

# **24/7 Connectedness and its Potential Impact on Today's Physics Students: Technology Use, Multitasking, and GenMe**

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**Abstract**—There is no question that the digital age is upon us. For many of us, the transformation to the digital age has been gradual; and, most often, welcomed. In the classroom, we have developed many useful and innovative applications technology-based pedagogies. Outside of the classroom, we use routinely rely on technology to communicate with our students. However, not all of us grew up with 24/7 access to information that the internet and today's technologies provide. Perhaps the impact of technology on those of us that teach is a bit different from the impact on our students. Many of our students today are members of the millennial generation, which is sometimes referred to as Generation Me (GenMe). Members of GenMe have literally grown up with technology and the instantaneous availability of information right at their fingertips. Computers, smart phones, iPads, and other technologies offer their users immediate access to information. Might these technologies be seen as a significant distraction to whatever the task at hand might be? Could these distractions be to blame for the perception of many in GenMe that they must multitask in order to get everything done? Might instant access to information be casting a cloud on student learning? If so, does this cloud have a silver lining? This paper addresses these and other questions through the use of a survey given to students in a second-level physics course in spring 2016. Results reveal that nearly all students feel the need to maintain this 24/7 connection using their smart phones. The impact that this level of connectedness may have on our students will be discussed.

**Keywords**—Digital age, millennials, multitasking, student learning in physics

## **1 Introduction**

Many of us have become reliant on our computers and smart phones to get through our daily routines. In fact, it is safe to say that many of us feel we couldn't do our jobs or function efficiently without these devices. We communicate with each other via

email, we look up definitions to words using an online dictionary, and we make restaurant reservations all with the push of a few buttons on a computer, smart phone, or other electronic device. For tasks such as these, our electronic devices come in very handy and save us precious time. The fact that these devices save us time and allow us to be more efficient is a perception many of us hold. But we must ask ourselves, are these devices actually encouraging us to tacitly multitask and hence actually reduce our overall efficiency?

Let's begin to address these questions by considering the following short example. While reading the morning news online (and perhaps enjoying a cup of coffee or tea) we come across an unfamiliar word. We immediately toggle between the news source and a Google search to look up the definition of the unfamiliar word. We instantaneously find the meaning of the word and toggle back to reading the news. As we do, we are distracted by the sound of a soft beep. This beep is our computer telling us we have some new unread emails in our inbox. We immediately toggle to our inbox to check these new messages. Some of these emails are work-related, some are from friends or family, some are connected to various messengers on social media, and some are unwanted spam-type messages from advertisers and the like. It takes us a few minutes and then we are again back to reading the online news. Within this short span of just a few minutes we found ourselves reading the news, looking up the definition of a word and then reading through several new emails. We have been distracted and encouraged to multitask, and we haven't really started our day yet! Without even realizing it, most of us multitask on a routine basis, for better or for worse. This is but one small example of how we have all become creatures of the digital era. We are bombarded with constant and overabundant information that comes to us in small sound bites or snippets literally every waking hour of the day. While many of us can turn off our devices and walk away from them, others feel an obligation to be plugged in all the time. This perceived need to always be plugged in is particularly true for many members of GenMe.

## **2 Relevant Literatur**

GenMe has received quite a bit of attention in recent years, and not all of it has been positive. These millennials are often described as being very self-focused and individualistic. It's not their fault. They have been showered with messages received from the media, their schools, and their parents that have all told them just how special they are. And they believe this message with an enormous amount of self-confidence [1]. This is not to say that the millennial is spoiled, but perhaps that they have been over-indulged in some respects. Twenge argues that many young people today have to overcome many challenges that previous generations did not have to face. These challenges include huge educational debts and an increasingly competitive job market upon graduation. It is perhaps the perception of many millennials that they find themselves in positions where they are being asked to do more than previous generations were asked to do, but have less resources at their disposal to do so.

But just who are the individuals that make up the millennial generation? While there are not firm generational cutoffs, the millennial generation typically refers to the current generation of young people, born in the 1980s and 1990s. Many titles have been given to this generation including Millennial, Generation Y (GenY), Echo Boomers, 24/7's, Generation Me (GenMe), and the iGeneration. For this paper, these titles referring to the millennial generation will be used interchangeably. As Twenge suggests, the use of the letter "i" could represent many things including the internet or the individual. Other generational references include those to the Baby Boomer generation (roughly those born between 1946 and 1964) and Generation X or GenX (roughly those born between 1965 and 1980). Those in GenX have also been referred to as Post Boomers, the 13th Generation, and the Doer's, among others.

Because GenMe has been given the message over and over again that they are special, this has perhaps caused this generation to be tagged as one with an over-inflated sense of self-worth and self-admiration. For example, Twenge and Campbell note that in America, the focus on self and self-admiration has been successful in raising people's opinions of themselves [2]. They note that in fact, self-esteem is at an all-time high. The caveat here is as Twenge and Campbell suggest; namely, that the good intentions behind self-admiration sometimes blur the line between it and narcissism. In a 2008 study involving a meta-analysis of the Narcissistic Personality Inventory (NPI), Twenge and Foster discovered that the move toward self-admiration has what they refer to as a dark side [3]. Overall, their results showed a marked increase in levels of narcissism in college students in the 2000s (GenY'ers) as compared to Baby Boomers and GenX'ers. In fact, as their study showed, the upswing was particularly steep between 2000 and 2006. These researchers note that over the last few decades, "narcissism has risen as much as obesity" [3, p. 31].

One of the significant cultural influences on those in GenY is that this group of individuals is the first to be born into and to have grown up with the internet and other technology-based tools. These tools include much more than those just used for educational purposes. Both in and out of the classroom, GenY'ers are constantly finding themselves connected to these tools through such venues as the media (in general) and through social media applications such as texting, tweeting, Instagram, Facebook, etc. This constant bombardment and access to various media applications is the norm for GenY. In fact, many don't realize that they are as plugged-in as they actually are. Being constantly plugged-in also provides this group of young people with numerous distractions, literally 24/7. As a result, GenY'ers routinely find themselves in front of a digital screen and constantly presented with the need to multitask, whether consciously or subconsciously. Could this constant bombardment of information be too much for an individual to consume in a given setting? Is multitasking really a choice young GenY students have or is it something they do because they feel they have no other option?

It is common for most college students today to possess both a laptop computer and a smart phone. In addition, many of these students bring both of these devices to class with them on a regular basis. As educators, many of us may agree that it is highly distracting for us when students are multitasking on their laptops and/or smart phones. But what impact does this have on our students?

A study conducted in 2010-2011 by Awwad, Ayesh, and Awwad at the United Arab Emirates University concluded that laptops were a definite distraction in the classroom [4]. While some of the study's participants used their laptops for academic purposes, many did not. Thus, students were essentially multitasking as they toggled back and forth between some non-academic activity on their laptops and the presentation in the class they were attending. This multitasking served as not only a distraction for themselves, but also for their classmates. Sana, Weston, and Cepeda also report that laptops pose a significant distraction to both users and their fellow students [5]. Using a simulated classroom, these researchers observed and examined the effects of laptop use in the classroom on student learning. Their results showed that lower test scores resulted for both participants that were multitasking using their laptops during class as well as for their classmates who were in direct view of the classmate that was multitasking. So there is a direct negative impact on the test scores of other students who are themselves not participating in multitasking with their laptops. The Sana, Weston, and Cepeda study suggests that simply sitting nearby someone who is multitasking can cause enough of a distraction to cause a decline in academic performance for the non-multitasking student.

Because GenY is the first generation to have instant access to all kinds of information, some have referred to them as high speed stimulus junkies. This connotation has to do with the fact that digital information is essentially available instantaneously. One might even use the analogy of a tornado – where in the midst of a tornado high winds are constantly flinging material and debris around, whether one likes it or not. In fact, recent studies have suggested that a new form of addiction, a digital one, is causing serious health-related concerns for individuals within this generation [6 – 7].

The number of young people experiencing significant depression and anxiety-related disorders has also increased dramatically for those in GenY. This generation seems to be much more “stressed out” than previous generations. As part of her doctoral dissertation study involving data obtained regarding 40,192 college students and 12,056 children between the ages of 9 and 17 who had completed measures of anxiety between the 1950s and 1990s, Twenge found that when a person is born has more influence on one's anxiety level than one's individual family environment [8]. Her results revealed that students in the 1990s were 85% more anxious than those in the 1950s and 71% more anxious than students in the 1970s. Twenge also found that generational differences explained approximately 20% of the variation in anxiety, which was approximately four times more than that accounted for by the family environment. While it could be that students in GenY feel more comfortable sharing their feelings of depression and anxiety than those of previous generation, these results certainly give us cause for concern. Feelings of anxiety and depression don't go away when a student sits down to try and study for a class. Rather, they can be intensified and even exacerbated. The end result could be yet another impediment to learning, thus making students even more anxious and depressed.

Certainly not all GenY students are anxious or depressed, however the increases in those reporting problems related to anxiety and depression is alarming. While we might think that always being plugged in would be helpful, it has actually been shown to create feelings of loneliness which can then be linked to increased feelings of anxi-

ety and depression. We naturally must question what impacts these side effects of connectedness may have, not only on their well-being, but on their academic performance.

Can the fact that GenY is essentially almost always plugged also be linked to increases in distraction and the perceived need to multitask? While some individuals might feel a sense of empowerment by multitasking because they feel they are getting more done, studies have shown that this is not the case. Baron suggests that for most cognitive tasks, we simply cannot concentrate on two things at once and expect to perform as well as if we had completed each task individually. She further argues that “a cascade of multitasking studies continues to indicate that one of the major issues is interruption. The intrusive stimulus breaks our concentration on the initial task at hand, and performance on that task degrades.” [9, p. 218]. The bottom line is multitasking can slow an individual down and create distractions that effectively cause one to become sidetracked. Precious time is lost as one has to refocus their attention to get back on track to complete the task at hand. The example we used in our introduction is a case in point. While we might perceive that we are more efficient when we multitask, the research outlined above does not support this fact.

What are the potential links between being plugged-in and multitasking and how are they related to poorer academic performance; and, perhaps result in even greater feelings of depression and anxiety for some students? A study by Becker, et al, for example, investigated whether media multitasking was a unique predictor of depression and social anxiety symptoms [10]. The study involved 318 participants that were asked to complete measures of their media use, personality characteristics, depression, and social anxiety. Their analyses revealed that even after controlling for overall media use and the personality traits of neuroticism and extraversion, higher depression and social anxiety symptoms were associated with increased levels of media multitasking. While issues related to depression and anxiety are not formally addressed in the present study, we feel it is important to talk about them. These issues are very real and should not be ignored.

Some of the questions that provide the framework for the present study include: What role, if any, does the internet and the constant barrage of information often incurred through multitasking have on the current generation of young GenY learners? Do internet and technology-based distractions that often go hand-in-hand with multitasking serve to impede learning? In this paper we will limit our focus to issues related to technology use, and distractors that surface with the use of technology effectively causing a student to multitask, whether intentional or unintentional. Student perceptions regarding these distractors and their potential connections to student learning will be discussed.

### **3 Focus of Study**

The present study was conducted in a second-level, algebra-based physics course entitled Light, Sound, Action (LSA) during the spring 2017. The 17 students, all millennials, enrolled in the course participated in the study. The primary focus of the

study was to determine whether these millennial students were positioning themselves, either intentionally or unintentionally, to be influenced by outside stimuli and distractors while they were studying. Through a set of anonymous questions, we asked students to respond to questions designed to elicit and uncover whether distractors were present which might, in turn, facilitate a perceived need to multitask while studying. The potential impact multitasking may have had on the students is also discussed. The subsections that follow provide a brief overview of the course as well as the background of the students enrolled.

### 3.1 Course Description

The spring 2017 semester represented the second time the course had been taught under this title. Previously, the course had been taught for 15 years under the title Physics for a New Millennium. The change in title was part of an overall rebranding of the course to appeal to a wider range of students.

LSA is taught in a workshop-style format. There is a significant body of research that suggests that learning in this type of interactive environment increases not only student motivation but also enhances student learning [11 – 19]. Within this active learning environment, students studied the concepts of sound and waves, electricity and magnetism, and light, color, and optics. Numerous hands-on activities were interwoven throughout the course. For example, in teams of 2 – 3, students performed activities dealing with physics topics such as the speed of sound in air, standing waves on a string, pendulum motion, electrostatics, electric circuit function and design, and motor-building. These collaborative-based team activities were referred to as *collabs*. Considerable emphasis was placed on teamwork and team building throughout all facets of the course.

### 3.2 The Students

The 17 students enrolled varied in class level from freshman to seniors. There were 9 women and 8 men enrolled. In terms of class level, the students ranged from the freshman to senior level (4 freshmen, 7 sophomores, 5 juniors, 1 senior). There was a wide-range of majors in this class. For example, several students were either audio production or audio technology majors. Others were concentrating on such areas as business administration, film and media arts, or law and society. A few of the students have declared their intent to pursue a minor in applied physics.

The section that follows highlights the data obtained during the spring 2017 semester. For the purpose of this paper, we focus on data collected through a questionnaire that relates technology use and potential distractors that might influence students both in and out of the classroom; and, simultaneously encourage multitasking.

## 4 Data Collected

The data presented in this section was collected via an anonymous questionnaire given to the students toward the end of the spring 2017 semester. Students were asked a total of 7 questions. The questions were designed to elicit responses that might shed some light on the role that technology use and distractors such as the students' smart phones might play in terms of student learning. Moreover, we were interested in learning whether these distractors served to encourage multitasking. If so, to what degree and what is the potential impact on the students?

The first question asked of the students was: *In general, what form of textbook do you use in your classes (hard copies, e-books, etc.)?* A summary of the students' responses is presented in Table 1. Because students responded anonymously to the questions, each student response is identified by number. Responses are presented verbatim.

**Table 1.** *Question 1:* What form of textbook do you use in your classes?

Student	Response
1	Usually hard textbook if I can afford it, otherwise a pdf.
2	Hard copies.
3	Hard copies.
4	Hard copies.
5	Hard copies.
6	Hard copies (mostly course reserves).
7	e-books.
8	I like hard copies.
9	Hard copies.
10	e-books.
11	Hard copies.
12	I scan the library textbooks and print it out or just work at the library.
13	Online books.
14	Hard copy that I scan for convenience – but I prefer hard copy.
15	e-books.
16	Hard copies.
17	This is the only class I've taken which uses a textbook, so a hard copy.

The intent of this question was to ascertain whether students were using paper or electronic copies of their textbooks. If students were using electronic copies, then this would mean that they were using their computers and hence have instant access to the internet. Thus, they might be more susceptible to distractors such as online apps and social media sites.

The second question asked of the students was: *How often do you use the internet instead of the textbook to answer a question?* A summary of student responses is presented in Table 2. The intent of this question was to determine whether or not students were going online to seek answers to their homework questions, regardless of

whether or not they were using a hard or electronic copy of the textbook. It is our position that if students were using a hard copy of the book, but still going online to try to find information to help them answer their homework questions, then they were potentially putting themselves in a position where they could more easily be distracted.

**Table 2.** *Question 2:* How often do you use the internet instead of the textbook to answer a question?

Student	Response
1	About 30% of the time (usually if I can't find an answer that I understand in the book).
2	Only when I absolutely can't figure out/fully understand the answer from the text.
3	Very often.
4	Very often, I would go to internet first.
5	Rarely, but if the textbook is not clear.
6	About 10% of the time.
7	Almost always.
8	I will look in the book first and then look online.
9	Once every ten questions/when I'm really stuck.
10	50% of the time.
11	20% of the time.
12	Rarely. I find the answers easier to understand and more accurate.
13	When it's an online textbook, often but if it's a physical textbook, not often.
14	If Blackboard is considered, then somewhat frequently. But book is very useful for homework.
15	25% of the time I use the internet, 75% of the time I use the textbook.
16	Never.
17	Very often.

One obvious distractor for many of us, and not just our students, is our smart phones. The third question posed to the students asked: *Does your smart phone play any role while you are studying?* The intent of this question was to uncover what role, if any, the students' smart phones might have played in terms of distracting them from the task at hand – namely, studying. Table 3 provides a look at the students' responses to this question.

The fourth question posed was: *Do you allow for outside stimuli from your phone or computer (social media, texting) while you are studying?* The impetus for this question was to uncover whether or not students allowed for outside distractions to impinge on their study time. We hoped to learn whether or not students were allowing distractions on a regular basis which would, in turn, necessitate multitasking. This data is presented in Table 4.



**Table 3.** *Question 3:* Does your smart phone play any role while you are studying?

Student	Response
1	Yes, I use it to play music on my speakers instead of my computer so I don't get distracted by music.
2	Only to play music.
3	I'll use my smart phone for looking up questions, and calculations.
4	Yes, sometimes I use it for calculations.
5	It is useful, not while studying, but in class when there is a concept I do not understand but I do not want to slow the class down I can use my smart phone to check on the concept.
6	Yes, to answer texts/messages; look up something quickly.
7	Yes, for quick definitions.
8	I use it as a study break.
9	Yes, as a distraction.
10	No.
11	I use my phone to quickly look up the definition of a word.
12	A distraction, sometimes a calculator.
13	Yes, to play music, look at messages.
14	It is my major distraction!
15	Distractions, and communicating with fellow students regarding class work.
16	Yes, listening to music or other distractions.
17	Just to play music or quickly Google something.

**Table 4.** *Question 4:* Do you allow for outside stimuli from your phone or computer (social media, texting) while you are studying?

Student	Response
1	Usually I can't avoid it, but it's mostly just to text my boyfriend while we both work if he's having a problem and/or to be moral support for each other.
2	I try to limit it to only music.
3	Yes, but I'll check texting only, just in case.
4	Yes, but I usually mute it.
5	No, I work with other students to avoid any want for outside stimuli.
6	I try not to but it always happens.
7	Only important calls (family).
8	Usually I like talking [sic] sets (like I will do a certain amount of problems before I reach for my phone).
9	Yes, but I try to cut down on it.
10	Music ... sometimes.
11	No.
12	Yes, I like being mildly distracted while I study.
13	Yes.
14	Yes, and I probably shouldn't.
15	Sometimes.
16	Sometimes, but I try to omit it.
17	I don't turn my phone off, but I don't check notifications.

It is perhaps quite obvious that most of us realize that if we are distracted by our smart phones while we are working, we are clearly not focusing our full attention on our work. We think that students understand this as well. When our smart phones vibrate or make a sound to signal that a new email or text message has just come in, it is perhaps natural to want to check to see what the message is. It’s also reasonable to assume that an average college-aged millennial probably gets a good number of such messages on any given day. The fifth question posed to the students was: *Do you use any applications on your phone or computer to regulate your study and break time?* By asking this question we wanted to see just how many students were taking action to intentionally turn away from distractors such as their smart phones. Student responses to this question are presented in Table 5.

The sixth question posed was: *Is your smart phone near you when you sleep?* While this question might seem to be a bit unusual at first, we thought it would be enlightening to see if students were tending to have their phones with them throughout the day and night. If so, these students would clearly be “connected” 24/7. Table 6 provides a look at what students said in response to this question.

The seventh and final question posed to the students was: *Would you give up your sense of smell to keep your phone?* As with the sixth question, this question might appear to be a bit peculiar, but we thought it might get at the issue of just how tied to being “connected” all the time the students were. The student responses to this question can be seen in Table 7.

**Table 5.** Question 5: Do you use any applications on your phone or computer to regulate your study and break time?

Student	Response
1	Yes, I have an app on my computer which blacklists certain distracting websites while I work.
2	No.
3	Yes, but I’ll check texting only, just in case.
4	No.
5	No.
6	No, I don’t normally regulate my time.
7	No, I just check the time.
8	No.
9	Yes, a pomodoro application on my computer.
10	No.
11	No.
12	No.
13	I just look at the time on them.
14	I use a planner (Google calendar).
15	No.
16	No.
17	No.

**Table 6. Question 6:** Is your smart phone near you when you sleep?

Student	Response
1	Yes, it's by my bed (it's my alarm in the morning).
2	Yes.
3	Yes, on my lamp desk, beside my bed.
4	Yes.
5	In the room, but not near me.
6	Yes, on the dock on my nightstand.
7	Yes, almost always.
8	My bed is next to my desk, and my phone is on the opposite side charging (I would need to get out of bed to grab my phone).
9	Yes.
10	Yes.
11	Yes.
12	Yes, but I put it on sleep mode.
13	Yes.
14	Yes.
15	Yes.
16	It's in the same room, but across the room.
17	Yes, I use it as my alarm clock.

**Table 7. Question 7:** Would you give up your sense of smell to keep your phone?

Student	Response
1	No, but I did consider saying yes, haha. My phone has a lot more significance this year than it ever has because my boyfriend lives out of state, so we've been long distance for a year.
2	No.
3	No.
4	Probably not.
5	Nope.
6	Yeah, I'm congested 90% of the time anyways, so I normally can't smell very well. Wouldn't be much of a loss.
7	No!
8	No!
9	No.
10	No ... my phone can't tell me if I am inhaling noxious gas ... on a good day, my nose might!
11	No.
12	Probably.
13	Probably.
14	No!
15	No.
16	No? What?
17	Yes, I don't really miss my sense of smell when I get sick, so I suppose so. Nope.

In the section that follows we provide a synthesis and discussion of the data presented here. In doing so, we have looked for possible emergent themes and common items that might distract students while studying. We were particularly interested in how technology-based distractors such as computers and/or smart phones might impact the students. While one could argue that there are always distractions – we main-

tain that students of millennial age are the first to experience these types of distractions on a regular, and literally, constant basis. Perhaps the students' responses will allow some light to be shed on what learning is like for the millennial student. In addition, we hoped to learn whether these distractions push the need for students to feel like they must multitask while learning. Given the fact that there does not appear to be any direct evidence in the research literature to suggest that anyone could successfully perform two different tasks better while multitasking than they could if they were performing each task separately, we feel the students' responses to these questions are critical, timely, and important.

## **5 Interpretation of the Data**

Our first question looked at the type of textbooks students tended to use in their classes – either hard copy or electronic. With the rising cost of tuition and books, faculty have been encouraged to consider using electronic books which are oftentimes less expensive than the hard copy versions. In looking at the student responses presented in Table 1 we find that roughly 75% of the students said they used hard copy textbooks. One concern we had was that if students were primarily using online textbooks, then they may already be setting themselves up for distractions from various internet-type sources. Our results seem to indicate that of the majority of the students prefer to use a hard copy version of the textbooks used in their classes.

The second question asked students about the frequency with which they turned to the internet to help them answer a question, the results were quite interesting. As Table 2 illustrates, 16 of the 17 students responded that they made some use of the internet when responding to questions. It appears that our concern might be justified in that the potential immediately exists for outside distractions once students find themselves using the internet.

All of the students in this study owned a smart phone. In the third question we asked the students whether or not their smart phones played any sort of role when they were studying. We left this question rather open-ended and did not intentionally ask them only about how their phones might help them when studying. Rather, we simply asked what role their smart phones might play. Upon looking at the data presented in Table 3, we note that four students responded that they use their phones to play music when they study. Seven students responded that they used their phones to look up information, to find a definition, or as a calculator. Interestingly, five students mentioned that their smart phones were a distraction – either intentional or unintentional.

Our fourth question was even a bit more open-ended and simply asked students whether they allowed for some sort of outside stimuli while they were studying. Of the students questioned, only two indicated that they do not allow for outside stimuli. However, while Student 5 answered no, that they don't allow for outside stimuli, they did say they liked to work with other students (with the intent of avoiding outside stimuli). However, we could argue that working with other students in and of itself would fall under the umbrella of outside stimuli. Many of the responses to this ques-

tion tended to indicate or imply that while students did allow for various stimuli to influence them while they were studying, they felt that they should not be doing. For example, Student 6 indicated that they try not to allow outside stimuli but that it always happens. Student 9 said that they did allow for outside stimuli, but they tried to cut down on it. Student 12, however, said that they did allow for outside stimuli because they liked to be mildly distracted when they studied. So we ask – what impact are these distractors and the constant availability of information via the internet having on students?

The student responses to the fifth question were quite enlightening. Less than 25% intentionally used an app to help them regulate their study time. While several apps are available for this purpose and would be very easy for students to access, most have indicated that they don't use them. Perhaps an additional study could address the specific reasons why students don't appear to feel the need to regulate their study time.

Responses to question 6 make clear the fact that all of the student participants have their phones close by, or very near them, while they sleep. We assume that students keep their phones with them during the day as well. What these responses indicate to us is that students feel like they have to keep their phones nearby literally around-the-clock. Hence, these students are connected literally every hour of every day.

While at face value, question 7 is a bit peculiar, but we really wanted to know how strongly the perceived need to be connected to one's smart phone was. While most of the students answered "no" to this question indicating that they would not be willing to give up their sense of smell to keep their phones, the response of Student 17 was particularly interesting. Note the cross-out response. The student originally responded "yes" to that question. Obviously, that student had second-thoughts about their response, crossed it out and said "no." Several students indicated that the survey questions really made them think hard about their responses. This question was surely one that gave the students pause.

In the following section we provide a brief summary and then present some questions that have emerged that we feel could be useful for future studies.

## **6 Summary and Questions for Future Studies**

In our literature review we touched upon the fact that millennials are often faced with many challenges that previous generations did not have to face. For example, upon graduation many millennials are finding it difficult to find employment given the tight economic conditions of the present day. To make matters worse, many millennials are graduating from college with an astronomical amount of debt compared to students in previous generations. So for all the emphasis during their childhoods that praised their self-worth and raised their self-esteem, many are being hit with a ton of bricks upon graduation. They are simply not prepared for an increasingly competitive job market. And, it's really not their fault.

While we can't draw firm conclusions based on a small group of students in a single class, we can infer that a majority of the students are routinely online, whether it

be on their computers or on their smart phones, during times when they are studying. Some recognized their phones as a distraction and implied that they really should be limiting its use while they are studying. However, when asked whether they were using an app to regulate their study time, the vast majority of students said they were not.

What we do see based on the results presented is that many of the students, whether intentionally or not, are setting themselves up for outside distractions while studying. These distractions often result in students multitasking while they are studying. Since we have found no evidence thus far that performance increases while multitasking, these results are somewhat concerning. It appears that this group of students fits well within the description of the millennial we presented in our literature review. These students tend to shift quickly from one thing to another, and, some seem to do so fully aware that outside distractions might be influencing them in a less than positive way.

There are many other issues raised in this paper, such as the validity of the material that students find on the internet and their ability to fact-check such information. We also found numerous studies relating increases in internet and technology use to a relatively recent increase in the number of students reporting that they have experienced issues related to depression and anxiety. While it is difficult to assess what impact multitasking has on academic performance, an additional survey given to a larger population of students could provide some additional insight into factors that might be impacting their academic performance.

## 7 References

- [1] Twenge, J. M.: *Generation Me: Why Today's Young Americans Are More Confident, Assertive, Entitled – and More Miserable Than Ever Before*. Atria: A Division of Simon & Schuster, New York (2014)
- [2] Twenge, J. M. and Campbell, W. K.: *The Narcissism Epidemic*. Atria: A Division of Simon & Schuster, New York (2009)
- [3] Twenge, J. M. and Foster, J. D.: Mapping the Scale of the Narcissism Epidemic: Increases in Narcissism 2002 – 2007 Within Ethnic Groups. *J. Res. Pers.*, 42, 1610 - 1622 (2008) <https://doi.org/10.1016/j.jrp.2008.06.014>
- [4] Awwad, F., Ayesh, A., and Awwad, S.: Are Laptops Distracting Educational Tools in Classrooms. *Procedia – social and Behavioral Sciences*, 103, 154 – 160 (2013) <https://doi.org/10.1016/j.sbspro.2013.10.320>
- [5] Sana, F., Weston, T., Cepeda, N. J.: Laptop Multitasking Hinders Classroom Learning for Both Users and Nearby Peers. *Computers & Education*, 62, 24 – 31 (2013) <https://doi.org/10.1016/j.compedu.2012.10.003>
- [6] Kandaras, N.: *It's Digital Heroin: How Screens Turn Kids into Psychotic Junkies*. New York Post (2016)
- [7] Digital Addiction: An ABC News 20/20 Special Report. <http://abcnews.go.com/2020/video/digital-addiction-2020-special-friday-109c-abc-47451357>. (2017, May 19)
- [8] Twenge, J. M.: The Age of Anxiety? Birth Cohort Change in Anxiety and Neuroticism, 1952 – 1993. *J. Pers Soc Psychol*, 79, 1007 – 21 (2000) <https://doi.org/10.1037/0022-3514.79.6.1007>

- [9] Baron, N. S.: Always On. Oxford University Press, New York (2008) <https://doi.org/10.1093/acprof:oso/9780195313055.001.0001>
- [10] Becker, M. W., Alzahabi, B. S., and Hopwood, C. J. Media Multitasking Is Associated with Symptoms of Depression and Social Anxiety. *Cyberpsychol Behav Soc* 66(2), 132 – 135 (2013) <https://doi.org/10.1089/cyber.2012.0291>
- [11] Laws, P. W.: Calculus-Based Physics without Lectures. *Phys. Today* 44(12), 24 – 31 (1991) <https://doi.org/10.1063/1.881276>
- [12] Beichner, R. J., Saul, J. M., Allain, R. J., Deardorff, D. L., and Abbott, D. S.: Introduction to SCALE-UP: Student-Centered Activities for Large Enrollment University Physics. Proceedings of the Annual Meeting of the American Society for Engineering Education, Seattle, Washington, Session 2380 (2000)
- [13] Hake, R. R.: Active-Engagement vs. Traditional Methods: A Six Thousand Student Study of Mechanics Test Data for Introductory Physics Courses. *Am. J. Phys.* 66, 64 – 74 (1998) <https://doi.org/10.1119/1.18809>
- [14] Cummings, K., Marx, J., Thornton, R., and Kuhl, D.: Evaluating Innovation in Studio Physics. *PER: A Supplement to the Am. J. Phys.* 67, S38 – S44 (1999)
- [15] Thornton, R. and Sokoloff, D.: Learning Motion Concepts Using Real Time Microcomputer-Based Laboratory Tools. *Am. J. Phys.* 58, 858 – 867 (1990) <https://doi.org/10.1119/1.16350>
- [16] Redish, E. F. and Steinberg, R. N.: Teaching Physics: Figuring Out What Works. *Phys. Today*, 52, 24 – 30 (1999) <https://doi.org/10.1063/1.882568>
- [17] Van Heuvelen, A. Overview, Case Study Physics.: *Am. J. Phys.* 59, 898 – 906 (1991) <https://doi.org/10.1119/1.16668>
- [18] Mazur, E.: Peer Instruction: A User's Manual. Prentice Hall, Upper Saddle River, NJ (1997)
- [19] Redish, E.F.: Teaching Physics with the Physics Suite. John Wiley & Sons, Inc., Hoboken, NJ (2003)

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