Thesis Project Portfolio

Romulus 1: 16-bit CPU

(Technical Report)

The Effect of Standardized Testing on Student Perceptions of School

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

My technical project in the Charles L. Brown Department of Electrical and Computer Engineering was the design and creation of a 16-bit Central Processing Unit (CPU) and its supporting memory. We created this CPU using Flash Memory, 74XX series logic chips, and passive electrical components. This project is intended to be an education tool for helping teachers teach and students learn about topics such as computer architecture, digital logic, machine code, and other electronic devices. Our project has many different indicators on it including many LEDs, 7-segment displays, switches and an ammeter that show how the CPU actually moves signals and data around in order to complete operations. It has accessibility options such as variable clock speeds to speed up or slow down to teach more about what is happening, a pause button, and a built in debugger to allow you to step through operations one at a time.

Along with the hardware of the CPU, my technical project also included an assembler and a compiler to allow code for the CPU to be written in machine code, our version of assembly, or our version of a C-like coding language. We also created a simulation version of our project, so that if a professor is using the actual device to teach, students will be able to follow along on their computer with a virtual version. These systems together allow students to experiment with either a top-down or a bottom-up approach to learning and teaching about computing systems and organization.

My STS journey started with a sociotechnical prospectus. In this prospectus, I did research into the differences in goals and motivations for different generations of people. I then connected that to my technical project by looking at the effects that these differences in life outlook affected the ability for younger generations to be taught by older generations. My plan to

continue writing my STS paper was to perform an Actor Network Theory for each generation, looking at the global events that shaped the shared experiences of different generations and how that affected their values, thought processes, and worldview. I then was planning on comparing these different values, thought processes, and worldviews to establish connections between difficulties that teachers have in modern classrooms, such as student attention spans, and the values that both the teacher and student generations generally hold. Then, I planned to use the events that are currently happening to try to predict the values of future generations and the problems that teachers might face when trying to teach them. All of this with the end goal to allow us to brainstorm solutions to problems before they actually become problems.

I narrowed my focus for my STS paper on standardized testing and asked the question: "How does standardized testing affect students' perspectives of school in the United States?" I looked at the federal laws over the years that have implemented standardized testing in the United States: The No Child Left Behind Act (NCLB) and the Every Student Succeeds Act (ESSA). I compared these two acts and explored the issues with NCLB that led to it being replaced by ESSA, and the ways that these problems are still relevant despite NCLB no longer being in effect. I analyzed this situation using Max Weber's theories of legal and traditional power. The legal power that policymakers have when creating requirements for standardized testing, and the traditional power that the school systems have over students.

I found that both students and teachers experience high amounts of stress due to standardized testing. For students, this stress comes from the perceived importance of performing well and placing a lot of value on the results of testing. This can lead to students prioritizing studying and schoolwork over other important aspects of their lives and can even lead to them

isolating themselves from friends and family. This makes students feel like school is only a place for them to fail and disappoint themselves and the people around them.

Teachers also experience a high amount of stress, because they are threatened with the possibility of losing their job if their students do not perform well. This has led some teachers to teach only what is going to be on the standardized test, even in ways that are detrimental to student learning, with the goal of increasing their performance numbers. Students that see this going on realize they have been lied to that school is there for them to learn, and therefore start to dislike school, because the reason they are there is not actually being addressed by school staff.