

ACM SIGCSE Special Projects Report

Solve this! Problems of practice teachers face in K-12 CS Education

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The goal of this ACM SIGCSE Special Project was to identify and disseminate a robust inventory of the problems of practice that primary and secondary teachers experience when teaching computer science (CS) in order to guide the development of CS education research and professional development. In this report, we provide a summary of our work, including dissemination of our findings.

Purpose

Though practitioners and researchers both are outcome-focused and interested in increasing academic achievement among students, the gulf between them can be wide (Wanzer, 2019; Denny et al, 2019). Educational research identifies answerable questions, but often does not address the problems teachers identify as important (Denny et al, 2019). Further, academic research findings can be difficult for teachers to apply to their practices and unique contexts (Hod, et al, 2018; Penuel and Farrell, 2017). Little research exists on the lived experiences of primary and secondary instructors who teach CS (Sadik et al., 2020; Yadav et al. 2017). Identifying problems faced by teachers can guide professional development offerings and help researchers develop studies that would result in meaningful improvement to CS education (Coburn, et al., 2013).

Our project has and continues to create an inventory of problems of practice faced by teachers across the world. This resource can help close the K-12 research - practice gap. The benefits to the SIGCSE community include:

- Provide researchers with an understanding of the lived experiences of primary and secondary CS teachers and the challenges they face,
- Suggest future directions for research,
- Identify problem areas where professional development providers can support teachers, and
- Provide topics for creating teacher practice briefs that support teachers in adopting evidence-based practices.

Project Plan & Timeline

Our project methodology was built upon prior research identifying questions of interest to practitioners and researchers (Begel and Zimmerman, 2014; Denny, et al., 2019). The novel contribution of this project is its focus on primary and secondary teachers' experiences, rather than software engineers' experience (Begel & Zimmerman, 2014) or questions for future research (Denny et al., 2019). The project builds on

our researcher experiences with open-ended, cross-sectional survey research (e.g., Semmens et al., 2015). The project methods and timeline are detailed in Table 1.

Table 1: Project Plan

	Tasks	Our Activity
July 2021	Created Questionnaire Received IRB Approval	We created an open-ended questionnaire with prompts about problems faced in teaching CS in respondents' classrooms and schools; wording of the prompts will be based on prior research. The questionnaire was created and distributed online via Qualtrics. To ensure timely approval by the Institutional Review Board, materials for human subject research were submitted and approved in July, 2021.
July - October 2021	Data Collection	We recruited participants through professional communities including CSTA, CAS, etc.; CSEdResearch; and social networks including contacts in Australia, Brazil, Canada, China, Denmark, India, Maldives, Nepal, New Zealand, the United States, and other countries. We opened data collection prior to the CSTA conference (July 2021), closing it in September 2021 to ensure maximum participation from teachers.
November 2021 - August 2022	Data Analysis	In keeping with standard qualitative survey methodology, we used a constant-comparative method to analyze preliminary data, especially checking for demographic representation with a goal of reaching saturation of the data (Morse, 1995). We used descriptive coding (first round) and focused coding (second round) to classify responses (Saldana, 2013). One researcher initially coded the data, then the research team reconciled the analysis through a process of collaborative coding (Smagorinsky, 2008; Syed, 2015). We provided gift cards to randomly drawn participants.
March 2022 - December 2022	Disseminate	We submitted a paper to ICER that was not accepted. A presentation on the findings was accepted to the CSTA 2022. We have another paper currently under review. We will hold a webinar on July 26, 2022 that will share findings with other K-12 CS education researchers.

		We are currently working on a page on our website (https://csedresearch.org) that will enable users to search for problems of practice. We expect this to be completed in August 2022. See Figure 1 below.
May 2022	Final report	We will provide the final report to the SIGCSE board.

We received a total of 733 responses to our surveys. After we removed entries that were blank, did not consent or did not teach CS or CT, 394 responses remained. Our analysis of the first set of questions related to classroom problems of practice is completed and captured in a paper that is currently under review. Our analysis for the other questions on our survey are currently undergoing further analysis, with the analysis expected to be completed by August 2022.

The screenshot shows the 'Problem Of Practice' page on the csedresearch.org website. At the top, there is a navigation bar with links for 'Community Resources', 'Current Projects', 'Our News', and 'Our Services', along with a 'DONATE' button. Below the navigation bar is a search bar with the text 'Find problem of practice' and a 'Clear Filters' button. The search results show 51 problems found, with a 'Show: 10' and 'Sort by: Default' dropdown menu. The results are listed in a table with columns for 'Type', 'Gender', and 'Country'. The first few results are:

Type	Gender	Country	Problem Description
General (School Related -> Lack of resources)			2021 Any mention of lack of school resources generally, or not listed in sub-codes
Equipment and Facilities (School Related -> Lack of resources)			2021 Lack of access to needed hardware, software, facilities. Includes resources not functioning correctly/technical issues.
Lack of Curriculum (School Related -> Lack of resources)			2021 Lack of curriculum and/or quality curriculum. Includes feeling that standards are not clearly articulated.
Budget (School Related -> Lack of resources)			2021 Explicit mention of budget or money
General (School Related -> Lack of teaching time or schedule)			2021 Includes both structural issues with how many classes are offered at the school AND trying to fit the curriculum into the amount of time available for teaching. Also includes challenges fitting in other topics (SEL, assessment)
General (School Related -> Lack of administrative support)			2021 General discussion of administration being unsupportive
General (School Related -> Recruiting)			2021 Low enrollment or difficulty recruiting students into class. Includes both students having no choice and being placed in class by administration AND students having choice and not choosing CS.
General (School Related -> Lack of prep time)			2021

Figure 1. Problems of Practice website page on the Resource Center website currently under development. This will include an “up vote” mechanism for teachers to upvote these problems (or add new ones).

Conclusion

This project also holds the promise of informing work that supports teachers in solving the problems they face in teaching computer science. We will continue to work through the CSTA Professional Development (PD) committee to share findings with PD providers in order to ensure that they are crafting opportunities that match teachers’ needs. We plan to use the findings to expand upon the current Teacher Practice Briefs being created with CSTA, to guide the development of new briefs that address high-need areas.

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