Experiences of Rural CS Principles Educators

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***Abstract*—Bringing computer science to rural schools is a persistent CS education challenge. Over 9 million students attend rural schools, nearly 1 in 5 of all public school students [1]. While rural schools have some advantages, they face significant challenges including recruiting and retaining qualified STEM teachers, school funding, and access to broadband Internet. To better understand how and why rural schools are teaching CS courses, researchers conducted focus groups during summer 2020. Participants included high school teachers who had completed the Mobile Computer Science Principles (CSP) professional development and were teaching in rural or town schools. Results indicate that in varied rural contexts, teachers play a key role in establishing and sustaining CS courses at their school while facing challenges such as how to navigate teaching, course capacity, and access to resources necessary to teach CSP. The experiences, strengths, and challenges of rural teachers can inform state policy leaders, curriculum and professional development providers, researchers, and other stakeholders as they work to expand access to meaningful CS learning for all students, including those in rural areas.**

***Keywords*—rural education, K12 computer science, computer science principles**

I. Introduction

The National Center for Education Statistics (NCES) defines urbanicity or locale by four categories (urban, suburban, town, and rural) with each category broken down into three subgroups [8]. The definition of rural is based on distance from urban areas and varies from 5 miles or less from an urbanized area to 25 miles or more from an urbanized area or 2.5 miles from an urbanized cluster [8]. While these NCES definitions are widely used and accepted within education research as the means of defining urbanicity and locale, there is an incredible variance within and between rural communities with each facing unique characteristics, challenges, and benefits [3].

Many schools in the U.S. face significant challenges, but these are often exacerbated in rural schools. Rural counties have higher poverty rates than urban counties [10] and fewer students of color [1]. Rural schools report difficulties in recruiting and retaining highly qualified teachers, particularly those in STEM disciplines, and in accessing teacher professional development [7]. School infrastructure can be more challenging to maintain in rural districts, with higher costs compared to the funding received [1]. The digital divide is significant with rural Americans less likely to have home broadband access and computing devices [2]. Rural schools also offer advantages such as smaller class sizes and similar or higher graduation rates than their suburban and urban counterparts [7]. As of 2020, twenty states require all high schools to offer a CS course [4]. Of high schools offering CS courses, suburban schools provide the greatest access (57% of suburban high schools vs. 44% of city, 43% of rural, and 41% of town schools) [4]. States with large rural areas such as Utah, Virginia, and Indiana, have struggled with the small numbers of students in rural schools [6], [9], [11]. Another factor is the lack of educators with CS experience and access to professional development [5], [7]. The majority of administrators in rural schools support CS learning for students, however, there is less support among rural teachers [5].

Mobile Computer Science Principles (CSP), an introductory high school course, aimed to better understand the challenges, supports, and barriers for rural CS by hosting focus groups with rural educators. Our hope is that the lessons we have learned will be useful for CS education stakeholders.

II. Project Description

The focus groups were open to current or past Mobile CSP teachers located in a rural or town locale. All teachers who completed the interest form (N=29) had taught Mobile CSP and were U.S. residents. Of those who were eligible to participate (N=21, 72%), 13 (62%) where from rural locales and 8 (38%) were from town locales. Fourteen teachers from 11 states participated in the focus group opportunity in June 2020. Teachers were asked about their school's physical locale, how they came to teach CS, and perceived barriers, challenges, supports, and advantages for CS opportunities within their school. Finally, participants were asked to explain how other factors such as lack of quality Internet access, high English-language learner population, socioeconomic status, and cultural values may impact CS opportunities. Recording transcriptions and moderator's notes were analyzed using inductive coding.

III. Results

Five themes emerged from the focus groups, as follows.

Definitions of Rural and Town are Varied. No descriptions of teacher communities were identical. One teacher de-

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scribed their school as "physically isolated in the mountains," while another shared that they were located near "mostly national parks and farmland," and others likened their community to a suburb. Current definitions of rural do not encapsulate the physical and social variance of rural communities [3]. Fully understanding the unique size, demographics, local industry, geography, etc. of rural communities will help address the unique needs and challenges of teachers and students.

CS Courses are Driven by Teacher Initiative. Participants felt responsible for taking the initiative to advocate for CS courses at their school. For example, when asked how CS courses are added, one teacher stated, "My ability and willingness to teach it. I think if I hadn't stepped up it would have fallen to the wayside." Some participants were intrinsically motivated as they personally enjoy CS and feel CS courses are a valuable asset to students: "CS is 100% more fun than grading Romeo and Juliet classes. I will push to add CS over adding more English to my day." Others mentioned feeling pressured to add more CS courses to meet state requirements, appeal to the administration's values, or adhere to the school or district's commitment to establishing a CS pathway. However, based on responses, it is clear that without teacher initiative, schools may not add or try out new CS courses.

Teacher Capacity Impacts CS Courses. Rural and town educators often felt pulled in many directions and a tension between what *needs* to be done and what *can* be done. Focus group participants expressed that once CS is in the course catalog, teachers are also responsible for selecting the curriculum, meeting enrollment goals, and teaching the CS course in addition to their other responsibilities. Rural educators often feel a strain in their personal capacity as they "cannot be two places at once" or simply "do not have enough hours in the day". If a teacher is needed to teach another class (e.g., English or Math), the CS course may be dropped if there is no state CS requirement. Participants described feeling a need to balance between bringing students the materials they need to know, providing courses that meet student and teacher interest, and the amount of time and energy educators have.

Access to Resources Impacts CS Courses. Rural schools have limited access to the computer or classroom resources necessary to successfully teach a CS course. Lack of internet at school and at home is another barrier that participants felt impacted their ability to offer CS. While Mobile CSP does incorporate unplugged activities, like most CS courses the class does require access to computers and the Internet for many lessons. Schools and students without access to these basic requirements may have a difficult time sufficiently participating in the course and rural educators expressed concern with the inability to provide these resources to students.

Rural Educators Choose Curricula in Response to Barriers. The barriers of teacher capacity, lack of resources, and lack of Internet impact what CS curricula educators decide to implement. Participants identified that they chose to use Mobile CSP because mobile devices are often more readily available or easily obtained in comparison to computers at school or home. As teachers are often stretched for time, turnkey courses that provide teacher materials limit the amount of preparation time. Teachers also appreciated that Mobile CSP provides guidance to new CS teachers: "Mobile CSP gave guidance instead of me having to teach on my own."

IV. Conclusion

This project explored factors influencing how CS courses are implemented and sustained in rural schools teaching Mobile CSP. CS education stakeholders may find it useful to understand the teacher-driven aspect of adding CS courses, rural teacher capacity, and other findings. For example, providing independent reviews summarizing curricula, easy-to-adopt recruitment strategies, and other teacher supports may reduce time commitments for teachers to create and sustain CS courses. Researchers should also consider to what extent supports and barriers to CS education are faced at both urban and rural schools, i.e., rural and urban schools may be similarly under-resourced as compared to suburban and town schools. This project was organized prior to and conducted during the COVID-19 pandemic and school shutdowns, which may have impacted participation rates and teacher responses.

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