

# A Longitudinal Pilot Study Exploring the Impacts of Coaching for Equity on Computer Science Teachers

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## Abstract

**Background.** U.S. state and district policies increasingly mandate computer science (CS) instruction in K-12 classrooms. To ensure all students benefit from computing education, we recognized the crucial need for teachers to adopt equity-focused practices. Leveraging a researcher practitioner partnership (RPP), we launched a pilot program providing teachers with individualized coaching.

**Intervention.** Our RPP developed and piloted a coaching program for high school CS teachers ( $n = 15$ ). The program enabled teachers to explore how to solve problems of equity they experienced in their classrooms that they wanted to resolve.

**Key Observations.** Coachees reported higher competence in their equity and inclusion practices. Most coachees advanced their self-assessed equity and inclusion practices from *Developing* or *Competent* to *Competent*, with an average Timepoint 1 to Timepoint 2 difference indicating a medium effect.

**Lessons Learned.** The pilot study's results indicate that the program may positively impact teachers' classroom practices. Challenges we encountered included a lack of time built into the schedule for coachees and coaches to build rapport and methods for coachees and coaches to record their sessions consistently. Further, having a control group would provide us the data needed to empirically state whether the program impacts classroom practices.

**Implications and Recommendations.** As a result of this project, we are developing free, publicly available professional development course and resources for educators who want to engage teachers in one-on-one coaching.

## CCS Concepts

• **Social and professional topics** → **K-12 education; Computer science education; Computing education programs.**



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## Keywords

coaching, equity, computer science, teachers

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## 1 Introduction and Background

Among the various groups historically marginalized in the field of computer science (CS), female students, students with disabilities, and English learners represent significant populations within the U.S. general K-12 student body. For instance, in 2023, students receiving special education services constituted 15% of public school enrollment [10], while English learners comprised 10.1% in 2020 [18]. Female students were also a majority, at 55.6% of all students in 2016. Despite their substantial presence in schools, these groups are considerably underrepresented in CS courses in the U.S.; in 2023, only 13% of students with an Individualized Education Program (IEP) or 504 plan, 6% of English learners, and 31% of female students enrolled in CS [2].

When underrepresented groups learn CS, it benefits them when their teachers are prepared to support their various learning needs. For example, previous research indicates that effectively meeting the needs of students with disabilities in CS classrooms requires addressing three key areas: teacher attitudes and expectations, pedagogical approaches, and accommodations and accessible materials [7]. Standards for such practices are defined throughout the Computer Science Teachers Association's (CSTA) Standards for Teachers [3]. Inclusive teaching practices are embedded throughout the standards, and *Standard 2. Equity & Inclusion* has several indicators specifically focused on such practices.

While many teachers engage in professional development (PD), coaching provides an opportunity for differentiated PD focused on the individual teacher's needs and is incorporated into their day-to-day activities. Coaching provides teachers opportunities to reflect on their practices and establish a professional learning community [9], which may increase job satisfaction and retention [19]. Several

studies have demonstrated how coaching can bolster the transfer of learning from PD to the classroom, improving adoption rates of teaching practices from 20% to 80% or more in some cases [4, 6, 11, 19]. As Table 1 from previous research [6] shows, coaching can be significantly more effective than more abstract PD elements at changing what teachers actually do in the classroom, having a greater potential impact on students and their learning. That is, as teachers receive PD that is more contextualized and tailored to their practices, they tend to experience enhanced knowledge, skills, and transfer to practice compared to when they receive PD that is more abstract or generalized (e.g., theory-focused or demonstration-focused).

The use of cognitive coaching has also been successful in supporting education faculty in learning and integrating CS concepts in teacher preparation programs [13]. Israel et al. found that coaching models that included co-planning and co-teaching components played an integral role in supporting computer science teachers in meeting the needs of diverse learners, including students with disabilities [5]. Coaching, therefore, is a critical component of effective professional learning with potential for clear impact on students, especially those historically marginalized in computing.

This experience report describes the impact of a CS coaching intervention on 1) teacher capacity to implement equitable teaching practices, aligning with Standard 2 (Equity & Inclusion), Standard 4 (Instructional Design), and Standard 5 (Classroom Practice) and 2) the sustainability of changes to teacher practice during and after the CS coaching process, with a focus on Standard 4 (Instructional Design) and Standard 5 (Classroom Practice). Practically, this CS coaching intervention could be replicated or adapted by others to train teachers in their communities. Notably, this is one of the first coaching-based PD initiatives that is explicitly tied to the CSTA Standards for Teachers.

## 2 The Coaching Intervention

We established a research practice partnership (RPP) with Code Savvy and the Northern Lights Collaborative for Computing Education (NLCCE) to study the impact of computer science (CS) coaching on teaching practices. Both partners used an instructional coaching model where coaches, after receiving summer training, mentored teachers through multiple coaching cycles over one school year. The model was specifically designed to align with the CSTA Standards for CS Teachers and to embed equitable teaching practices.

This report focuses on the second cohort of coaches and teachers. During the first cohort, coach training was held online and the coaching intervention lasted for one school year (September through May). In the first cohort, teachers reported an increased use of equity-focused teaching practices [16], an increase in their computer science knowledge and skills [17], and an increase in their professional growth and identity [14]. The RPP then used the findings and lessons learned from the first cohort to update coach training and materials as described in [15] for the second cohort. During the second cohort, the RPP was able to offer coach training in person and to provide additional coaching support through one school year and half of the following school year.

### 2.1 Training the Coaches

Each spring, we recruited coaches from the RPP's networks, selecting them based on their computer science knowledge, pedagogical approaches, experience with equitable teaching practices, and collaborative skills. After completing summer professional development, each coach mentored one or two teachers during the school year. The program consisted of three or four coaching cycles per academic year, which included stages for planning, implementation, and reflection. This workload was designed to be manageable for coaches with full-time teaching positions. We assessed the program's effectiveness after the first year and in the second year focused less on the number of coaching cycles and more on maintaining a regular meeting schedule between coaches and teachers.

Coaches completed 24 hours of summer professional development and participated in a community of practice during the school year with monthly hour-long meetings. Coach professional development focused on the stages of the coaching cycle—planning, implementing, and reflecting—as well as inclusive instructional practices. Activities included readings, discussions, observations, role plays, and more that allowed coaches to both see and practice coaching computer science. The coaching PD included the following:

#### **PD for Coaches (3 days, 24 hours in-person, in summer).**

This PD had a variety of engaging activities that provided opportunities for modeling and practices in both teaching and coaching. The PD included four key areas:

- Practice with CSTA Standards for CS Teachers and Resources
- Self-Reflection Checklist - a rubric to assist CS teachers in identifying areas of strength and areas for growth in their teaching practice
- Training on equitable teaching practices using resources from the Coaching for Equity book Aguilar, Cornell Tech's CS Coaching Toolkit Card Deck, and Teaching Moments equity case studies [12]
- Training on the Coaching Process, including stages of the coaching cycle, utilizing coaching tools (e.g., coaching log, rubric, questions) with a goal of integrity of implementation rather than precise fidelity to the tools [8], providing just-in-time PD to teachers to build their content knowledge and pedagogical content knowledge, supporting adult learners (andragogy), and building relationships with teachers through alliance building strategies, learning how factors such as interpersonal skills, collaboration, expertise, and coaching lenses impact the relationship
- Overview of the project's research and evaluation tools and processes.

#### **Meetings of RPP Team and Coaches (1 hour/month September through May, online).**

CS coaches and the RPP project team met on a monthly basis to review progress on coaching with teachers, discuss and role play issues of equity, provide just-in-time PD, and review evaluation and research data. Example activities included reviewing the coaching log and looking at examples of completed logs, applying CS-specific frameworks such as Universal Design for Learning and Culturally Responsive-Sustaining Education in revising lessons.

**Table 1: Teacher professional development outcomes [6]**

PD Elements	Knowledge Level (% understanding)	Skill Attainment (% attaining)	Transfer to Practice (% implementing)
Theory - presenter explains content	10%	5%	0%
Demonstration- presenters model instructional practices	30%	20%	0%
Practice - participants implement instructional practices	60%	60%	5%
Coaching - participants receive ongoing support in the classroom	95%	95%	99%

**Reflection (approximately 4 hours in June)** At the end of the academic year, the CS coaches and project team engaged in a reflective process, conducting evaluation interviews, completing surveys, and reviewing data to inform activities for the following year.

### 2.2 Coaching the Coachees

Each program also recruited and selected teachers (or coachees) to participate in their coaching programs. Teachers were recruited from the RPP’s networks and were teaching computer science in high school as a standalone course or integrated in another course. The teacher application process included an administrator support letter to ensure the school was aware of the coaching program and its observation of classroom instruction. Coaches and teachers utilized CSTA resources to guide the coaching process and supplemented with additional resources as needed.

Coaches and coachees attended an orientation and then met 1:1 in a pre-coaching meeting. These activities helped to:

- Establish the relationship and trust between the coach and coachee.
- Introduce the project and set expectations.
- Discuss what the teacher could expect from each coaching cycle.
- Provide information on how to complete the CSTA Standards for CS Teachers Self-Reflection Checklist, the survey, and an equity case study.
- Identify a student population historically marginalized in CS to focus on during coaching.

Each coaching cycle (which lasted 6-8 hours) included the following stages and utilized coaching questions from the CSTA CS Coaching Toolkit:

- **Planning:** Informed by the self-reflection results, teachers identified areas they wanted to improve and set specific goals (e.g., improving collaboration structures to engage all students, improving student use of CS vocabulary). The coach and teacher then planned instructional strategies and determined what data would be collected.
- **Implementing:** The lesson was taught using the planned strategies. The coach observed and collected data, and in some cases modeled a lesson or co-taught if desired. If a coach was not able to attend in person, the lesson was recorded for later review (using the Swivl platform).
- **Reflecting:** The teacher and coach documented their reflections, aligned to CSTA’s CS Instructional Practice Evidence Guide and the specific goals of the cycle. They discussed the

observation and reflections and developed an action plan for continuous improvement.

A post-coaching closeout meeting was conducted to:

- Summarize highlights from the teacher’s improvement over the year.
- Ensure teachers had completed a final self-assessment and survey.
- Create a plan for the teacher’s continuing professional growth for the next year.

## 3 Implementation and Results

We obtained Institutional Review Board (IRB) approval from one of the participating institutions. Both coaches and coachees received stipends for their participation in this study. For this experience report, we share results of the full Cohort 2 who participated in three semesters (1.5 school years) of one-on-one coaching, August 2023 through January 2025. For results, we share findings from surveys as well as interviews conducted by the evaluation team.

### 3.1 Participating Coaches and Coachees

Coach recruitment was initiated through the dissemination of a formal position description across the networks of each partner organization. From the applicant pool, twelve coaches (six per organization) were selected. The selection criteria prioritized three key qualifications: (1) prior experience in teaching computer science in high school; (2) a demonstrated commitment to working with adult learners; and (3) expertise in supporting students from groups typically marginalized in computing.

Sixteen coachees participated in this study were primarily veteran high school educators ( $M_{years\ teaching} = 15.35, SD = 6.45$ ) who were novices to teaching computer science, with fewer than three years of experience in the subject. These individuals, recruited nationally via professional networks and online outreach, held diverse teaching licenses, most commonly in math, science, and business; a few were also licensed in special education or English as a second language. Their own CS backgrounds varied, with 75% ( $n = 12$ ) having taken at least one college course in the subject and some possessing prior industry experience. The demographic composition of the group was as follows: seven participants were women, four reported having a disability, and 15 identified as White, with one identifying as Hispanic/Latinx.

## 3.2 Data Collection & Analysis

Data collection for Cohort 2 included a survey and self-reflection checklist data. The evaluator on the project also conducted interviews with both coaches and coachees to gauge their experiences, self-reported impacts, and satisfaction with the coaching program. Data was collected at the start of the program (Timepoint 1), after one year (two semesters) of participation (Timepoint 2), and at the end of the third semester (Timepoint 3). We obtained usable data from 15 of these Cohort 2 coachees. Because we added an additional data collection time point, analyses in this section leverage repeated measures ANOVAs (which is an extension of the dependent samples t-test for 3 or more timepoints).

## 3.3 Impacts

**3.3.1 Standard 2: Equity and Inclusion.** Coachees rated their equity and inclusion practices at Timepoint 1, on average, as “Developing” ( $M = 2.72, SD = 0.43$ ), while at Timepoint 2 they rated their equity and inclusion practices as “Competent” ( $M = 3.16, SD = 0.58$ ). Thus, coachees increased from Timepoint 1 to Timepoint 2 by an average of 0.43 points (on the five-point scale), and increased at Timepoint 3 ( $M = 3.60, SD = 0.59$ ) by an average of 0.29 points. A one-way RMANOVA indicated that teachers’ ratings increased over time ( $F(2, 24) = 8.12, p < .01$ ). Specifically, average ratings were statistically significantly higher at Timepoint 3 compared to Timepoint 1 ( $M_{diff} = 0.71, p < .01$ ). The figure below shows the average level of competence coachees indicated for their Standard 2 Equity & Inclusion practices at all three Timepoints. The blue bidirectional arrows represent scores between scale anchors (e.g., 1.5).

Coachees rated via 9 items their attitudes toward equitable teaching practices from 1 (Strongly disagree) to 5 (Strongly agree). The nine items were treated as a single Equity Attitudes Scale and showed adequate reliability at Timepoint 1 ( $\alpha = .88$ ), Timepoint 2 ( $\alpha = .80$ ), and Timepoint 3 survey ( $\alpha = .86$ ).

Results from a one-way repeated-measures ANOVA showed no statistically-significant change in coachees’ reported attitudes toward equitable teaching practices over time ( $F(2, 26) = 0.60, p = .55$ ). On average, coachees rated their attitudes toward equitable teaching practices as slightly above *Agree* at all three time points. Results were the same when we examined each of the nine items individually.

The key takeaways related to Standard 2 were:

- Most coachees rated their equity and inclusion practices as Developing or Competent prior to participating in the program
- After participation in the program, most coachees rated their equity and inclusion practices as Competent. The average difference between Timepoint 1 and Timepoint 2 indicated a medium effect
- Coachees’ ratings of their equity attitudes were approximately the same across all three timepoints. This result could partially be explained by the relatively high ratings of all equity attitudes the coachees reported even at Timepoint 1, prior to the program.
- On average, coachees largely felt positively toward their equitable teaching practices at all three timepoints.

**3.3.2 Standard 4: Instructional Design, Standard 5: Classroom Practice.** For Standard 4, coachees rated their instructional design practices at Timepoint 1, on average, as *Developing* ( $M = 2.64, SD = 0.58$ ), while at Timepoint 2 they rated their instructional design practices as *Competent* ( $M = 2.97, SD = 0.72$ ), and at Timepoint 3 they rated themselves between *Competent* to *Accomplished* (mean = 3.61,  $SD = 0.93$ ). A one-way RMANOVA indicated that teachers’ ratings increased over time ( $F(2, 24) = 8.88, p = .001$ ). Specifically, average ratings were statistically significantly higher at Timepoint 3 compared to Timepoint 1 ( $M_{diff} = 0.76, p < .01$ ) and compared to Timepoint 2 ( $M_{diff} = 0.53, p < .05$ ).

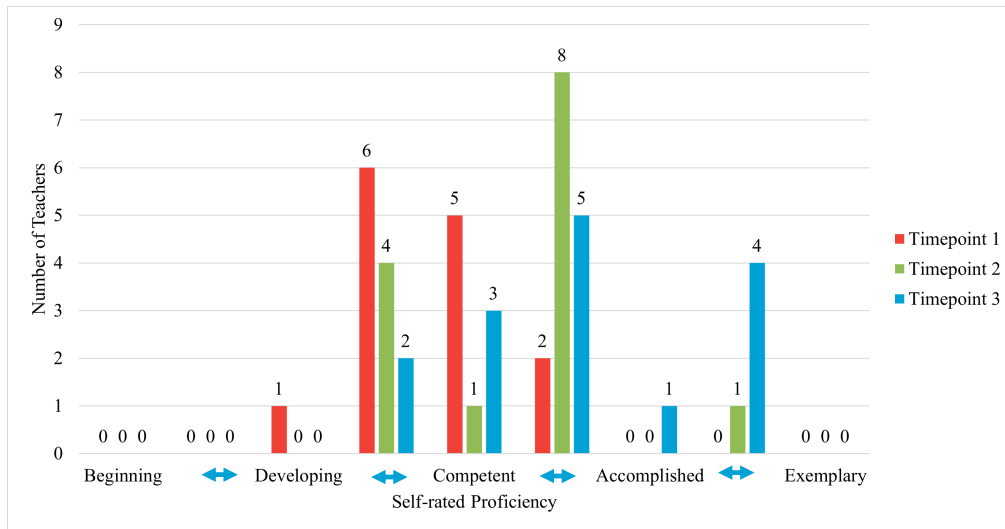
For Standard 5, on average, coachees rated their classroom practices at Timepoint 1 as nearly *Competent* ( $M = 2.98, SD = 0.52$ ), while at Timepoint 2 they rated their classroom practices between *Competent* and *Accomplished* ( $M = 3.36, SD = 0.72$ ) and ratings were approximately the same at Timepoint 3 ( $M = 3.73, SD = 0.79$ ). A one-way RMANOVA indicated that teachers’ ratings increased over time ( $F(2, 24) = 5.26, p < .05$ ). Specifically, average ratings were statistically significantly higher at Timepoint 3 compared to Timepoint 1 ( $M_{diff} = 0.67, p = .02$ ).

Coachees rated their use of high-impact instructional design and classroom practices on the survey at each timepoint using the following scale: Not attempted or Never, A few times a year, Monthly, Weekly, or Daily. There were 16 items across the scale related to Standard 4 and 5 (i.e., Use inquiry-based learning strategies, Use a variety of assessment strategies). This measure showed strong reliability at Timepoint 1 ( $\alpha = .88$ ), Timepoint 2 ( $\alpha = .90$ ), and Timepoint 3 survey ( $\alpha = .94$ ).

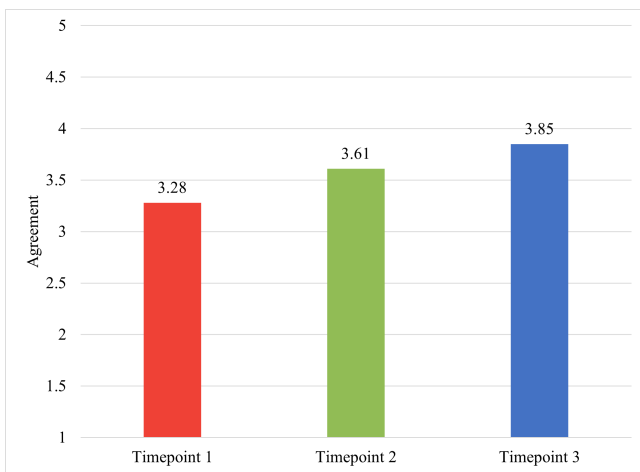
Results from a one-way repeated-measures ANOVA showed a statistically-significant increase in coachees’ reported use of high-impact instructional design/classroom practices over time ( $F(2, 26) = 4.81, p < .05$ ). That is, on average, coachees rated their use of high-impact pedagogical strategies as *Monthly* at Timepoint 1 ( $M = 3.28, SD = 0.76$ ), at Timepoint 2 that average rating approached the *Weekly* value ( $M = 3.61, SD = 0.67$ ), and at the Timepoint 3 survey this rating (on average) was even closer to the *Weekly* value ( $M = 3.85, SD = 0.79$ ). Pairwise comparisons indicated that scores at Timepoint 3 were statistically significantly higher than scores at Timepoint 1 ( $M_{diff} = 0.40, p < .05$ ).

Key takeaways for Standards 4 and 5 were:

- Coachees’ self-ratings of their instructional design practices (Standard 4) increased at Timepoints 2 and 3 (when compared to Timepoint 1)
- Coachees’ self-ratings of their classroom practices (Standard 5) were higher at Timepoint 3 compared to Timepoint 1
- On average, coachee’s reported use of high-impact instructional design and classroom practices increased significantly from Timepoint 1 to Timepoint 3
- The program is likely exposing coachees to inquiry-based strategies and they are aware of how and/or the extent to which they use inquiry-based strategies.
- The program seems to recruit educators that value multiple perspectives and likely supports sustaining the idea that highlighting multiple perspectives is important to effective teaching.



**Figure 1: Teachers’ average ratings of their practices related to Standard 2, Equity & Inclusion practices. Double arrow indicates halfway between the two adjacent scale points.**



**Figure 2: Teachers’ reported use of instructional design and classroom practices.**

## 4 Lessons Learned/Insights

### 4.1 For Coaches

During interviews conducted by the project evaluator the coaches stated that, from their perspectives, the more useful aspects of the PD provided for coaching included:

- Providing the PD in-person rather than virtual
- The opportunity to connect with other coaches
- The activities—especially the identity wheel
- The opportunity to learn new perspectives from the RPP team and other coaches

The coaches felt that the less useful aspects of the PD, and thus areas for improvement, included:

- The volume of hands-on activities didn’t allow the time to absorb the materials
- It was challenging for some coaches to travel to the city where it was held
- The coaching log template wasn’t fully complete at the PD session and the coaches would have liked to get summer training on the final version during the PD
- The coaches wanted more exemplars for what type of feedback to give on the video recordings of coachees.

Reflecting on the monthly coach meetings, coaches felt that the more useful aspects of the meetings were:

- Time to connect personally, and learning others’ perspectives, ideas, and real-world experiences
- Being able to help newer coaches

The less useful aspects of the virtual monthly coaches meetings included:

- Challenging to find a time to meet convenient to all coaches
- Sometimes equity conversations in monthly meetings were less helpful given the different classroom contexts. For example, one coach noted that “I heard people talking about having no racial and ethnic diversity in their schools—this is not the case for me.”
- Since breakout room conversations weren’t fully shared with the larger group, there was concern that content was lost.

### 4.2 For Coachees

In interviews, the coachees felt that the best aspects of the program included:

- Someone to talk to/work with and the resources,
- Being recorded and getting feedback to improve their coaching, and
- Great support for coachees who are more isolated at their schools.

Coachees also shared the less useful aspects of the program, which included:

- Would have liked to receive more constructive feedback from coach
- Misalignment of types of schools between some coach and the coachee pairs (e.g., serving students from low-income backgrounds)
- Sometimes documents were hard to find in the drive
- The coaching log to record their interactions with coaches
- Swivl wasn't my favorite (I don't like recording myself) but it was still helpful. Would have been nice to see an example before diving in.

The coachees noted that the program changed their practices in the following ways:

- Helped to bring it to the forefront of their minds. Having the coach ask questions about classroom practices made them more aware of potential issues and how to mitigate them.
- How to help students who are learning English break down free response questions from the AP CS A exam. Got some ideas from review videos
- Focused on fostering communication and giving airtime to historically marginalized students in their classroom.

There were also indirect impacts of the program. Coachees shared what they learned from the program with others at their respective schools:

- Worked with school counselor to get them thinking about scheduling girls into CS
- Talked with administration about the program
- Spoke with colleagues at school about inclusive practices in PD

### 4.3 For the RPP Team

For the RPP team leading the coaching program, the second cohort provided an opportunity to refine the professional development and academic year coach meetings. During the second year, the monthly meetings placed a greater emphasis on equity attitudes and shifting from deficit- to asset-based perspectives. The monthly meetings also provided an opportunity to practice coaching skills utilizing the resources from the PD. For example, a meeting might start with a reflection related to disabilities and then include an activity to identify and select a UDL4CS strategy to improve the lesson for students with disabilities.

The RPP team also worked on refining the coaching log and continuing to provide guidance and exemplars of what a completed log might include to help guide coaches. The section of the log for the coaching cycle meetings was simplified from Cohort 1 so that it could be used for a meeting that included planning and/or reflecting stages of the coaching cycle. However, even with the simplified log, many of the logs were incomplete and the rich data that could have been obtained was not. A simpler method of collecting data (e.g., checklists or sentence starters) may help coaches ensure that critical data about the session is collected.

The RPP team is using the evaluation and research data, input from advisors, and their own personal reflections to create an online

professional learning course. The course captures activities that resonated with coaches and coachees and provides scaffolding in using coaching resources from CSTA and other sources. The RPP team is also planning to include a facilitator's guide so that professional learning communities, such as a district or CSTA chapter, can lead a local cohort given that coaches found the in-person PD valuable. We anticipate these online materials to be available December 2025, and linked on the Northern Lights Collaborative resources page (<https://northern-lights.umn.edu/resources>).

## 5 Implications and Recommendations

Since there was no control group in this pilot study, we cannot empirically state whether the program was solely responsible for the growth in coachees' understanding of classroom practices as they align to the Standards. However, we can state that for the coaches, they valued the sense of community, peer-to-peer learning, and in-person connections fostered by the pilot program. The primary areas for improvement involve refining the pacing of content, ensuring all practical tools are finalized and modeled before delivery, and restructuring virtual meetings to be more flexible and contextually relevant. For the in-person PD, the PD is valued and should be maintained as the cornerstone of the program. However, its structure and accessibility can be improved through intentionally building in more time for reflection and debriefing after each major activity. Making sure that all of the materials are ready at the PD would also be helpful, as well as developing a library of exemplars on how to provide critiques on teacher-recorded video presentations. For the virtual monthly meetings, coaches would like to differentiate more by context where possible to allow for more targeted discussions and sharing of experiences. The RPP team is considering how best to include these elements in the professional learning course.

From the coachees' perspectives, the recommendations are related to improving the coach-coachee matching process so that their contextual backgrounds more closely align and training coaches to deliver more constructive feedback. More specificity around the coaching logs and what to include in them (potentially with some quantitative items included) would be beneficial.

## 6 Conclusion

Through this pilot project, we explored some of the possibilities in a structured one-on-one coaching program delivered to high school CS teachers. While the number of participants in the study was small, the pilot program gave us an opportunity to explore how coaching could be implemented through a research practice partnership. Participation in a 1.5 year coaching program likely enhanced teacher confidence in both their conceptual and practical understanding of teaching CS to their high school students. While this study supports coaching as a promising approach, further research (including studies with a control group) is essential to isolate the key program elements that most effectively advance the goal of a robust and equitable CS education for every student.

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