distracting by leaving them in my room or my backpack[sic].” (not bringing laptops to class)

“[F]orbidding the use of headphones. Web filters, which block out distracting social media sites.” (blocking out websites)

“We could make laptops/digital devices less distracting by placing them in a bin at the beginning of class.” (bin for laptops)

“Don’t allow us access to the internet” (not having access to the internet)

“The teacher having the students completely closing there[sic] devices during lessons. Otherwise, there really is no way to stop it.” (closing the lid)

The second theme, “surveillance or monitoring,” included responses from students that focused on better surveillance from teachers, as well as limiting what could be seen on the screen of other students. Sample responses from the “surveillance or monitoring” theme included:

“[H]ave a program installed that allows teachers to monitor your activities.” (better surveillance from teachers)

“By preventing people from looking at each others’ screen.” (limiting screen visibility)

“[T]eachers would most likely need to monitor the laptop use better but it is easy for kids to switch tabs so it is really up to the student learning. Perhaps they could also have their backs towards the teachers[sic], so they feel intimidated to stay on task.” (better surveillance from teachers)

“Have the class formatted in a layout where the teacher can walk around, or sit at the back and monitor the correct sites are being used.” (better surveillance from teachers)

The third theme, “change in the lesson,” comprised responses from students such as making lessons more engaging, better integration of laptops, and enforce a required completed workload for each class. Sample responses from the change in the lesson theme included:

“Have a mandatory limit on what needs to be done by the end of the class to ensure people are pushed to work to get the minimum done.” (required completed workload)

“If the activities/assignments done in class were more interactive within the laptop, it would be harder to get off topic surfing the web since you have to be paying attention to what is happening on your screen.” (better integration of laptops)

“Have more engaging activities that can actually keep students focused instead of making them so bored that they want to shop or play games or surf online.” (lessons more engaging)

A number of students stated that laptops cannot be made less distracting, or that they did not know how to. Sample responses included:

“I don’t think that’s possible.”

“I don’t know, I don’t find them very distracting.”

Responses from the fifth theme, “self behaviours,” included student comments emphasizing self-control and restraint in using laptops during class. Sample responses from this theme included:

“If a student does not want to work then you cannot force them to work. It’s like the expression: you can bring a horse to water but you can’t make him drink.”

“[P]ersonal willpower to only open tabs needed or documents in use.”

“Control ourselves.”

Some students indicated in their responses that they would want to see a change in the teacher. This theme included responses focusing on giving more freedom to students

on their laptops and having teachers showing students how to use laptops properly.

Sample responses from the change in teacher theme included:

“[D]on’t punish harder, teach them to respect authority. ezipz[sic].” (using laptop properly)

“[M]ake the teachers tell the students to shut laptops when they are doing a lesson or talking.” (using laptop properly)

A few students explained that a change in technology might make laptops less distracting in class. This theme included comments on making the technology itself less distracting. Sample responses from this theme included:

“[B]y making it more silent. For example, silent mode, typing quietly, etc.”

“[T]urn off your ringer or put it on vibrate.”

Three students indicated that they did not find laptops distracting at all in class.

5. Discussion

5.1 Overview

The purpose of this study was to examine the use of laptops in secondary school environments by examining student perceptions of the advantages of using laptops, distracting laptop-based behaviours, factors that influence these behaviours, and suggestions for maximizing advantages and minimizing distractions.

5.2 Perceived Advantages of Laptops

One of the most significant results from this study was 8 out of 10 students reported that they were on-task “often or always” while using their laptops in class. This result strongly indicates that the dominant behaviour of secondary students within this study is engaging in on-task behaviours. Though the students indicated their laptops were helpful in certain subject areas, it is still unclear why the dominant behaviour was engaging in on-task behaviours. However, one possible factor relating to student on-task behaviour could be the participant demographics, and that students were enrolled in expensive, privileged private schools.

The frequency of secondary students on-task behaviours in this research is consistent with some previous research in higher education (Awwad et al., 2013; Kay & Lauricella, 2011c; 2014; Ragan et al., 2014; Tallvid et al., 2015). Awwad et al. (2013) reported that 50% of students were on-task, and Kay and Lauricella (2011c) noted that students were on-task 80-90% of the time. Tallvid et al. (2015) observed a range of on-task times from 48% to 90% (specifically note-taking, academically-related word processing use).

Based on the results of this study, it seems that secondary school students are on task when using laptops more than higher education students. However, the variance in the data from higher education research makes comparisons between secondary and higher education difficult. There are at least two plausible reasons why this difference might exist. First, the classes in secondary school typically are much smaller compared to university classes, and behaviours, off-task or otherwise, are more easily detected by the teacher. Second, a more structured set of external “school” rules that govern secondary school classrooms are not typical for higher education environments.

The key advantage to having laptops in the classroom was access to information, which accounted for nearly 60% of all responses. Several researchers reported that laptops allowed for greater access to information by students (Grimes & Warschauer, 2008; Lindroth & Bergquist, 2010; Kay & Lauricella, 2011a; 2014; Ragan et al., 2014). Students in the current research explained that they were able to do more research in class for assignments, had access to more resources for activities and studies, and were able to find clarifications on content in real time during the lesson. As such, the results from this research are consistent with findings from previous researchers.

When students were directly asked about the perceived advantages of using laptops in class, nearly 40% of all responses related to the use of technology and associated programs as being a clear advantage. Some students (28%) reported that they found the use of technology, in general, to be an advantage as it allowed them to better integrate themselves into the course and with peers. For example, students were able to write an essay in class on the laptop in less time (than pen and paper) and immediately have spell check, dictionaries, thesauri, and encyclopaedias at their disposal. They were also able to

communicate more effectively during pair and group assignments by sending work to each other over the internet and even use programs that would update work in real time (such as Google docs). Several researchers reported on laptop advantages for improved communication and access to resources (Kay & Lauricella, 2014; Kraushaar & Novak, 2010; Lindroth & Bergquist, 2010; Ragan et al., 2014). Kay and Lauricella (2014) reported in their study that students indicated the advantages of laptops included collaboration with peers. The advantages of technology use such as better communication and integrative uses of technology for assignments has also previously been reported on by Kraushaar & Novak (2010), Lindroth & Bergquist (2010), and Ragan et al. (2014); as such, the results from this research appear consistent with previous research.

5.3 Off-Task Behaviours

Students reported that they engaged in a number of off-task activities on their laptop during class. This study asked students to report on the frequency of email, surfing the web, social media, instant messaging, and playing games. On average, only about 1 in 4 students reported engaging in off-task behaviours during class, often or always. Several researchers have investigated student off-task laptop behaviours in class (Aguilar-Roca et al., 2012; Fewkes & McCabe, 2012; Fried, 2008; Junco, 2012b; Kay & Lauricella, 2014; Kraushaar & Novak, 2010; Tallvid et al., 2015; Turkle, 2011). The frequency of off-task behaviours from other studies varied from 16% for Aguilar-Roca et al. (2012), 23% for Fried (2008), and 60% for Ragan et al. (2014).

Results from this research indicated that the majority of students frequently used their email and surfed the web during class most compared to other off-task activities. Three-quarters of the students reported using email “on occasion or always.” This result is

inconsistent with results from other researchers focussing on higher education. Kay and Lauricella (2014) reported the frequency of using email at 35%, and Junco's (2012b) research indicated student's emailed only about 10% of the time in class. Students in this research did not explain why email was so prevalent, though Turkle (2011) proposed that email has become so commonplace that students do not associate it as being an off-task activity. It is possible that email was the most frequently reported off-task activity by students as it is a means of communication among their peers, but also one that may not be restricted in access by firewalls compared to social media and instant messaging communication sites.

Surfing the web was the next most frequently reported off-task activity. Nearly two-thirds of students reported surfing the web during class "on occasion or always." This result is somewhat inconsistent with research in higher education where surfing the web was not as frequent (Kay & Lauricella, 2014; Ragan et al., 2014). Some students explained that searching the web was initially for academic reasons, but if they were bored they would "multitask" and surf for personal reasons. It is otherwise unknown why the reported frequency of surfing the web during class would be higher when compared to post-secondary students.

The next most frequently reported off-task activity was social media use, with about half of all students reporting that they used social media "on occasion or always" during class. This result is consistent with previous research in higher education. For example, Ragan et al. (2014) reported social media use at 20%, Junco (2012b) reported social media use during class (Facebook specifically) at 28%, Aguilar-Roca et al. (2012) at 40% and Kay and Lauricella (2014) between 40-50%. It is somewhat surprising to note that nearly half

of all students reported “never or rarely” using social media in class given the teenage demographic. Fewkes and McCabe (2012) also reported that 48% of secondary students never use social media (specifically Facebook) during class time. However, it is likely that social media sites are either restricted or blocked completely by school firewalls at the secondary level, compared to higher education where such restrictions rarely exist.

Instant messaging, as an off-task activity, was rarely engaged in by a majority of secondary school students in this study. This result is similar to those for higher education students reported by Junco (2012b). Conversely, Kraushaar and Novak (2010) reported 61% of higher education students engaging in instant messaging during class. Just as with social media use, it is surprising that the frequency of use with instant messaging was relatively low in this study. It is possible that instant messaging is no longer as prevalent because social media has replaced it as a short-message tool (for example Facebook chat).

Lastly, playing games was reported as the least frequently engaged in off-task activity by students with seven out of ten students never or rarely playing games. These results were somewhat consistent with previous studies. For example, Kay and Lauricella (2014) reported 80% of higher education students never or rarely played games during class, and Ragan et al. (2014) reported students playing games only about 8% of the time during class. On the other hand, Fried (2008) reported that students played games 25% of the time, and Tallvid et al. (2015) observed game playing by students 23-45% of the time. The infrequent use of playing games is most likely explained by the use of the web filters to block access. Another possibility is that due to smaller class sizes in secondary schools, it may be easier for a student to be caught playing a game compared to higher education.

In summary, the frequency of engagement in off-task activities by secondary school students in this study is consistent with previous research in higher education.

Discrepancies can be explained by restricted access to sites through web filter in secondary schools as well as challenges unique to smaller class sizes and the stronger physical presence of the teacher.

5.4 Factors the Affect Off-Task Activities

5.4.1 Subject Area

Current literature does not specifically look at the impact of subject area on laptop-related behaviours. Social studies and language courses were reported as being most helpful for using laptops. Less than 5% of students reported that laptops were never or rarely helpful in either of these courses. Students explained that they found laptops particularly helpful for these subject areas because they were required to take notes or to write essays and other papers in-class.

About two-thirds of students also indicated that laptops were helpful in the category labelled “other courses” (Arts, technology, and physical education). Students did not explain why laptops were particularly helpful in these type of courses though. Future studies should include whether open-ended questions or interviews to examine why these subject areas may be more beneficial for laptop use, particularly because they do not involve much writing like social sciences and language courses might.

Nearly half of all students reported their laptops being helpful for science courses “on occasion or always.” Some students explained that they could take some notes in science class on their laptops, but the primary advantage was being able to look up information in class.

Lastly, two-thirds of all students reported their laptops never or rarely being helpful in mathematics class. Some students explained that they did not find laptops advantageous in class as it was easier to take notes by hand – particularly for mathematical formulas.

It should be noted that the influence of subject areas, if any, could be a reflection of content, students' attitudes toward this content, or the class teacher (e.g., the particular teaching style or even if the student likes the teacher). Csikszentmihalyi (1990) did mention that students tend to be out of flow during mathematics, science, and social studies courses. As previously mentioned, this could be due to the content-heavy aspect of these courses compared to more physical or creative aspects associated with physical education, music, and art courses. However, as mentioned in the previous paragraph, some students in this study found laptops unhelpful in classes, like math, where they found it easier to take specialized notes by hand. More in-depth analysis involving qualitative data collection in the form of interviews or focus groups would help to better understand the dynamic of laptop-use and subject area.

5.4.2 Distraction from Laptop and Peer's Device

A number of researchers have explored distraction of laptop-use by students in class (Fried, 2008; Kay & Lauricella, 2014; Sana et al., 2013). The research focused on whether students were distracted by their laptop or by another student's laptop nearby. In the current study, many students (50%) reported that they were “never or rarely” distracted by a peer's device during class. The results from the other questions in this study would seem to indicate a possible contradiction based on comments from students. Students regularly cited distraction from their peers who were engaged with social media

and/or video games. However, most students explained that they were on-task for most of the lesson and were able to focus on their work. It appears that students may be distracted by their peers' laptop behaviours, but overall, these distractions are minimal compared to time spent on-task. These results align with those of Kay and Lauricella (2014) and Sana et al. (2013) who reported minimal distractions from other students' laptops in class.

5.4.3 Instructional Method

At present, current research does not exist on the possible effect that instructional method might have on student laptop behaviour in class. However, a few researchers have tangentially highlighted some evidence exploring the impact of instructional method (Bonifaz & Zucker, 2004; Csikszentmihalyi, 1990; Kay & Lauricella, 2011c; Fewkes & McCabe, 2012; Ragan et al., 2014). For example, Csikszentmihalyi (1990) had found some indication that the degree of flow experienced by a student may be affected during certain instructional methods. However, in this study, secondary students were asked how often they were distracted in class and started using their laptop during a specific instructional method (independent work, group work, lecture, and student presentation).

Eighty-four percent of all students indicated that they were distracted "on occasion or always" during independent work compare to any other method. Only 16% of students reported "never or rarely" being distracted during independent work. Students explained that during independent work they were free to complete other work without teacher or peer supervision which often lead to engaging in off-task activities such as surfing the web, checking email, or using social media. Student responses were consistent with the results of other researchers reporting on structured and unstructured class environments with

laptop use (Kay & Lauricella, 2011c; Ragan et al., 2014). For example, Ragan et al. (2014) argued that unrestricted use of laptops can provide students with a nearly unlimited source of distraction. Kay and Lauricella (2011c) likewise noted that instructors who do not integrate laptops into their class can lead to students choosing for themselves what they will use their laptops for.

Over half of all students reported being distracted “on occasion or always” during group work. Some students explained that they would socialize during group work activities or that they would finish the assigned work in less time and use the laptop for off-task activities (surfing the web, social media). Other possible explanations include the group work not being properly structured (unclear instructions, too much/little time to complete), students being distracted by their peers, and less direct supervision and observation by the teacher.

Over 50% of students reported “never or rarely” being distracted during lectures. These results may be explained by students reporting that they either would take notes during lectures or were instructed not to use their laptops. Interestingly, Csikszentmihalyi (1990) found that students tended to be more in flow during group work activities compared to lectures. Perhaps the difference in the current study can be accounted for by a perceived academic need to participate in an activity. For example, students explained during lectures they used laptops to take notes, or did not use laptops at all. They may have felt using the laptops to take notes during a lecture was academically important, compared to group work where they may be less burdened and could rely on their group members for help.

Lastly, 70% of students reported “never or rarely” being distracted during student presentations. A few students explained that they would not use their laptops during student presentations out of respect for their peers and that if they were presenting to the class, they would not want to see students on their laptops.

5.4.4 Gender

Gender differences among students’ responses were also evident from the research. Female students engaged more frequently in on-task activities than males. Kay and Lauricella (2011b), on the other hand, noted that post-secondary school females were more distracted by their peers compared to males. It is unclear why there is a disparity here. The open-ended questions did not provide insight as to why the difference in on-task behaviours may have occurred. A possible explanation for the results of this research might be that females tend to be more academically focused compared to males, or, are less prone to engage in off-task activities.

Females reported engaging in social media/networking more frequently than males and males engaged more frequently in gaming. These results are consistent with previous researchers (Barker & Aspray, 2006; Colley & Comber, 2003; Joiner et al., 2005; Kay, 2007; 2008; Li & Kirkup, 2007; Papastergiou & Solomonidou, 2005; Rideout et al., 2010; Sanders, 2006; Tallvid et al., 2015). Joiner et al. (2005) reported that males significantly play games more than females. Kay (2007) notes that males tend to play games and surf the web more than females do, but females tend to email and instant message more.

No significant differences between males and females were found for email, surfing the web, or instant messaging in this research. Joiner et al.’s (2005) results differed slightly in that males reported emailing and instant messaging more than females, but males did

surf the web more than females. Differences in females' social media use and males' gaming behaviours have also been reported by a number of researchers (Barker & Aspray, 2006; Comber & Colley, 2003; Kay, 2007; Rideout et al., 2010).

Possible explanations for these male and female off-task activities differences could be explained by socio-cultural norms where males tend to lead in gaming and females in social media use. For example, Heintz-Knowles et al. (2001) reported that male characters in video games are designed with "competitor" roles, whereas female characters are seen as more of an object such as a victim or "damsel in distress." Female students may not connect with typical female character roles in video games and therefore would not engage as much compared to males. Shaw (2011) argued that the way in which video game marketers, and even researchers, explore gender differences often supports the "traditional correlations between masculinity and technology, and the converse disassociation of femininity and technology" (p. 35).

It is also interesting to note that male-female differences here at the secondary school level are consistent with male-female differences at the post-secondary level. Regardless of age, it appears that males are more likely to play games on their laptops in class compared to females, and females are more likely to use social media compared to males.

5.5 Maximizing Advantages and Minimizing Distractions

5.5.1 Maximizing Advantages

Students were asked how laptops could be more beneficial to class. The two most frequent responses were more restriction and enforcement of laptop policies and rules (21%) and better engagement and inclusion of laptops in the lesson (20%). Students cited

distraction from other students' devices, distraction from off-task activities on their own device, and simply forcing themselves to be on task as the reasons behind needing more restriction and enforcement of laptop policies and rules. Regarding distraction from other students' devices, students explained that they could sometimes see their peers on a website of interest to them and would focus their attention on their peer's laptop rather than the lesson. Similar responses were given for distraction from their device as students reported that they might go off-task if the teacher did not enforce laptop use for specific activities. Some students also explained that they felt they would work more productively and on-task if they were cut off from off-task websites or laptop use altogether when the laptop was not explicitly required. Interestingly, the points raised by students for ways to increase laptop advantage must come from an external source. The onus for restriction and enforcement of these rules would reside with the individual teacher and not the student. It is conceivable that students at this age do not believe they have the self-control to minimize the temptations of distraction.

On the other hand, some students reported a more positive approach to making laptops more beneficial in class – through the use of better engagement. A number of researchers have investigated the advantages of laptops use in terms of improvement of engagement and found similar results (Barak et al., 2006; Efaw et al., 2004; Gaudreau et al., 2014; Grimes & Warschauer, 2008; Kay & Lauricella, 2011a, 2014; Weaver & Nilson, 2005). Students explained that if laptops were better integrated into the lesson, through activities (independent, in small groups, and as a class) that it would serve a more succinct educational purpose. In fact, some students even proposed the creation of applications and software to enable better engagement and prevent off-task tendencies. The students'

instincts are consistent with research on laptop use in higher education. Barak et al. (2006), Kay and Lauricella (2011a), Weaver and Nilson (2005) all reported that laptops helped to improve student learning when sufficient structure and meaningful use of laptops was used. Likewise, Gaudreau et al. (2014), Kay & Lauricella (2011a), and Lindroth and Bergquist (2010) explained that students found they were able to research concepts and terms and have access to other academic resources more easily through the inclusion of laptops in class.

Better engagement of laptops in class could be related to subject area and instructional method also. If a teacher decides to use laptops in a productive and meaningful way in a subject area where student do not always find laptops helpful, there is the possibility of an increase in student on-task behaviours. Kay and Lauricella (2014) argued a similar point, and proposed advantages, may in part relate to the quality of instructional method being used. Some students also reported some of their teachers not actively using laptops in the class – from the students’ perspective – because the teachers felt that laptops were a distraction or even that they were uncomfortable with using the technology in class.

5.5.2 Minimizing Distractions

Students were asked how they could make laptops less distracting in class and, consistent with the maximizing advantages responses, 65% reported that more restriction, surveillance, and monitoring was needed. It is interesting to consider that despite the numerous student comments about the advantages of having laptops in class, removal of laptops was posed as a solution to minimizing distractions. Students explained that restrictions could come in the form of firewalls and filters to block off-task sites, limitations

on when laptops could be used in class, and even turning off the Wi-Fi altogether. Research on laptop implementation and management ideas and is divided on using a structured approach, restrictions, and outright banning (Fang, 2009; Kay & Lauricella, 2011c; Skiba, 2011). For example, Kay and Lauricella (2014) advocated for more meaningful inclusion and use of laptops in class as part of the lesson to limit distractions. On the other hand, Bonifaz and Zucker (2004) argued that firewalls should be in place to prevent students from engaging off-task and inappropriate websites during class. Finally, Efaw et al. (2004) recommended that teachers specify times when laptops should not be used (during specific activities such as lectures and movies) or to have the lids down.

Some students explained that the use of surveillance (17% of all responses) through monitoring software, greater teacher awareness, and one humorous reference to a “7-11 anti-shoplifting mirror at the back of the room” would also help to curb distraction in a class by ensuring everyone was on-task. Efaw et al. (2004) likewise advocated for a stronger teacher presence to monitor the goings on in the classroom.

On the other hand, nearly 20% of students reported that a change in the lesson or the teaching style could help reduce distractions on the laptop in class. Students explained that if lessons were more engaging, interesting, and interactive, they might not engage in off-task activities as often.

Several researchers have explored the impact that distraction can have on students in class using laptops in order to propose methods for improving advantages (see for example Aguilar-Roca et al., 2012; Fried, 2008; Judd & Kennedy, 2010; Lord, 2004), and the responses from the students seem to align with this research. However, further research is

needed to discern what specific laptop-based activities students would be beneficial and limit distractions during class.

6. Conclusions

6.1 Summary

Key results from this study indicated that 80% of students reported being on-task in class, and about two-thirds of students believed that access to information online was the most significant advantage of laptop use in class. Email and surfing the web were the most frequently reported off-task laptop activities students engaged in, while IMing and gaming were the least. Regarding factors influencing off-task behaviours, social studies and language courses were considered the most helpful to students for using laptops in class, primarily because of the requirement of note-taking and writing. About half of the students reported not being distracted by their peers' laptop behaviours during class. In terms of instructional method, independent work was the most frequently cited reason that led to laptop-related distraction and student presentations the least. Ways to increase advantages of laptop use, as reported by the students, included restriction and enforcement, and more meaningful use of laptops (44% of all responses). Finally, gender differences in laptop behaviours were evident, with females significantly more engaged in on-task activities than males. Females significantly engaged in social media more than males, but males engaged in gaming significantly more than females.

6.2 Educational Implications

There are at least four educational implications noted after this research was completed, each has been outlined below.

First, a majority of students reported being on-task while using their laptops during class indicating that laptops may be beneficial for learning in a secondary-school

environment. However, engagement in specific off-task activities by students are important to note as they can impede student learning. Based on feedback from students, restrictions, structure, and meaningful use could help to limit off-task laptop behaviours. The implication is that teachers need to consider pedagogy, and specifically, the way laptops are going to help the students meet learning goals.

Second, subject area appears to have some effect on student laptop behaviour; however, based on responses from students, laptop use seems to be more superficial in nature through note taking and web searches. The superficial use can be seen with social studies and language courses as student responses indicated that they found using their laptop most helpful in these courses, than in math or science, for note taking. This is an important educational implication to note as teachers need to concentrate on how students will use their laptops to achieve their learning goals.

Third, instructional method also seems to have an effect on student laptop behaviour. Unlike subject area, instructional method can more directly impact student laptop behaviour while in class. Surprisingly, when students think they are being monitored, they will use laptops more effectively. Perhaps students in this age group may not have the self-control required to use laptops in class. The educational implication then is that more structure and restrictions need to be applied to ensure that students are engaging in on-task laptop behaviours. Another implication is that teachers need to understand when students will be distracted, mainly during independent study and group work. Teachers will need to ensure that during those specific times, the activities need to be well structured and meaningful to the students to negate distraction and off-task behaviours.

Lastly, there is an educational implication related to gender differences as indicated by this research. While of course a teacher should not selectively enforce restrictions for one gender over another, the implication may be more significant to single-sex schools. For example, teachers of male-only schools should be aware of male engagement in gaming on laptops while teachers of female-only schools should be aware of female engagement in social media on laptops.

6.3 Limitations and Future Research

At least seven limitations are evident from this research and outlined below, as well as suggestions for future research to meet these limitations.

First, one of the limitations of the research is the use of only one data collection method, the online survey. The scale for this studies was a modified version of Kay and Lauricella's (2010) Laptop Use Scale. Future research should include multiple data collection methods to help gain further insights into what students do on their laptops in class, and the benefits and challenges associated with laptop use.

Second, while the questions on the survey used semantic scales and open-ended questions, there is still a limitation on the depth of information that can be provided by the participants. Future research studies might use focus groups, interviews, and/or external observation to discern more rich detail and context into the topic. External observation could also occur through monitoring software in order to ascertain the specific actions of participants.

Third, there are a few possible limitations related to data collection in the scale used in this research. The focus of this research was primarily on disadvantages, though a future scale should look at multiple advantages to understanding why computers are

advantageous to students in class. For example, aptitude for using laptops could also be included as a measure, possibly as it may relate to factors influencing off-task behaviours. If a student feels more comfortable with using a laptop in class, they are more likely to use it effectively for learning. Conversely, if a student does not feel comfortable with using a laptop, they may be more likely to engage in off-task laptop behaviours instead. Laptop aptitude could then be a valuable measure related to student laptop use.

Fourth, while it is clear that there were differences within subject area, it is not clear why this is evident. It became apparent from student responses that students were primarily using their laptops in a superficial manner; several responses indicated notetaking and web surfing as the main uses of laptops in class. As a result, laptop use in courses that tend to rely on note taking, such as social studies and languages, were reported as more helpful compared to courses such as mathematics and science. Future research should include interviews with the teacher, documentation of the methods being used, and closer linking of what is being done in the class with how the laptops are used.

Fifth, as the research also explored instructional methods, it would be prudent to investigate class-by-class differences. For example, while all classes for a specific subject will most likely have the same content and assignments, it is unlikely that the instructional methods used by the teacher in each class will be the same. It is important then for future research should include more qualitative data, as well as clearer documentation, to understand the relationship between instructional method and student laptop-based behaviour.

Sixth, another possible limitation of this research stems from the population examined. The sample size is relatively small and lacked diversification – all students came

from affluent private schools. Results from public schools that use laptops in class could be significantly different due to larger classes and more diverse population. It is also worth noting that there is an assumed honesty in the students' answers. For example, there might be a social desirability on the part of the students to be seen to be on-task. Thus, future research should include more varied populations in the sample to discern results that are more reflective of the population as a whole.

Lastly, related to the sample population is that only students were a part of this research. This poses a limitation due to the lack of inclusion of teachers and their input as to what they find successful and unsuccessful about laptop use in class. Teachers would be able to share valuable details and context as to their pedagogy used in the classroom, and how that may affect student behaviour and engagement through various instructional methods and laptop-based activities implemented. Thus, future research should include teachers of laptop-based programs, as well as participants from more socially diverse populations.

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Appendix A – Student Online Consent/Assent Letter

Introduction

My name is Daniel Benzimra and I am graduate student in the Faculty of Education at the University of Ontario Institute of Technology (UOIT) in Oshawa, Ontario.

My thesis research focuses on the activities and behaviours that secondary students engage in on their laptop/digital device within a laptop stream program. I am looking at what students are actually doing on their laptops during class time; are they engaged in on-task activities such as taking notes, or are they engaged in off-task activities such as Facebook.

Of particular interest to me is the affect that said off-task behaviour, whether multitasking or not, has on the other students in the class. Are students being distracted and thus being taken away from the learning or instructions provided by the teacher?

Activity

You (or your child) will be asked to participate in an online survey (hosted on surveymonkey) on their activities on their laptop/digital device during class, as well as outside of class. This survey should take no more than 10-15 minutes. This survey will be completed on their own time.

All students who participate in the survey will have an opportunity to win one \$50 gift card (of the winner's choosing) through a random draw at the end of June 2015. In order to be considered for this \$50 gift card, please answer the voluntary email question at the end of the survey. Collection of this email address will only be used to notify the winner, after which time, all emails addresses will be deleted permanently.

My research and findings will be shared with the teacher, principal, school board, and UOIT. While the information will be shared, your (or your child's) marks will not be affected, nor will you (or your child) be identified in any way.

Participation is completely voluntary in completing this questionnaire - at any time should you wish to stop, you may exit the survey. You (or your child) will not be able to withdraw your responses from the questionnaire once you have submitted the completed questionnaire. However, no identifiable information is being asked of you (or your child) on the survey (such as your name, address, or other contact information), nor will it be possible to connect you (or your child) with any set of responses. If you choose however to enter the random draw for the chance to win one \$50 gift card (of the winner's choosing), you must provide an email address to be contacted by. You will not be contacted with this email address unless you are selected as the winner. All email addresses collected will be immediately deleted after the random draw has taken place (end of June 2015).

Your (or your child's) name will not be used in the thesis, nor will it be identifiable

anywhere else. A pseudonym will be used if a name is necessary. All of the research will be stored on an encrypted flash drive that will be kept on me at all time. The flash drive will be stored in a locked safe at my home during the rest of the time. This research will be kept for 7 years.

Agreement

Parent/Guardian Consent

By selecting "I agree (Parent/Guardian)" at the bottom of this page, you are agreeing to the following: I hereby consent for my child to fully participate and engage in the research as outlined in this letter for the graduate thesis to be completed by Daniel Benzimra. This represents informed consent in which all of the risks and benefits have been explained, as well as the specific activities to be engaged in by my child. I further understand that the participation of my child in this research is not mandatory and I may request that my child not participate in the research at any point in time by simply exiting the survey.

By consenting to participate in the research, I do not waive any legal rights or recourse.

Student (18+)

By selecting "I agree (Student 18+)" at the bottom of this page, you are agreeing to the following: I hereby consent to fully participate and engage in the research as outlined in this letter for the graduate thesis to be completed by Daniel Benzimra. This represents informed consent in which all of the risks and benefits have been explained, as well as the specific activities for me to be engage in. I further understand that my participation in this research is not mandatory and that I may no longer participate in the research at any point in time by simply exiting the survey.

By consenting to participate in the research, I do not waive any legal rights or recourse.

Student Assent (under the age of 18)

I have had a chance to read and discuss the letter of consent that my parent/guardian just assigned above. I agree to participate in this research, and understand that even if I consent now, I may withdraw without any penalty at any time by simply exiting until the survey is submitted.

By consenting to participate in the research, I do not waive any legal rights or recourse.

Appendix B – Student Survey

Demographics

1. Age?
2. Gender?
3. Grade?

On-Task Activities

4. How often do you engage in on-tasks activities during class? (Never, Almost Never, Rarely, On Occasion, Sometimes, Often, Frequently, Almost Always, Always)
5. In your opinion, what are the benefits of using laptops in the class?

Off-Tasks Activities

6. The following questions ask about your activities on the laptop during class. (Never, Almost Never, Rarely, On Occasion, Sometimes, Often, Frequently, Almost Always, Always)
 - a. Email
 - b. Instant message
 - c. Social media/networking
 - d. Play games (online/offline)
 - e. Surf the web

Factors that Effect Off-Task Behaviour

7. How helpful is your laptop in the following subject areas? (Never, Almost Never, Rarely, On Occasion, Sometimes, Often, Frequently, Almost Always, Always)
 - a. Language course (e.g. English, French)
 - b. Math course
 - c. Science course
 - d. Social studies course (e.g. history, law)
 - e. Other (please specify)
8. In a given class, how often are you distracted by another student's laptop activity? (Never, Almost Never, Rarely, On Occasion, Sometimes, Often, Frequently, Almost Always, Always)
9. In a given class, how often are you distracted and start using your laptop when the following instructional methods are used? (Never, Almost Never, Rarely, On Occasion, Sometimes, Often, Frequently, Almost Always, Always)
 - a. Lecture
 - b. Independent work
 - c. Group work
 - d. Student presentation

Maximizing Benefits and Minimizing Distractions

10. How could you make laptops less distracting in class?
11. How could you make laptops more beneficial in class?