Expanding Computer Science Education in Rural Areas: Impact of Teacher Training on Teachers' Identity, Commitment, Confidence and Competence

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Abstract

The lack of computer science education in rural areas presents unique challenges in the current pursuit of achieving equitable access to computer science education. The growing recognition of the need for computer science education highlights the necessity of including rural areas, and a corresponding increase in the demand of competent computer science teachers and educators. Teacher training programs play an essential role in meeting these demands.

This paper evaluates the impact of a teacher training program focusing on professional identity, commitment, confidence, and competence as it relates to computer science teaching. The research includes teachers from rural, suburban and town locales enrolled in three separate semester courses. Through a mixed-method design, it uses quantitative data obtained through surveys taken prior to and at the completion of the training program to measure the impact. The survey encompasses three domains: Teacher and Computing Identity, Rural Identity and Teacher Mindset, and, lastly, Teaching Perceptions and Computational Thinking. Qualitative data collected through reflective journals provide information on teachers' backgrounds and teaching experiences, as well as anticipated professional growth.

Following training, the findings show that rural teachers reported positive changes in their identities and teaching competencies and are more likely to advocate for more students to take computer science courses. Teachers in rural areas also showed a marked improvement in confidence and commitment to teaching computer science.

1 Introduction

Computer science (CS) education gained significant attention after the publication of a concerning report titled *Running on Empty: The Failure to Teach Computer Science in the Digital Age* by [1], which revealed outrageously low figures for women in computing and highlighted that more than two-thirds of the country's population were lacking the standards for a comprehensive computer science program at the secondary school level [2]. Consequently, countries and academic scholars began to place high values and emphasis on the need for children to develop a strong foundation and gain fundamental understanding of computer science [3]. This includes developing digital tools to aid computational thinking, a problem-solving approach in computer science [4]) and fostering collaborative learning from an early age [5]. The expansion of computer science education promises feasible results, given that computer programming has recorded profound positive effects on the meta-cognitive ability, reflectivity, and divergent thinking in young children [6], and when given age-appropriate technologies, curriculum and pedagogy, young children can actively engage in learning from computer programming and take the first steps in developing computational thinking [7].

However, if a significant expansion of CS education is to be equitably achieved, it becomes highly imperative to understand the inequalities in access to computing tools and human resources. Despite a notable increase in enrollment in CS majors since 2009 [8], there is still a marked disparity between rural and urban areas with respect to access to computer science education. A study of 1,537,073 students in Texas showed an under-representation disparity index (which is measured by the quotient of the rate or proportion for the target group over the rate or proportion for the comparison group) of 0.84 for rural areas and an over-representation disparity index of 1.19 for their urban-suburban counterparts [9]. In fact, only 57.5% of public high schools in the United States offer foundational computer science. Although this is an increase from 53% in the previous year, there are still disparities as rural and smaller schools are less likely to offer computer science foundation [10]. These disparities pose a systematic and national challenge and are created largely by patterns of residential segregation and socioeconomic disadvantage [11].

The integration of computer science into almost every discipline creates lucrative jobs and promising career opportunities. However, the field is still underpopulated and under-represented [12]. Specifically, one of the significant challenges and bottlenecks in the expansion of computer science education is the inaccessibility of highly qualified teachers in rural areas [13]. To help address the CS teacher deficit, Morrissey and Koballa et al [13] developed a preservice CS certification pathway, a testing option for CS professionals who want to transition from industry into teaching, and a CS endorsement for teachers who are certified in other teaching areas to obtain CS certification but very few of the CS endorsement program providers target rural, high-need school systems. The remoteness of rural areas often leads to unique challenges in expanding access to CS education, including limited technological infrastructure such as the high-speed Internet, fewer opportunities for professional development, and difficulties in recruiting and retaining qualified teachers [14]. Teacher preparation programs in under-resourced institutions of learning in the United States will need to inculcate CS education in order to foster their teacher preparation and professional development efforts [15].

We therefore seek to provide answers to the following research questions:

RQ1: How does participation in the computer science training program influence rural teachers' professional computing identities?

RQ2: How does the training program affect teachers' commitment to teaching computer science?

RQ3: How does participation in the teacher training program affect confidence and teaching competence of rural teachers?

2 BACKGROUND

2.1 Paucity Of CS Education In Rural Areas

The National Center for Educational Statistics (NCES) defines locale by four categories - Urban, Suburban, Town and Rural. Each of these categories are broken down further into sub-groups [16]. Although each these groupings by NCES are widely recognized and used for educational research, each category presents unique challenges [17], specifically with respect to bringing computer science education to the rural schools, which is seen as a persistent CS educational challenge [18].

Access to computer science education is less prevalent in schools in the rural areas compared to their more urbanized counterparts [19]. Although Broadening Participation in Computing (BPC) education projects have been effectively implemented in some states in the United States of America, such as Maryland [20], California [21], and Utah [22], rural schools are not still within sufficient reach largely due to their geographical disadvantages [23]. An attempt to identify the implementation challenges for a new computer science curriculum in rural western regions of the United States also revealed that the concept of computational thinking and coding were foreign to the teachers whom required a pedagogical shift to teach CS [24]. Thus, incorporating computational thinking into rural education can foster structural thinking, critical reasoning, and creativity [25].

2.2 CS Teacher Training Programs

The lack of access and implementation of computer science education in rural areas has led to increased efforts to broaden the participation in CS education through various teacher training programs. Computer science is seen as one of the most segregated disciplines in the United States, highlighting the necessity of teacher training in developing the knowledge and practices that would broaden participation in computing [26]. Well-designed teacher training programs help build computational thinking skills in teachers. An online STEM-based activity Computer Science Teacher Training (CSTT) was put in place to develop pre-service teachers' Computational Thinking (CT) skills measuring problem decomposition, algorithms, pattern recognition and abstraction, and revealed a 13.58% improvement in the CT test mean scores [27].

Quality teacher training programs targeting K-12 teachers have the tendency of reaching more students [28]. For example, WeTeach_CS designed a teacher training program to certify teachers to teach high school CS in Texas, leading to an increase in the number of certified teachers in rural areas [29]. A comprehensive study on the computer science K-12 outreach teacher training programs of eleven universities demonstrated the effectiveness of these training programs in making computer science accessible to teachers [28].

Professional development has been shown to be among the key factors that contribute to the turnover and retention of STEM teachers in rural areas [30]. Susie and Thomas et al, [13] developed a project that highlights a mechanism that has the potential of increasing computer science learning opportunities for students in rural, high-need school systems by using well-trained set of teachers. Rural teachers are able to exhibit creative ways of incorporating Computational Thinking into their subjects, following teacher workshops [31]. There are several tools and techniques used in expanding computer science in rural areas. These include Modeling and Simulation [32] as well as robotics, game design and culturally responsive teaching models [33].

2.3 Theoretical Framework

Teacher Identity. Teacher identity stands at the core of the teaching profession [34]. It is broadly defined as being recognized as a certain kind of teacher by self or by others [35], and can be perceived as a multifaceted construct that covers the beliefs, values, and perceptions of an individual about their role as an educator [36]. Teacher professional identity is dynamic and changes over time based on internal factors such as emotion and external factors such as life experiences and exposure [37]. Not only does identity provides a great framework in understanding computer science teacher preparation and professional development [38], it is also one of the factors of consideration for entering into the profession of teaching computer science [39].

We can therefore conclude that teacher identity plays a key role in shaping the pedagogical approaches and overall effectiveness of a teacher. It is thus imperative to evaluate the impact of the teacher training program on the unique identities of the teachers under study and how they develop.

Commitment. Teachers' commitment plays a central role in the expansion and, subsequently, the sustenance of computer science education, both on a rural and urban scale. Teacher training supports educators by boosting their commitment and confidence in their ability to teach computer science as well as leading students in completing course capstone projects [40]. Mentoring experiences have also shown to build teachers commitment to computer science education [41]. Following an instructional coaching program, teachers in under-served rural areas looked beyond infrastructural challenge, such as wireless access, to exhibit very keen interest in the development of computer science master teachers [13].

Essentially, efforts to provide comprehensive professional teacher training programs are critical for ensuring teachers' commitment and motivation to delivering efficient computer science education to students.

Confidence And Competence. Many K-12 teachers are new to the teaching of computer science, which requires new disciplinary knowledge and skills. Teachers' confidence, or self-esteem, is one of the factors that affect teaching, and it is imperative for teachers to feel confident in their ability to deliver computer science education [42]. Understanding teachers' confidence level is so essential that it allows us for adjustment of the contents of the teacher professional development program in order to meet teachers' needs [43].

In addition, competence in teaching computer science plays a significant role and must be bolstered if expansion of computer science education is to be achieved. Studies reveal that insufficient number of trained and capable teachers is a common barrier to the broad-based adoption of computer science in secondary schools [44]. All of these highlight the effectiveness of professional training on teachers' confidence and competence whilst preparing for a career in teaching computer science.

3 Research Methodology

We engaged 64 participants, primarily high school teachers and a few others in a comprehensive teacher training program was conducted by the computer science department of a Midwest university in the United States. The program aimed at equipping teachers with requisite skills needed to deliver effective computer science education particularly focusing on participants from rural and under-represented areas, with the overall goal of integrating computer science into high school curriculum.

3.1 Research Design

A mixed-method design was employed, combining both quantitative and qualitative approaches. The rationale for using both approaches is to comprehensively evaluate the impact of the teacher training on teachers' identities, perceptions and commitments. The quantitative approach utilizes pre- and post-surveys measured on a Likert scale, while the qualitative method integrates teachers' self-reflective journals to gather information regarding teachers' motivation, years of teaching experience, and prior computer science knowledge.

3.2 Participants

To recruit teachers into the program, we emailed multiple teachers and lists of schools managed by our university and the state Department of Education, with the aim of reaching a wide range of participants. Teachers were invited to complete a brief survey to enroll in the program. All teachers who signed up were accepted as long as they were involved in education in some capacity - this included elementary teachers, a librarian, a substitute teacher, an unemployed teacher, and two recent graduates who showed interest in advancing careers in education.

We had a total of 64 participants join our professional development program. These were primarily high school teachers, though we also had two middle school teachers, one junior high teacher, a librarian, and one pre-professional. This mix of participants ensured that exposure to computer science education is extended beyond high schools to middle and elementary school levels.

The program covered a wide geographic area by involving 34 unique school districts, out of which 27 were classified as rural. This 79.41% representation of rural teachers reflects the program's success in targeting under-served areas.

3.3 Data Collection

The participants were asked to complete pre- and post-training surveys built into the course at the beginning and ending of the course, respectively. The surveys cut across three major areas – Teacher and Computing Identity; Rural Identity and Teacher Mindset; and Teaching

Perceptions and Computational Thinking. The data used for the research covered Spring 2023 to Fall 2023 semesters.

Survey Instruments The survey instruments used for this research were constructed using frameworks in existing literature, all of which were targeted towards evaluating the impact of a teacher training program on teachers' identities, perceptions and sense of belonging amongst other related parameters.

The survey instrument includes items from Computing Identity Framework/Model[45], which reflects interests in computing topics and practices, recognition in computer science with respect to being computer savvy, and performance/competence that highlights how people feel they could perform or understand computing topics and practices.

We adopted a survey construct from Ni et al's Teachers' Professional Identity in Computer Science [38], covering self-identification, community/sense of belonging, interest and value of teaching computer science, learning/striving to teach well, confidence in teaching computer science, and commitment to teaching computer science.

We utilized the Rural Identity Scale (RIS) [46] which proved essential for understanding the unique identities of the teachers in rural areas. It measures teachers' perceptions about rural life, activities and behaviors as well as relationships with persons in the rural community.The RIS showed an acceptable internal reliability of $\alpha = 0.72 - 0.83$ which boasts of its effectiveness in capturing rural identity. The teacher mindset survey, carved out of [47] and [48], was a vital instrument in supplying the valuable insights into diverse aspects of teachers' mindsets. It measures parameters such as concerns on social comparison, self-efficacy, comfort being oneself, measurement of task value, as well as the perceived costs of participating in the training program. Each survey item were measured on a 5-point Likert scale, with 1 being "strongly disagree" to 5 being "strongly agree," which eventually helped in measuring teachers' attitudes in the role of being computer science teachers.

Lastly, the survey incorporated items from Teachers' Self-Efficacy in Computational Thinking (TSECT), which is meant to capture a sense of students' self-efficacy in utilizing programming and Computational Thinking [4]. All of these instruments were put together to provide a comprehensive evaluation of the impact of the teacher training program in expanding Computer Science Education.

3.4 Ethical Considerations

Participants in the study were informed prior to the commencement of the program about the purpose of the study, what it entails and their right to opt out at any time.

Identifiable information was collected for the purpose of merging the pre-survey and the post-survey responses. This was stipulated on the Institutional Review Board (IRB) document approved prior to the commencement of this research. All responses were anonymized during the data analysis to protect the identity of the participants.

Participation in the research was voluntary, and had no intended penalties for non-participation.

3.5 Training Program

Content And Delivery Method The teacher training program covered foundational computer science courses packaged into 3 graduate-level courses delivered by our college of engineering. An additional 3-credit hour graduate course focused only on CS pedagogy was delivered by the college of education; however, the focus in this paper will be on the CS courses. The CS courses align with the content in typical CS0 and CS1 courses aligned with AP CS Principles and AP CSA, with the addition of pedagogical content, activities to create lesson plans, reflective journals and discussions. The following is an overview of the curriculum coverage:

- Introduction to Computing for Educators (2 credit hours)
  - Overview of history of computing and modern impact on the society
  - Theories of Computational Thinking
  - Pre K-12 Standards
- Computer Education Programming Fundamentals (1 credit hour)
  - Concept knowledge crucial for developing and teaching programming
  - Practice reading and writing of basic program codes
  - Basic concepts of conditionals and looping constructs
- Computer Programming for Educators (4 credit hours)
  - Basic concepts of programming (variables, control flow, functions, objects)
  - Interactive lessons and engaging projects reinforce new skills
  - Exploring pedagogical strategies for teaching programming

The training was delivered through a hybrid model that combined online modules and in-person workshops. The online modules leverage the power of digital learning by incorporating learning and content delivery through Codio learning platform [49]. This was particularly impactful, as it allowed for wider range of access, especially for participants residing in rural areas.

Teacher Training Workshop We conducted two-day in-person workshops, which were a blend of theoretical learning and hands-on activities that allowed for interaction with the participants. They included sessions on problem-solving, where teachers were partitioned into groups to discuss how problem solving fit into their respective content areas and how it is being incorporated into their pedagogical styles. Participants were also engaged in coding sessions using block coding for elementary levels.

The workshop also included collaborative learning through discussions and joint problem solving activities, which brings about synergy among the participants thereby enhancing their professional development.

3.6 Teachers' Autobiographies

We analyzed the teachers' autobiographies which provided the qualitative data on their personal experiences, challenges and aspirations related to CS education. Each of the teachers reflected on their early exposure to technology, professional growth and their motivations for incorporationg CS into their teaching practices. They represented different educational backgrounds and levels of teaching, from elementary to high school and includded both STEM-focused and general teachers.

3.7 Data Analysis

Quantitative Data Analysis

A statistical paired t-test was used to determine the significance of the difference in the mean pre- and post-survey responses. Beyond statistical significance represented by p-values, the expression of results with effect sizes and confidence intervals provide a more comprehensive method of statistical results [50]. We therefore computed the effect sizes and confidence bounds to complement the p-values in measuring the effect of the training program. Hedge's g [51] was calculated as a variation of Cohen's d [52]. This is because Hedge's g includes a correction factor that reduces the bias on small sizes the results from Cohen's d.

Qualitative/Thematic Data Analysis

A thematic analysis approach was used to identify recurring patterns and themes within the teachers' autobiographies. Each autobiography was read by multiple researchers to capture key narratives. Key phrases such as "Early exposure", "Student-centered goals", "Apprehension about CS", "Self-taught", "Desire to help students learn CS", "No background in CS" etc were identified and coded. The themes were cross-referenced to ensure consistency.

4 RESULTS

The impact of the teacher training program on rural, town, and suburban populations is shown in Table 1. A total of 24 teachers completed both the pre and post surveys, and comprises 13 teachers from town, 8 from rural and 3 from suburban locales. The data was filtered such that only the teachers that completed both the pre and post surveys were included in the analysis. Also, the results provide an understanding of the teachers' experiences, challenges and aspirations as revealed through their autobiographies. Thematic analysis revealed key themes capturing the diverse journeys of the teachers as they navigate the learning and teaching of computer science, which goes a long way to support the role of professional development in equipping teachers to prepare the next generation of CS education professionals. The following subsections provides specific details of the impact of the teacher training program.

4.1 Thematic Results From Teachers' Autobiographies

The teachers' initial interactions with technology varied widely and are reflective of the state of technological development during their times. Early exposures ranged from using TRS 80s and Commodore 64 to working with gaming tools like Atari and Nintendo. Early exposures

Table 1: Computed Results from Survey Data

Item	**Locale**	**Effect Size**	**P Value**	**Lower Bound**	**Upper Bound**
Teacher Identity					
I truly enjoy teaching Computer Science	Rural	0.4954	0.1704	0.2044	0.7956
	Suburban	0.0000	0.0000	0.0000	0.0000
	Town	-0.0712	0.8078	-0.1099	-0.0441
I see myself as a computer science teacher	Rural	0.1824	0.5630	0.1022	0.3978
	Suburban	0.2469	0.4226	-0.2522	0.9189
	Town	0.3755	0.0532	0.2643	0.6588
I have actively looked for opportunities to teach computer science	Rural	0.4322	0.0331	0.2044	0.7956
	Suburban	-0.2066	0.4226	-0.9188	0.2522
	Town	0.3574	0.1511	0.3084	0.7685
Commitment/Striving to Teach Computer Science					
I work hard to be the best computer science teacher that I can be	Rural	0.7221	0.1705	0.2044	0.7956
	Suburban	0.6532	0.4226	-0.2521	0.9189
	Town	0.1878	0.5345	0.1322	0.3294
I attend professional development to help me keep up with the latest developments in [CS] teaching	Rural	0.3383	0.3506	0.1533	0.5967
	Suburban	0.9237	0.1835	-0.5044	1.8377
	Town	0.0000	1.0000	0.0000	0.0000
I advocate for more students to take courses in computer science	Rural	0.2832	0.4512	0.1022	0.3978
	Suburban	0.6532	0.4226	-0.2522	0.9189
	Town	0.1758	0.5845	0.0881	0.2196
Confidence in Teaching Computer Science					
How well can you implement alternative strategies in your computer science classroom?	Rural	0.8092	0.1114	0.3066	1.1934
	Suburban	0.4131	0.1835	-0.5044	1.8377
	Town	0.0642	0.8193	0.0441	0.1098
To what extent can you gauge student comprehension of what you have taught?	Rural	0.5970	0.2443	0.3066	1.1934
	Suburban	0.3939	0.1835	-0.5044	1.8377
	Town	0.1399	0.7112	0.0881	0.2196
How much can you do to adjust your lessons to the proper level for individual students?	Rural	0.3611	0.4869	0.2044	0.7956
	Suburban	0.2066	0.4226	-0.2522	0.9189
	Town	0.0000	1.0000	0.0000	0.0000
How much can you do to get students to believe they can do well in computer science?	Rural	0.7221	0.0062	0.3577	1.3923
	Suburban	0.0000	1.000	0.0000	0.0000
	Town	0.3273	0.3905	0.2203	0.5490
How much can you do to help your students value learning computer science?	Rural	0.7649	0.0.0062	0.3577	1.3923
	Suburban	0.0000	1.0000	0.0000	0.0000
	Town	0.2906	0.3665	0.1762	0.4392
How much can you do to foster student creativity in computer science?	Rural	0.3708	0.0331	0.2044	0.7956
	Suburban	0.0000	1.0000	0.0000	0.0000
	Town	0.1869	0.5696	0.1322	0.3294

were limited to basic tasks, leaving gaps in foundational knowledge of programming and problem-solving skills.

Educators frequently encountered challenges when learning or teaching CS, including limited prior knowledge, fear of failure, and difficulty adapting to new tools and programming concepts. These challenges highlight and importance of providing structured learning opportunities and support system to build educators' confidence and teaching capabilities.
A recurring them was the teachers' motivation to grow professionally by learning computer science. Many of the teachers viewed professional development as an opportunity to enhance their teaching practices and prepare students for careers in technology.
The teachers consistently emphasized their desire to inspire and empower students through CS education. A particular teacher shared success using Code.org and Scratch to enage students in collaborative problem solving.
Many of the teachers highlighted enthusiasm for applying computer science concepts to real-world problems such as robotics, web development and practical coding projects.

4.2 RQ1: Bolstered Professional Identity

The training program impacted rural teachers' professional identity, evident from the moderate effect size of 0.4954 in Table 1 where teachers report enjoyment of teaching computer science. Although the p-value of 0.1704 suggests a statistically insignificant change, the 95% confidence bound ranged from 0.2044 to 0.7956, indicating the true effect size lies within that range – signifying a meaningful effect.

Similarly, the training gave the teachers strong motivation to actively engage in activities that provide opportunities to teach computer science thereby bolstering their professional identity.

4.3 RQ2: Commitment To Professional Growth

The program instilled a sense of commitment to advancing the teaching of computer science among rural teachers, indicated by an effect size of 0.7221 for striving hard to be the best computer science teacher. In addition, the training led to a positive shift in teachers' willingness to participate in professional development programs to keep pace with current developments in computer science teaching as shown in Table 1.

4.4 RQ3: Increased Confidence And Competence

Table 1 shows that the rural teachers demonstrate increased confidence — they are more able to gauge students' level of comprehension as indicated by an effect size of 0.5970. More so, an effect size of 0.8092 for implementing alternative teaching strategies highlights a boost in the confidence of the teachers and enhance competence in teaching computer science.

Trailing closely behind the ability to measure students' level of comprehension and building alternative teaching strategies is the rural teachers' ability to adjust lessons for individual students and foster students' believe in their ability to become successful computer science students, evident by effect sizes of 0.3611 and 0.7221, respectively. Rural educators are more able to engage students in activities that foster creative thinking after the program than they were before the program.

5 DISCUSSION

The findings from the teacher training program highlight the potential for professional development programs to transform rural educators and equip them for advancing computer science education. Given the unique challenges faced by rural teachers, which includes a shortage of qualified teachers and limited access to resources, the outcome of the program is significant.

A profound impact of the program is on teachers' identities with a moderate effect size which indicates meaningful impact despite a statistical insignificance. Teachers reported greater enjoyment in teaching computer science after the program, and are more motivated to seek out opportunities to teach computer science.

The program also had a positive impact on teachers' commitment to professional growth, evident by willingness to participate in professional development programs that would keep them up to date with advancements in computer science education.

The teachers' demonstration of increased ability to gauge students' level of understanding, adjust lessons to meet students' needs, and implement alternative teaching strategies is an indication that the program effectively equipped the teachers with the requisite skills and confidence in teaching computer science in rural areas.

5.1 Broader Impact Of The Teacher Training Program

With the goal of achieving a broad impact, we initially attempted to reach at least 50 teachers in 50 different schools. However, while this target was not met, we successfully reached 34 unique school districts - out of which 27 were rural.

About 18 of the school districts reached by our program have committed to offering either AP CS Principles-aligned course or our AP CS A-aligned course, with 8 of those districts planning on offering the associated AP exam (see Table 1). More schools reported that they were going to integrate at least parts of this curriculum into their classrooms. Roughly 363 students will be taking a CS course designed by our program, and around 2,000 students will be reached through teachers who completed at least some part of the professional development provided as a result of this program.

6 LIMITATION OF THE STUDY

The findings of this study are limited by small sample sizes, which reduces the ability to generalize the results to the rural populations. This reduces the statistical power of the study and in turn makes it difficult to obtain significant effects and draw solid conclusions.

More so, the sample has a lack of diversity which makes it difficult to represent a wide range of experiences and viewpoints found in rural areas, thereby missing out on important points. As a result of this, it is essential for future research to involve larger and more diverse samples in order to guarantee their applicability across rural areas.

Currently, there are about 120 teachers in the program and there are plans to recruit more

Table 2: Impact By Numbers

Group	Total
Teachers who completed at least 1 course	51
Teachers who completed 10 credit hours*	22
School Districts Reached	34
Rural	27
Urban	7
Schools offering the Courses Fall 2023	18
Schools integrating some part of the Courses	25
Number of new AP CS A courses offered	3
Number of new AP CS Principles courses offered	7
Est. Students Reached By Our Curriculum Fall 2023	363
Est. Students Reached By a Teacher Trained by this Program	2052

* 12 actively working to finish

later this year. This will create room for additional data to be collected more quickly, especially as we will be using similar survey instruments to explore how rural students are impacted by our curriculum.

7 CONCLUSION AND FUTURE WORK

Overall, this analysis demonstrates that our teacher training program positively impacted teacher identity, commitment to teaching and boosting confidence in teaching computer science among rural educators.

The teacher training program will build on its current success to provide more insights based off on teachers' reflective journals. Future work will focus on providing valuable insights on how teachers adapt to teaching of computer science, taking into account the emotions, excitements, apprehension and feeling of being overwhelmed that accompanies teaching. This will provide unique experiences of the teachers.

Also, reflections on learning theories and ecologies which reveals disparities that affect access to computer science will be another area of focus in the future.

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