

INTRODUCTION

Accurately analyzing the manner by which computer science is taught in high schools is a much more difficult, nebulous task than might be first gleaned. Subjects like mathematics and English are entrenched into the educational status quo of high schools, reflected in a long history of past successes and failures useful in the contemporary judgement of academic achievement. Computer science has no such track record. A general lack of standards for computer science instruction as well as reporting produces data that is often misleading, outdated, or simply inaccurate. This phenomenon is made abundantly clear in the data collection of Wisconsin's Department of Public Instruction, or DPI. Despite these shortcomings, we were able to supplement and cross-check this data with other independent sources of information, such as Marquette University's Professional Development(PD) programs, College Board's Advanced Placement statistics, and data from Microsoft's Technology Education and Literacy in Schools (TEALS) program. With the results from analyzing, cleaning, and matching many of these sources, we were able to make important distinctions in the data, such as separating CS courses taught by a licensed teacher versus an unlicensed one.

DATA SOURCES

DPI: As mentioned earlier, the Department of Public Instruction's public and confidential data is ripe with valuable information for this project. The problem with collecting this data, however, is that the DPI website has no Application Programming Interface (API) that a script can interact with to send requests and receive responses. But it was clear that manually harvesting data on every computer science teacher in the state of Wisconsin would be unfeasible; there are simply too many entries. Furthermore, the 'Download' button on the search interface did not capture the data in expandable rows, which meant that only a brief overview of a teacher was recorded. To overcome this problem, a script would have to emulate the behavior of a human: load the page, click on dropdowns, enter search queries, and record the results. Selenium, an opensource Python package, allows for automated interaction with web pages by establishing a connection to the internet browser via a Python API.

College Board: One of the easiest ways for a high school to get involved with computer science is through the College Board. The curriculum of Advanced Placement courses are nationally standardized and consequently requires less planning on the part of instructors. In 2016, the College Board launched a new course, called AP Computer Science Principles. The course is specifically tailored to generate interest in computer science and explores the many ways in which the study shapes innovation. Consequently, the course has become a much more palatable option for CS newcomers than Computer Science A, which is best taken with a degree of previous programming experience. Data from AP exams is undoubtedly the most reliable data source at our disposal. The College Board keeps detailed reports of every exam, including total tests taken, score percentages, and demographic breakdown. AP data is particularly interesting to us for a number of reasons. Firstly, the presence of AP examination at a school is an excellent indicator that the eponymous course is also taught there, although it is possible (though unlikely) for students to take an AP exam for a class they have not taken. This knowledge can also clarify different naming standards for courses, providing us a better understanding of what is a CS course and what is not. For instance, a course titled "Introduction to Computing" is vague and keeps us guessing as to whether or not the course material is CS-intensive. But if AP Computer Science A exam data shows up at the same school, then the ambiguity is lessened. The supplementary demographic data also allows us to assess the equity or lack thereof of an offered exam.

TEALS: Many classroom teachers are actively working towards obtaining a CS license while under supervision. A primary way that this can happen is through Microsoft's Technology Education and Literacy in Schools (TEALS) program. TEALS is a philanthropic program that provides aid to select schools that are struggling to establish a sustainable CS program [1]. Through TEALS, an instructor can partner with a volunteer in the tech industry to teach a high school computer science course, and in doing so learn and develop the skills needed to teach computer science full-time. The data that we have from TEALS is limited to a list of schools that TEALS has worked with in a given year, which is obviously insufficient to exactly pinpoint teachers that are in the program. However, it does allow us to concentrate more on the other schools that have computer science enrollment but an unknown instructor.

Marquette PD: Marquette University has a program called PUMP-CS, short for Preparing the Upper Midwest for Principles of Computer Science. Headed by Dr. Dennis Brylow, PUMP-CS seeks to foster K-12 computer science growth by hosting teacher workshops for various computer science courses [2]. Furthermore, PUMP-CS has partnered with the Milwaukee Teacher Education Center to provide an alternative pathway to CS licensure, allowing existing teachers to add on the computer science license without having to quit their day job and return to college [11]. Marquette collects information about the teachers that register for workshops. Since anyone can register, Marquette's records include many teachers without a CS license, who would thus not show up in the DPI records. And since we continue to discover more and more computer science courses not taught by a licensed computer science teacher, this data source is an excellent supplementary resource to fill in some of the gaps in our knowledge. Furthermore, we can reach out to these teachers to encourage them to pursue a pathway to CS licensure so that they will not run into issues with the DPI.

The main research questions that we sought to answer are as follows:

1. Are there any licensed computer science teachers in Wisconsin for each school, if so, how many?
2. Of those teachers, are they currently teaching what we would consider to be a computer science course?
3. Can significant growth in access to computer science be observed over the last few years?
4. Does a trend exist amongst computer science teachers not identified by the DPI?
5. Is Wisconsin computer science equitable?

REFERENCES

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