

# Digital Distractions in College Classrooms and Its Impact

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University campuses have progressively been equipped with technology. In fact, the presence of technology on university campuses is expected to be increasingly noticeable, as many universities are undergoing digitization processes. Students use many different types of technological devices and software applications during academic activities. Any stimulus or information that diverts an individual's attention from the main task at hand is considered a distractor. Distractors affect the human ability to concentrate and have an external (noise, movement, etc.) or internal (thoughts, feelings, etc.) origin.

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## 1. Introduction

Today's children and teenagers have grown up in classrooms where the use of different applications such as Classcraft, Code.org, Educaplay, Kahoot!, Genially, Pixton, RPGplayground, Storyjumper, among many others (e.g., <sup>[1][2][3][4][5][6][7]</sup>), was commonplace. Teachers and students of all educational levels are comfortable with technology, and devices and apps are commonly used to plan and develop learning activities. Our education system cannot do without technology <sup>[8]</sup>. Moreover, in general terms, the isolation during the COVID-19 pandemic and subsequent social distancing guidelines have increased the use of technology by instructors and students.

The presence of technology in classrooms opens the door to a huge range of opportunities that would not otherwise be possible. With the help of technology in the classroom, many educational benefits can be achieved. These benefits include inclusion (e.g., using assistive technologies for students with dyslexia, attention-deficit/hyperactivity disorder, or visual impairments), student engagement, facilitating instructor-student and student-student interactions, and creating interesting learning opportunities (e.g., <sup>[9][10][11][12][13]</sup>).

In addition, technology allows for a more sustainable and universally accessible educational model in many ways, including: (1) facilitate access to education, (2) reduce costs, (3) reduce carbon emissions and environmental impact, (4) enable personalized learning, and (5) increase collaboration. Technology can enable access to education for students who are unable to attend traditional education programs for many reasons including geographical or financial constraints. Online courses and virtual campuses can reach students in remote locations or those who cannot afford to attend a physical institution. Moreover, by using technology, educational institutions can reduce costs associated with physical infrastructure, transportation, and paper-based materials (printing). This promotes sustainable resource usage. Technology can also help reduce carbon emissions and other environmental impacts associated with traditional educational models. In doing so, technology can help educational centers become more environmentally sustainable. Technology can enable personalized learning, which allows students to learn at their own pace and according to their own preferences. This can reduce student dropout rates and make learning more sustainable over time. Technology can enable collaboration between students and professors from different parts of the world, fostering a more diverse and sustainable learning environment. By enabling international collaboration, technology can help students develop a global perspective and learn about sustainable practices in different cultures. Overall, technology can enable a more sustainable educational model by increasing access, reducing costs, and minimizing waste. By leveraging technology, educational institutions can promote sustainability and ensure that education is accessible to everyone, regardless of their location or financial situation.

Technological devices, including smartphones, tablets, and laptops, are ubiquitous on university campuses and in university classrooms. Most university students bring one or more of these devices into the classroom (e.g., <sup>[14][15][16][17]</sup>). College students apparently use these digital devices to take part more appropriately in learning activities. However, digital devices can also hinder the learning process by making distracted students think that they can multitask without affecting their academic performance. In fact, technology has brought a paradox into students' lives: technology helps

them participate in learning activities, but technology is also a source of distraction from getting their tasks done. Nevertheless, eliminating technology from classrooms to prevent digital distractions would generate inequalities between students with and without access to technology outside the classroom. In addition, digital illiteracy could increase among the youngest learners <sup>[8]</sup>. For these reasons, it is important that both professors and students make appropriate use of technology so that its use in education is sustainable and can be maintained in the long-term.

## **2. Necessity and Challenges of Sustainable Digital Uses in College Classrooms**

There are different reasons and motivations for students to bring computers to university classes, including personal preference and the desire to use them for notetaking or information research <sup>[18]</sup>.

Many professors are adapting their methodologies to incorporate the use of technology <sup>[19]</sup>. The use of technology on university campuses means that professors must face new and demanding challenges. Instructors must be technologically skilled, and able to efficiently integrate the use of technology into methodologies and into the learning activities planned. This is of vital importance for the use of technology to be sustainable in the long-term. In <sup>[20]</sup>, the authors researched perceptions of Iranian English professors and other foreign languages college professors on using technology. These researchers confirmed that technological literacy was one of the main concerns of the instructors.

Therefore, it is important that professors accept the challenge of incorporating the use of technology in the classroom and dedicate time and effort to face this challenge successfully. Some scholars have researched how university professors acquire the knowledge and skills necessary to use technology in the classroom, finding that this process happens in many ways (e.g., <sup>[21]</sup>).

Monitoring students' use of technology during their work is also very important and necessary for a sustainable use of technology in the long-term. In <sup>[22]</sup>, the authors note that laptops are widespread in university classrooms and that, although they are a valuable tool, they allow students to be distracted by the Internet. So, it is important to guarantee that students are not getting distracted by using technology for off-task purposes.

## **3. Digital Distractions in College Classrooms**

Students frequently multitask during academic activities <sup>[23]</sup>. Although some think that multitasking is synonymous with efficiency, there is evidence that most students find multitasking to be very distracting (e.g., <sup>[24]</sup>). In fact, there are many researchers who have conducted studies dismantling the digital native myth (e.g., <sup>[23][25][26][27][28][29][30][31][32][33][34]</sup>). Contemporary research has demonstrated that the ability to multi-task does not exist. Activities take longer for students due to the time spent on distracting activities and the extra effort involved in getting back on task <sup>[35]</sup>. Attending lectures and engaging with digital technologies for off-task purposes at the same time has a negative impact on students' learning outcomes and academic performance. Students who regularly multitask for off-task purposes do not perform their academic tasks as well as those who only focus on their work. If the student's academic performance is affected, this situation will not be sustainable over time since it would mean a significant deterioration of the learning process and its results.

This is consistent with the cognitive bottleneck theory of attention, the selective attention theory, and the cognitive load theory.

The cognitive bottleneck theory of attention focuses on the limitations of attentional processing, suggesting that attention is a limited resource and that there is a bottleneck in information processing that limits the amount of information that can be processed at any given time. The theory suggests that this bottleneck occurs at the level of working memory and that the attentional selection process helps to prioritize and filter incoming information <sup>[36]</sup>. Digital distractions can easily overwhelm our attentional system, leading to reduced attentional resources for other tasks. Despite the capabilities offered by cognitive control, humans have a limited capacity to carry out several control-dependent processes simultaneously <sup>[8]</sup>.

The selective attention theory focuses on how attention is selectively directed towards certain stimuli while ignoring others. This theory suggests that attentional selection is necessary to focus on relevant information and ignore irrelevant information. According to this theory, the brain has limited resources and must selectively allocate attention to important information to avoid overload <sup>[37]</sup>. The presence of technology and associated distractions can make it difficult for students to exercise selective attention and cause them to lose focus on important tasks.

The cognitive load theory focuses on the limitations of working memory and suggests that there is a limit to the amount of information that can be held and processed in working memory at any given time (e.g., [38][39][40][41][42]). The constant presence of technology and associated distractions can increase students' cognitive load, which could interfere with their ability to process and retain information.

In [43], the authors give a very visual and revealing description of a university classroom as a place where all heads are tilted towards a flickering screen. Digital overload is a common problem today. Students are constantly bombarded with messages and alerts on their laptops, tablets, and smartphones, which makes focusing on their tasks difficult for them. So when students are tempted to procrastinate, distractions and diversions are only one click away.

According to the social learning theory, a student's learning is influenced by their social environment [44]. Technology can create a culture of distraction in which students feel pressured to be constantly connected and distracted by incoming notifications and messages. This culture can cause students to lose their ability to focus and maintain their attention on a specific task. Additionally, the situated cognition theory asserts that knowledge is closely linked to the context in which it is acquired [45]. If students are constantly exposed to technology and distractions, they may be less likely to remember specific information because they are not connecting this knowledge with a meaningful context.

## **4. Impact of Digital Distractions in College Classrooms**

When it is digital technology that diverts an individual's attention away from the primary task being done, it is referred to as a digital distractor (e.g., [46][47][48]).

Some instructors think that a student can only be distracted by another student. However, many of the interruptions that students experience are caused by their technological devices. In fact, an important number of researchers (e.g., [8][49]) remark that many classroom situations can be distractors, and that some of these distractions are caused by technology including email, instant messaging apps, social networks, and games.

There are several reasons why monitoring technology use and managing distractions is important for long-term sustainable and effective technology use, including: (1) improved concentration, (2) healthy habits, (3) better time management, (4) reduced cyberbullying and misuse, and (5) improved learning outcomes. Distractions, especially those resulting from technology, can hinder a student's ability to focus on their studies. By supervising technology use and minimizing distractions, students are more likely to focus on their studies, leading to improved academic performance. In addition, excessive use of technology can lead to addiction and harmful habits, which can negatively affect physical and mental health. Professors can help students to learn healthy habits for using technology in a sustainable way. Unsupervised technology use can lead to wasted time and reduced productivity. By supervising technology use, professors can help students manage their time effectively, and teach them to use technology in a way that supports their learning goals. Unsupervised technology use can also lead to cyberbullying and other forms of harmful behavior. Supervising the use of technology can reduce the risk of this type of behavior and promote a safe and respectful online environment. In addition, by monitoring technology use, professors can ensure that students are using technology in ways that enhance their learning experience. This includes the use of technology for research, collaboration, and other educational purposes. Overall, monitoring technology use and managing distractions are crucial to sustainable and effective use of technology in education. By promoting healthy habits and minimizing distractions, professors can help students use technology in a way that supports their academic success and overall well-being.

In [50], the authors have identified three different lines of research regarding digital distractions and their consequences. Firstly, some researchers have focused on providing insight into what students do when they are using their technological devices for off-task purposes during academic activity (e.g., [22][51][52][53][54][55][56]). Secondly, some scholars have researched the negative consequences of digital distractions on students' learning outcomes and academic performance (e.g., [43][57][58][59][60][61][62][63][64][65]). Finally, some researchers have focused on identifying digital distractions' determinants, for example, gender or age, and the extent to which these determinants influence digital distractions (e.g., [66][67][68][69]). Some of these studies and surveys are briefly described below.

Regarding the research on the use of technology for off-task purposes, the authors in [52] tried to identify the types of applications commonly used by students in class, and their reasons for doing so. Results showed that students regularly used technology for a variety of non-academic reasons, and that text messaging and email were the most commonly used applications.

The study conducted by the authors in [53] found that during class, university students often engaged in using online communication, online photo sharing, and online information seeking, among other usages.

In [54], the author asked college students about their perceptions regarding the use of digital devices for off-task purposes during lessons. Students reported an average use of technology for off-task purposes of 10.93 times per day, and 80% of them admitted that this behavior distracted from their duties and tasks.

In [55], the authors used in-class observations and surveys to analyze the use of laptops by students. These authors observed changes in computer use during an unmonitored 165-min class without restrictions. Student reports provided similar information on laptop activities as were provided by the observations. Notetaking and social media websites were the most common uses of laptops. The data showed that students spent almost two thirds of their time on off-task computer activities. It is also remarkable that students' engagement in their tasks had great variations throughout the class.

Regarding the negative impact of digital distractions on students' learning outcomes and academic performance, the experimental study conducted in [57] demonstrated lower performance in a lecture quiz of those students who did off-task text messaging during the lecture versus those who did not.

Moreover, the research presented in [22] showed that the class performance of students who brought laptops and frequently used Internet for off-task purposes was affected negatively.

On their side, the experiment presented in [59] showed that divided attention between technology and a lecture did not have a negative impact on the comprehension of this lecture but significantly reduced long-term retention of the lecture. Results were measured through a within-class quiz and unit and final exams performance, respectively.

The experiment described in [61] on the use of mobile phones in a classroom revealed that message creation unrelated to a class lecture negatively impacted students' learning outcomes.

In [63], the author explored students' disordered use of technology. His study remarked on different types of digital inconvenience, ranging from short interruptions to the ways in which technology was significantly diminishing students' work.

In terms of determinants influencing digital distractions, the research presented in [67] showed that impulsive individuals are more prone to digital distractions, and that habitual use of technology is the strongest determinant of digital distraction intensity. In fact, according to these authors, the intensity of digital distraction is determined by an individual's Internet addiction; i.e., Internet-addicted students are more prone to digital distractions during academic tasks.

In [69], the authors examined how media multitasking affects students' social and psychological well-being. They found that media multitasking involved different behaviors with differing effects (null, negative, and positive) on students' perceptions of psychological and social wellbeing.

It is also important to remark that students' classroom technology use for off-task purposes can distract their peers and negatively affect the learning outcomes of neighboring students. This was demonstrated in the experiment conducted by the authors in [17] where students scored better on post-conference questions about contents covered while neighboring students were on-task note taking than on those questions about contents covered while neighboring students were off-task web browsing, irrespective of where they sat in relation to the classmate.

Keeping students motivated, thinking, doing activities, and far away from boredom are the best ways to prevent digital distractions [70]. In fact, research has revealed that students' attention increases during and immediately after a change in behavior or pedagogy of the instructor (e.g., [71][72]). However, even considering that student involvement and active learning are key to overcoming distractions, distractions remain present in a significant way.

Finally, it is also interesting to notice that a bit of cyberloafing as leisure can be positive when performed moderately as a means of recovery outside the classroom. In the study presented in [65] involving 1050 undergraduate students at a large Chinese University, the test results showed a negative relation between academic performance and media multitasking in class. However, the relationship between academic performance and cyberloafing out of class was inverted U-shaped.

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