



# The Paperless Classroom in High School Physics

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## Background

Due to increased access to technology in the classroom and new limits on paper and copies, I decided to study the effects of the paperless classroom. In my high school physics classroom I have a class set of devices (laptops and Chromebooks). While technology has been in my classroom for a few years and it is used sometimes, I had not fully transitioned to making my class technology based prior to this study. While most of my students have access to technology at home, some do not, so this was a major concern going into the paperless unit.

Students are often hesitant to transition and teachers feel like they do not have enough training to transition to a technology based classroom effectively. In the end the students often like it, but the teachers are often left frustrated, as it is new to them and they do not feel as though they have been trained adequately<sup>1</sup>. As one-to-one computing and paperless classrooms become more and more common, some of the training could be moved to teacher training programs so that teachers enter the classroom prepared to utilize any technology that is available to them<sup>2</sup>.

## Methodology

To study the effectiveness of the paperless classroom, I first conducted a pre-treatment unit that was done completely on paper. I then taught a treatment unit that was nearly entirely paperless.

For each unit, students took a pre-test and post-test to measure learning. Students turned in assignments during each unit and classwork completion rates were compared. I also kept a time log and a teacher journal to compare how class minutes were spent and how I perceived activities were going for each unit.

At the beginning and the end I administered a student technology survey. At the end I conducted student interviews.

## Results

Efficiency in transitions and classroom procedures was about equal between the pre-treatment and treatment units. Where time was added to take out and put away computers, it was saved in not having to pass out papers and quicker transition times.

Students' overall attitudes towards turning in assignments, taking notes, and taking assessments digitally improved from the pre-study survey to the post-study survey (Chart 1).

Classwork completion rates increased from 91% to 95%, which resulted in a medium sized normalized gain<sup>3</sup>. The pre-test and post-test results for the pre-treatment unit resulted in low normalized gains. The pre-test and post-test results for the post-treatment unit resulted in medium normalized gains.

My teacher journals and the student interviews showed a general trend. At the beginning of the treatment unit there were frequent frustrations and things were not going very smoothly. As the unit progressed and procedures became more familiar to both the teacher and the students, there was a very favorable view of doing and turning in work digitally.

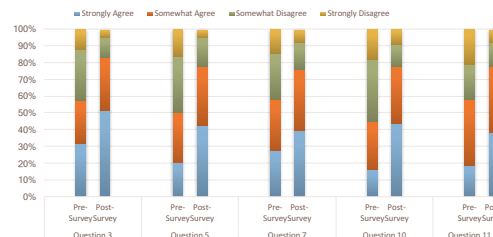


Chart 1. Student Technology Pre/Post Survey Results, (N=99). Note. Question 3: Turning assignments digitally is an effective way for me to submit my work. Question 5: I prefer to turn in assignments digitally. Question 7: I feel organized when all of my assignments and notes are digital instead of on paper. Question 10: I prefer to take notes digitally. Question 11: I would feel confident taking a computerized exam.

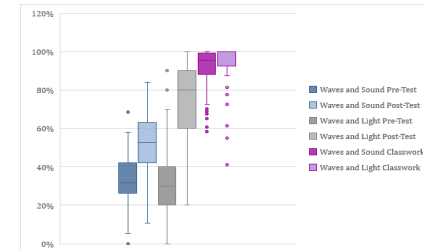


Chart 2. Test score and classwork score distributions, (N=99).

## Research Questions

Question	Data Sources		
<b>Focus Question:</b> What technology-based tools can I utilize to create an effective and efficient paperless classroom with one-to-one in-class Chromebooks in a high school physics class?	Time Log	Teacher Journal	Student Technology Pre/Post-Survey
<b>Sub-question #1:</b> What classroom procedures can be implemented to create greater efficiency in utilizing technology?	Time Log	Student Interview Questions	Teacher Journal
<b>Sub-question #2:</b> Can the use of technology in the classroom improve achievement and learning?	Waves and Sound Pre/Post-Test	Waves and Light Pre/Post-Test	Classwork Completion Rates

## Conclusions

With proper teacher training and time to get comfortable, a technology based, paperless, or nearly paperless classroom can be both efficient and effective. It should be expected that both teachers and students will run into some frustrating situations as this new way of running class is implemented, but if they persist, the issues can be worked out and the class can run smoothly.

I found that students were turning in more of their work because they were able to get to their assignments on their phones and easily finish them up at home if they needed to, they weren't losing their work, and everything with due dates was in one place on Google Classroom. This also improved the ability of absent students to catch up after missing class.

The Google suite of applications plus the add-ons are very good and can help students and teachers to accomplish a lot. There are also other programs and websites that are great for a technology based science course.

I did find that drawings and solving math problems still work best on paper or on white boards, but students were able to take pictures of their papers or whiteboards to insert into their documents.

Grading tests and quizzes was much easier when it came to multiple choice and written response questions. I did not have to decipher hand writing.

Overall, the treatment unit went very well and I will go into next school year with a paperless classroom.

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## References

- Minkew, L., & Anderson, J. (2015). Teacher self-efficacy in 1:1 iPad integration in middle school science and math classrooms. *Contemporary Issues in Technology and Teacher Education (CITE Journal)*, 15(1), 334-387.
- Spray, H. A., Olson, K., & Carr, J. (2012). The new learning ecology of one-to-one computing environments: Preparing teachers for shifting dynamics and relationships. *Journal of Digital Learning in Teacher Education*, 28(2), 63-72.
- Hake, R. R. (1998). Interactive engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, 66(1), 64-74.