Some Pros and Cons of Laptop Use in Class

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We did not have laptops or computer networks in schools in 1968, when I started teaching physics. When classroom computers became available, followed by the internet, I greeted them as great educational tools. I developed my own website[1] in order to provide reference material and assignments for my students.[2] I found that online assignments were more likely than traditional ones to be completed. I also had my own system making password-protected grades available online. The parents loved it. I began giving some tests online. However, there is a downside to laptop use in class.

When I came to Iona Prep in 2004, I was delighted to find that every student had a laptop in class. Every teacher had a school-provided laptop, and every classroom had Smart Board projection equipment. This was computer nirvana. I made all of my class notes available on my website and told the students to leave their textbooks at home. (They had to carry the laptop around all day; why carry the textbook also?) When we solved problems in class, the students did not have to copy the problem down; they could view it on their computers and do the work on paper, thus saving time.

Having class notes online not only saved time in class, but also helped any student who was absent. They had only to go to my webpage to see what had been covered.

However, over the past few years I have become less enthusiastic about having each student with a computer on the desk all period. I know that I am better off taking notes by hand rather than on a computer. However, I wondered if younger brains, those brought up with computers, were perhaps wired differently. I wondered if they might be better off taking notes on a computer, so I did some online research. The operative question was, "Is there a difference between taking notes on the computer vs. taking them by hand? If so, which is better for teenagers? "

While I found a substantial number of articles on this topic, many of them were based upon the same research by Pam Mueller and Daniel Oppenheimer.[3-5] They reported that taking notes by computer resulted in more complete notes, sometimes nearly verbatim. They also concluded that taking notes by hand resulted in better recall and better cognition. This was true, even when the students were permitted to review their notes immediately before taking a test.

Not all of the literature is based on Mueller and Oppenheimer. For example, teachers at West Point[6] and Sierra Nevada College[7] come to similar conclusions. The bottom line seems to be that test results are better if notes are taken by hand. The various authors theorize that taking notes by hand makes the listener engage with the material and uses more brain power than simply typing notes. The West Point article, somewhat counterintuitively, indicated that the stronger students were harmed more than the weaker students by taking notes on a computer.

There is also the problem of distractions. I've caught too many students off-task, checking email, Tweeting, watching sports clips, and doing other things unrelated to the current lesson. In May of 2016 I gave an anonymous survey to my 66 high school junior physics students. The students self-reported that when they had a computer on the desk all period, they would (on the average) be off-task about 36% of the time. In order to encourage them toward better habits, I had them read the *Scientific American* article,[4] reflect on its contents, and answer a couple of questions about it. My students are basically good kids. I hoped that raising their consciousness might be more effective than lecturing them about being off-task.

Early in the 2016-2017 school year, I again tried to raise the students' consciousness by having them read the same article,[4] reflect on its contents, and answer questions. I also became more proactive by limiting the times when students had their computers open on the desk. After all, I am the adult in the room. I believe that I need to help the students to understand that multitasking can be detrimental to their understanding and their grades.[8,9] Although this is anecdotal, this approach did seem to keep the students more focused. It certainly reduced the stress I experienced trying to keep the students on task.

Incidentally, the laptop restriction was not enforced during lab periods. During labs the students usually work in pairs. In many cases one computer is used to collect data, frequently using PASCO Capstone, and the other is used preparing the report. Thus computer use facilitates collaboration. Students also share information and data through email and text message.

During the 2017-2018 school year I intend to try flipping the classroom[10] with certain topics. I suspect that using the computer to watch the videos[11] at home will be beneficial. Shifting computer use to homework will provide more time for group work in the classroom. This is a hoped-for outcome of the flipped classroom approach. More group work may also help to alleviate the social isolation to which excessive computer use can contribute. Sherry Turkle has written and presented on computer use contributing to social isolation.[12]

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11. I have made a few of my own videos; however, AAPT had an excellent webinar recently during which I learned about Jonathan Thomas-Palmer's website, http://www.flippingphysics.com/, which has many useful videos that are generally better than mine.
12. See https://www.ted.com/talks/sherry_turkle_alone_together for one example.

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And the Survey Says ...

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African American, Hispanic, and Native American women earning bachelor's degrees in astronomy, physics, chemistry, electrical engineering, mechanical engineering, and engineering technology

The last two months, we looked at the representation of African American, Hispanic, and Native American women earning bachelor's degrees in physical sciences and engineering. This month, we look at African American, Hispanic, and Native American women earning degrees in astronomy, physics, chemistry, electrical engineering, mechanical engineering, and engineering technology. These three physical science disciplines account for 75% of the bachelor's degrees awarded in the physical sciences in 2013, and the three engineering disciplines account for 56% of the bachelor's degrees awarded in engineering that same year. Instead of looking at the proportion of bachelor's degree recipients who are African American, Hispanic, and Native American, we look at the rate of degree production per 1000 degree recipients.

Number of Bachelor's Degrees Earned in Select Fields per 1000 Degrees – All Bachelor's Degree Recipients & African American, Hispanic, and Native American Women, 2013

Field of Study	All Degree Recipients	African American, Hispanic, & Native American Women
Physics	3.45	0.47
Astronomy	0.21	0.04
Chemistry	7.60	5.23
Electrical Engineering	9.51	1.67
Mechanical Engineering	11.46	1.67
Engineering Technology	9.41	2.76

Data from the National Center for Education Statistics compiled by SRC Staff
www.aip.org/statistics

The data show that 3.45 out of every 1000 bachelor's degrees overall are awarded in physics. For every 1000 bachelor's degrees awarded to African American, Hispanic, and Native American women, 0.47 are awarded in physics. If the demographics of a discipline mirrored the demographics of all degree recipients, the numbers in each column would be the same. This is not the case. Unless something dramatic changes, African American, Hispanic, and Native American women will continue to be underrepresented in the physical sciences and engineering.

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