

Paper 3742-2019
The “Why” and “How” of Teaching SAS® to High School Students
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ABSTRACT

Learning SAS® for the first time as a budding epidemiologist in graduate school, I remember being amazed at how powerful and customizable SAS was in making sense of huge amounts of data. I also remember being very intimidated by all the moving parts involved in learning such a program! My study and use of SAS has continued since that time, specifically now as a Doctor of Public Health student. I have often wondered how much farther along my research would be at this point had I learned SAS in high school. When one of my professors recently told me that resources are available for teaching SAS at that level, it prompted me to ask a local high school teacher what she thought about teaching SAS to her students. When she replied that she thought it was a great idea but did not know how she could do this, I realized this was a gap that needed to be filled. The aim of this presentation is to raise the awareness of educators about the importance of, and resources available for, teaching SAS to high school students.

INTRODUCTION

Children in primary grades show a strong interest in science and math, but by the time they enter into middle and high school their interest declines. Educators have been concerned about this for some time now due to the increasingly greater need for a scientifically literate public; a high demand for employees with a STEM (Science, Technology, Engineering, and Math) background; and the aim for science to have public support and interest (Savelsbergh et al., 2016). Ever-changing information and communication technologies (ICTs) have resulted in new ways of collecting massive amounts of data. To make sense of it all, and put this information to good use, we need fresh perspectives for applying a working knowledge of mathematics and innovative methods for teaching our youth mastery of these skills (Zengin & Tatar, 2017). Data science in particular has become a hot topic in both industry and academia (Krishnamurthi & Schanzer, 2017). As this trend will certainly continue at a rapid pace, why wait until students enter college to introduce them to this fascinating area of science and technology?

WHY TEACHING SAS TO HIGH SCHOOL STUDENTS IS IMPORTANT

The research by Savelsbergh et al. (2016) states that student attitudes, motivation, and interest are important determinants of the quality and depth of learning processes, student persistence, and study choice. Further, this research study points out that ICT-rich learning environments that include computer-based instruction and computer-based labs result in more positive student attitudes toward learning. They gave the following reasons for this: students enjoy working with computers; they feel safer to experiment and make mistakes; and they appreciate the quick feedback on their efforts in learning and mastering skills. Given that student interest in STEM

courses wanes in the middle and high school levels, promotion of more favorable attitudes through innovative teaching programs, such as teaching SAS, is important. Lastly, the Savelsbergh et al. (2016) study found an overall increase in student achievement in science and mathematics education (as assessed through student testing) when these topics were presented with innovative teaching approaches.

Another study evaluated four online STEM tutorials that were developed using multimedia and cloud-based technologies for high school and college students (Cheng & Feng, 2016). The aim for the group of high school students in the study was to broaden STEM participation through a bridge program that could be accessed 24/7 online by students when needing assistance in applying problem-solving activities and project-based assignments. Findings from this study showed that high school students benefitted from the tutorials (as assessed by pre- and post-tutorial surveys for student learning outcomes), although these benefits were higher for the college student group. The authors of this small study concluded that these innovative online tutorials surpassed traditional STEM methods of content delivery alone in enhancing cyber teaching and learning, especially regarding student motivation. According to a study by Zengin & Tatar (2017), results similar to those from this Cheng & Feng (2016) study have been replicated in at least six other studies that evaluated using dynamic mathematics software to teach high school students. Might high school programs that incorporate 24/7 access to SAS[®] University Edition also have the potential for improvements in student learning and motivation similar to those shown in the Cheng & Feng (2016) study?

VOICES FROM THE FIELD: UNIVERSITY PROFESSORS

Because I wanted to know what university professors who teach SAS think about students learning SAS in high school, I posed this question to a few of them in my sphere of academia. Tammie Johnson, DrPH, an associate professor who teaches epidemiology and biostatistics in the Brooks College of Health at the University of North Florida, had this to say, “Teaching high school students SAS is an interesting idea. I’m sure the SAS code would not be a problem for most of them. The more challenging part will be teaching them to make statistical decisions. To do this requires critical thinking skills they may not have developed yet” (T. Johnson, personal communication, June 1, 2018).

Charlotte Baker, DrPH, an assistant professor of epidemiology in the Department of Population Health Sciences, Virginia-Maryland College of Veterinary Medicine at Virginia Tech, shared her thoughts with me. She stated, “In terms of teaching SAS to high schoolers, I think it is a great idea. The earlier we introduce different ways of doing math and statistics to kids, the better. If in the real world, I’m not always doing things by hand, why do we insist on doing that for kids until they get to college? SAS can be a great tool to teach the concepts of different math and statistics and will get students comfortable with doing them by computer. You’re able to introduce larger data sets to make more real-world problems rather than perfect problems for learning. If I had had the chance to do more programming type courses in high school, I would have. It would have only made me better prepared for college and, eventually, graduate school. The same way we teach SAS to graduate students is not how I would teach it to high school students. I think because they are different ages and at different stages, a more general approach that better incorporates their world and their abilities would be optimal. Programs like ‘Black Girls Code’

give great examples for how to bring all types of coding to the forefront and make it fun for kids of all ages. SAS as a company has an entire team that has thought these things through and I like how they do it, too” (C. Baker, personal communication, July 19, 2018).

Lastly, I interviewed C. Perry Brown, DrPH, a professor of epidemiology and biostatistics in the Institute of Public Health, College of Pharmacy and Pharmaceutical Sciences at Florida A&M University. To paraphrase, Dr. Brown thought that it might be easier for college students to re-grasp SAS once they were four years into college (the time-frame they would most likely begin SAS courses at the college level), but to keep this time gap in mind. He also thought it might be most beneficial to teach SAS to those high school students who have strong interests in math and science. To determine the feasibility of teaching SAS to high school students before incorporating it into the regular school curriculum, he recommended to first teach it through the venue of a six-week “SAS Academy” summer camp for upper classmen as a pilot program (C. P. Brown, personal communication, July 19, 2018). Dr. Brown’s recommendation for this is supported by the National Science Foundation’s research that shows summer academies have a positive impact on influencing students to major in and pursue STEM careers (Cheng & Feng, 2016).

THE BENEFITS OF TEACHING SAS TO HIGH SCHOOL STUDENTS

There are many compelling benefits that come from teaching SAS to high school students. To emphasize this point, the American Statistical Association sent representatives to the American School Counselor Association Annual Conference in Denver, CO in 2017 to convey the importance of how studying statistics, especially with computing power, can position high school students for success in college (ThisIsStatistics, 2017). SAS[®] software is used at the college-level across a broad range of courses including psychology, sociology, statistics, mathematics, business, life sciences, and public health (SAS, 2018). Those who have realized the value of applied mathematics and have developed their statistical literacy are needed now more than ever in today’s workplace (Zengin & Tatar, 2017).

SAS programmers are in high demand in the workplace, particularly statisticians, and knowledge of SAS can give students an advantage when seeking jobs in technology, marketing, finance, insurance, statistics, public health, research, and medical areas (SAS, 2018). High school students interested in careers as statisticians should be encouraged to take courses in statistics, computer science, mathematics, and science (ThisIsStatistics, 2016). The U. S. Bureau of Labor Statistics predicts that jobs for statisticians will grow 34% between 2016 and 2024, which is faster than the seven percent growth rate for all occupations (ThisIsStatistics, 2017).

To identify the career skills most valued by employers, Money[®] Magazine and PayScale.com analyzed 54 million employee profiles across 350 industries from entry-level to top executive positions, isolating specific skills that were correlated with higher pay, advancement, and career opportunity (Renzulli, Weisser, & Leonhardt, 2016). They found that one of the top four skills was the ability to make sense of “big data”, with expertise in SAS being the skillset that gave the biggest pay boost, 6.1% higher in 2016, versus those who did not have this skillset. In addition, a

more recent article from 2018 identified SAS as the number one skill of eight top career skills desired by employers, and that this resulted in a pay difference of 17% higher versus those in the same data analyst position without it (Pfeuffer, 2018).

RESOURCES FOR TEACHING SAS TO HIGH SCHOOL STUDENTS

Teacher training should be substantial in order to be effective in student achievement and attitude (Savelsbergh et al., 2016). The SAS company provides several comprehensive resources to high school teachers. Free resources include: training workshops for teachers; professional development; classroom materials; and SAS e-learning and how-to videos. SAS publishes books for purchase to help learn SAS for beginner to advanced levels. SAS Certification for Academics is also available to educators at a reduced fee for the standard certification exam. Further information about these resources can be found online through the webpage, *SAS Academic Programs: High School Teacher Workshops* (SAS, 2018).

CONCLUSION

Using modern ways of computation as effective venues for thinking, talking, and writing about data may be a good starting point in developing STEM curricula for high school students, especially when dynamic mathematics software is incorporated. A review of the literature provides ample evidence that creating innovative STEM teaching programs for high school students improves student attitude, motivation, and learning outcomes. Those who have a solid SAS skillset are in high demand in the workplace and have a distinct advantage for securing jobs that pay well and afford opportunity for career advancement. However, because high school teachers may not know that resources for teaching SAS to their students are freely and readily available, this paper aims to increase their awareness and help them to better prepare their students for success in our modern digital age.

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