Where Are We Now? Results from a National Study of Computer Science Teachers and Teaching

Eric R. Banilower
Horizon Research, Inc.
Chapel Hill NC USA
erb@horizon-research.com

Evelyn M. Gordon
Horizon Research, Inc.
Chapel Hill NC USA
egordon@horizon-research.com

ABSTRACT

The National Survey of Science and Mathematics Education has provided nationally representative data about the status of K–12 science and mathematics education periodically over the past 40 years. In 2018, the sixth iteration of the study, the study’s scope was expanded to include a focus on K–12 computer science education and the study renamed The NSSME+. Data come from roughly 1,300 schools, 7,000 K–12 science and mathematics teachers (who were asked about their integration of computer science into their instruction), and 300 teachers of high school computer science. This session will engage participants with results related to computer science education in the U.S., including: how many, and which, students have access to computer science instruction; who teaches computer science and what pre-service preparation and in-service professional development they have; the nature of computer science instruction; and access to resources, including instructional materials, to support instruction.

CCS CONCEPTS

• **Social and professional topics-K-12 education**

KEYWORDS

K–12 Computer Science Education; Computer Science Teacher Preparation; Computer Science Teacher Professional Development

ACM Reference format:

Eric R. Banilower and Evelyn M. Gordon. 2018. Where are We Now? Results from a National Study of Computer Science Teachers and Teaching. In *Proceedings of The 50th ACM Technical Symposium on Computer Science Education, Minneapolis, MN, USA, February 27 - March 2, 2019 (SIGCSE'19)*. ACM, New York, NY, USA, 2 pages. <https://doi.org/10.1145/3287324.3287515>

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the Owner/Author.
SIGCSE '19, February 27–March 2, 2019, Minneapolis, MN, USA
© 2019 Copyright is held by the owner/author(s).
ACM ISBN 978-1-4503-5890-3/19/02.
<https://doi.org/10.1145/3287324.3287515>

1 Objective

National interest in providing computer science education at the K–12 level has grown steadily since ACM founded the Computer Science Teachers Association (CSTA) in 2004. This trend is evident in SIGCSE conference sessions focused on K–12 education, President Obama’s Computer Science for All initiative, the growth of online instruction and advocacy sites such as CS for All and code.org, and the development of K–12 computer science standards by CSTA and an increasing number of states. However, there has been no nationally representative study of the status of computer science education at the K–12 level. The 2018 NSSME+ provides nationally representative results about K–12 computer science education, including who teaches it and what they are doing in their classrooms.

The 2018 NSSME+ administered surveys at approximately 1,300 schools, and included roughly 300 teachers of high school computer science and 7,000 teachers of K–12 science and mathematics throughout the U.S. The study consisted of both teacher- and school-level questionnaires, and the sample was designed to provide both national estimates and disaggregation of the data by various school and classroom factors. Results from the study include:

- The distribution of computer science classes and computer science teachers in the nation’s schools, including the access of historically underrepresented students to these classes/teachers;
- The qualifications of computer science teachers;
- The instructional objectives and activities that characterize computer science instruction; and
- The integration of computer science concepts (including computational thinking) in mathematics and science instruction.

2 Outline

This session will share findings from the study and engage participants in considering the implications of the results for both the preparation and support of computer science teachers. The session will be divided into three main segments of approximately 25 minutes, each of which will include multiple strategies for participant engagement. The first segment will

share findings related to the current computer science teaching force and how their preparation compares to recommendations described in CSTA's *Ensuring Exemplary Teaching in an Essential Discipline* [1] and the International Society for Technology in Education's *ISTE Standards for Computer Science Educators* [2]. Results show that although only about 1 in 4 high school computer science teachers nationwide have a degree in computer engineering, computer science, information science, or computer science education, almost half have completed coursework in at least 3 of the 4 content areas recommended by both CSTA and ISTE.

The teacher preparation recommendations will also inform the second and third segments, to consider related needs among the current teaching force. The second segment will focus on the amount and nature of professional development opportunities, including induction experiences, computer science teachers have access to and participate in. For example, over half of high school computer science teachers have completed more than 35 hours of professional development related to computer science teaching in the past three years, but nearly a fifth have not had any professional development in this time frame. The third segment will share data about the nature of computer science instruction, including the extent to which students are engaged in the types of computer science practices described in the *K–12 Computer Science Framework* [3]. Between 50 and 60 percent of high schools offer courses that include programming or require programming as a prerequisite, though 80 percent of schools provide access to these types of courses when online and offsite options are included. Only about a fifth offer AP computer science courses. Teachers reported that they have students work on programming activities using a computer at least weekly in over 95 percent of those courses, and in almost three-fourths of classes they have students comment their code to document purposes or features at least weekly. In contrast, in about a third of computer science classes teachers rarely or never have students systematically use test cases to verify program performance and/or identify problems, and they rarely or never have students write their reflections in about half of computer classes. Despite recent trends encouraging the incorporation of computer science into science and mathematics courses, a large majority of science and mathematics classes (71–89 percent, depending on grade level) never include coding as part of instruction.

In each segment, participants will first be asked to predict results, based on their experience and knowledge, and discuss their predictions in small groups before findings from the study are detailed. Participant questions and reactions will be encouraged throughout, particularly comparing their initial

predictions to the empirical findings of the study. As part of each segment of the session, we will lead a discussion of the implications of the results for efforts to increase student access to high-quality computer science learning experiences. These conversations will include both small-group and whole-group discussions to provide opportunities for all participants to share their views and to hear the views of others.

3 Expectations

The intended audience for this session includes policy makers and practitioners who train, support, and provide instructional resources for computer science teachers.

As a result of this session, participants will gain a national perspective on the current state of the K–12 computer science teacher workforce and computer science teaching. Participants will also learn about areas of need for professional growth among new and veteran high school computer science teachers. Lastly, participants will share and develop new insights into how teachers of computer science can be effectively prepared in pre-service programs, supported with ongoing professional learning opportunities, and provided with the tools and resources to be successful in the classroom.

4 Suitability for a Special Session

Results from the study address multiple areas of interest to the SIGCSE community and could not be communicated effectively in a 25-minute paper session. In addition, we have designed the session to be more interactive than a typical paper or panel session to allow attendees to explore the implications of our findings for their own work. A special session organized specifically for these needs is an ideal alternative.

ACKNOWLEDGMENTS

This material is based upon work supported by the National Science Foundation under Grant No. DGE-1642413. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. The presenters also wish to thank Daniel J. Heck, Kristen A. Malzahn, and P. Sean Smith for their contributions to the project.

REFERENCES

- [1] B. Ericson, M. Armoni, J. Gal-Ezer, D. Seehorn, C. Stephenson, and F. Trees. 2008. *Ensuring exemplary teaching in an essential discipline: Addressing the crisis in computer science teacher certification*. New York, NY: Association for Computing Machinery and Computer Science Teachers Association. Retrieved from <https://www.csteachers.org/resource/resmgr/CertificationFinal.pdf>.
- [2] International Society for Technology in Education. 2011. *Standards for Computer Science Educators*. Retrieved from <https://www.iste.org/standards>.
- [3] K–12 Computer Science Framework. 2016. Retrieved from <http://www.k12cs.org>.