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Designing a Program to Develop Computer Science Master Teachers for an Underserved Rural Area

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Designing a Program to Develop Computer Science Master Teachers for an Underserved Rural Area

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Abstract

Due to a shortage of rural computer science teachers, researchers used a three-phase method to design a computer science endorsement, which will be coupled with an instructional coaching endorsement within an Educational Specialist degree program. The team conducted interviews of teachers as well as school and district level administrators in rural areas to determine needs and resources available to develop computer science master teachers. Interviewers also investigated recruitment, preparation and support processes pertinent to the program. Findings included that, although infrastructure for wireless access is lacking, school and district administrators are very interested in supporting teachers to become computer science master teachers. STEM teachers are especially interested in computer science content related to their teaching field. Partners indicated an interest in developing teacher leaders, in order to encourage a sustainable computer science program in the school and district. Information gathered was used to design a program that intends to meet the needs of potential rural computer science master teachers.

Keywords: Computer Science Education, Teacher Leadership, Rural Education

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Job reports indicate there were over 400,000 open computer science (CS) positions in the United States in 2020, with only about 70,000 CS students graduating and joining the job force (Code.org Advocacy Coalition, 2021). Contributing to this is the nation's CS teacher capacity deficit. In 2020, only 47% of high schools nationwide taught CS (Code.org et al., 2020). Moreover, CS courses are disproportionately distributed, as "schools in rural communities and schools with higher percentages of economically disadvantaged students are less likely to teach computer science" (Code.org et al., 2020, p. 15). To address the CS teacher deficit, the Southeastern state where this project took place has a pre-service CS certification pathway, a testing option for CS professionals wanting to transition from industry into teaching, and a CS endorsement for teachers who are certified in other teaching areas to obtain CS certification. However, none of the CS endorsement program providers target rural, high-need school systems.

In addition to creating certified CS teachers, supporting those teachers in becoming teacher leaders would provide a pathway for integration of CS instruction into schools and districts in high-needs areas. This was seen in Lotter et al. (2020), where teacher leaders saw part of their role as providing opportunities to their students that would not otherwise be available. These teacher leaders improved their relationships with students, colleagues, and the community, which can lead to improved teacher retention (Burton & Johnson, 2010). Driven by the need for certified CS teachers, as well as the leadership needed to implement CS education school- or district-wide, this project seeks to develop an investigative process that will result in a Master Teacher CS program with ongoing support in a high-needs area.

Literature Review

This project was informed by four areas of thought regarding CS teacher education: teacher endorsement, teacher recruitment, teacher professional development (PD), and teacher leadership development. Initial teacher preparation efforts are not meeting the demand for highly-qualified CS teachers (Code.org, 2017b; Montoya, 2017). This is due to the limited number of CS teacher preparation programs and that few CS graduates choose to pursue teaching (Code.org Advocacy Coalition & CSTA, 2018). Thus, providing certification options for experienced teachers wanting to transition into CS is seen as a viable means to address the increased push for CS education in schools (Code.org, 2017a).

Teacher Endorsement

CS endorsement programs serve as a means for teachers to add CS as a new area of certification to their current teaching certificate (Code.org, 2017a). CS endorsement programs are offered through universities and, in some states, through non-university providers. A university provider may incorporate the CS endorsement as a track within a graduate degree program. Guided by CS teaching standards that vary from state to state (Code.org Advocacy Coalition & CSTA, 2018; Code.org et al., 2020), the learning experiences of most CS endorsement programs require a year or more to complete and include content and pedagogical coursework along with a CS-focused field experience (Columbus State University, undated; Oconee Regional Educational Service Agency [RESA], undated). CS endorsement programs use face-to-face, as well as hybrid and online delivery formats (Vivian et al., 2014) and, because they are structured to meet the needs of practicing teachers, tend to reflect the learning tenets of teacher PD.

Teacher Recruitment

Efforts to recruit experienced teachers from other content areas into a CS endorsement program must be strategic and comprehensive (Luft et al., 2011), which involve helping experienced teachers explore the field of CS teaching and determine if preparing to become a CS teacher is a good choice for them. When attempting to recruit CS teachers from the corps of experienced STEM teachers, the professional trajectory of these teachers must be considered. In science education, Luft et al. (2019) describe teachers' professional trajectories in the context of continuous learning and use Mezirow's (1978, 2012) transformative learning theory to frame the process of teacher professional growth aided by supportive communities. The professional trajectories that teachers chart for themselves can help them determine if transitioning into CS teaching is an appropriate choice for them as well as the knowledge, practices, and attributes they would need to develop (Luft et al., 2019). Research by Qian et al. (2018) also highlights the importance of understanding the backgrounds and motives of teachers when recruiting for CS. They found that teachers may have "hidden computing backgrounds" that are not always apparent, such as the mathematics teacher with informal programming experience. Moreover, experienced teachers tend to be committed professionals and much less likely to leave the profession than early career teachers (Garcia & Weiss, 2019), making experienced STEM teachers ideal recruits for pathways that enable them to transition into CS teaching (Code.org, 2017b). Additionally, as in all STEM areas, recruiting efforts must target teachers who reflect the diversity of the students they will teach (Montoya, 2017).

Teacher Professional Development

CS teacher preparation research is clear that the knowledge base for effective teaching includes CS content knowledge and pedagogical content knowledge (PCK) (Yadav & Korb, 2012). The CS content that teachers should know is aligned with the five core concepts of computer systems, networks and the internet, data and analysis, algorithms and programming, and impacts of computing in addition to the seven core practices that support computational thinking (K-12 Computer Science Framework, 2016). Fundamental to PCK in CS are the teacher's knowledge of common student misconceptions and areas where students encounter learning challenges (Yadav et al., 2016).

Besides content and PCK, CS teachers should be prepared to engage economically, ethnically, and linguistically diverse students (Montoya, 2017). Teachers need to understand the importance of culturally relevant interactions to the persistence and success of students traditionally underrepresented in CS (Charleston et al., 2017). These cultural interactions may be reflected in CS course curriculum as well as in culturally sensitive teaching and assessment strategies that focus on what diverse groups of students know and can do (Ladson-Billings, 1995). In addition, cultural interactions presented through peer and community modeling, familial cultivation, and multifaceted mentoring can be strategically encouraged by teachers. These need to be a part of CS teacher preparation, as these interactions have been shown to broaden the participation of African Americans and others in the CS educational pipeline (Charleston et al., 2017). Budge (2006) pointed out the importance of teacher leaders' understanding the culture in rural schools in order to be successful. Rural students have particular needs to be addressed in PD, such as lack of access to experiences and resources, that can be supplied through community connections, field trips and contests (Lotter et al., 2020). In addition, school and school system leadership are critical in supporting teacher change (Whitworth & Chiu, 2015).

CS preparation for experienced teachers transitioning into CS teaching is further informed by research on effective PD. Desimone's (2009) conceptual framework highlights key features of successful PD identified from research (Borko, 2004; Knapp, 2003): content focus, active learning, coherence, duration, and collective participation. The framework has been used in STEM fields, including CS, to guide the development of PD experiences. For example, Qian and colleagues (2018) used the framework to design a PD program for teachers preparing to teach a new CS course for the first time. The program was delivered online and spread out over many months, which was viewed as advantageous because teachers could access the program's materials when their schedules allowed. In addition, Buczynski and Hansen (2010) found PD that attends to the features of Desimone's framework and considers factors that promote engagement increases the likelihood of teacher learning and changes that benefit student achievement.

Teacher Leader Development

The importance of teacher leadership to school improvement and student learning has drawn attention to the need for PD that prepares teachers for leadership roles (Angelle & DeHart, 2011; Berry, 2019; Wenner & Campbell, 2017). The need for teacher leadership development in STEM areas, including CS, is particularly critical due to the unique characteristics of STEM teacher leadership (Criswell et al., 2017). Criswell and colleagues argue that the demands of STEM teacher leadership are different than those of non-STEM teacher leadership, particularly with regard to new national standards, the constantly changing knowledge base in STEM fields, the limited emphasis on STEM learning in schools, and the paucity of school leaders with STEM backgrounds (Criswell et al., 2018). Competencies deemed central for STEM leadership PD include those in the areas of leadership, beliefs about STEM learning, STEM discipline content knowledge, and the capacity to integrate STEM and non-STEM disciplines (US Department of Education, undated). Of particular relevance to the proposed project is the structure of the National Science Foundation (NSF) Noyce Initiative to Increase and Mentor Physics and Chemistry Teachers (I-IMPACT) program and the conceptual framework that guided this work to prepare teacher leaders (Criswell et al., 2018). The concepts of STEM teacher leader as effective practitioner, as learning partner, as productive scholar, and as policy voice functioned as drivers for this multi-year PD effort. During PD the I-IMPACT Master Teacher Fellows engaged in sessions that focused on the development of content and PCK, teacher leadership skills and dispositions, mentoring and professional learning community practices, and dissemination of new understandings and practices. Additionally, Lotter et al. (2020) investigated STEM teacher leadership in rural areas, and noted that teacher leaders built strong relationships with students, provided students with new academic pathways to success, and built strong connections in the community.

Research Questions

The literature review informed the processes of this study, as seen by the importance of strategic and comprehensive recruitment of experienced teachers (Garcia & Weiss, 2019; Luft et al., 2011; Qian et al., 2018). Preparing teachers involves PCK, knowledge of common misconceptions, culturally responsive interactions, and CS content (Charleston et al., 2017; Qian et al., 2018; Yadav et al., 2016; Yadav & Korb, 2012). Supporting teachers as they move into leadership is central to the idea of creating master teachers, requiring school system support and guidance on the unique demands of STEM teacher leaders (Criswell et al., 2018; Whitworth & Chiu, 2015). Development of a program to provide CS Master Teachers relied on investigations into current program offerings at other institutions, as well as state requirements for CS endorsements. However, before attending to processes and development, viability concerning

infrastructure and interest in the targeted area had to be considered, for without those elements the project could not move forward.

In response to the current conditions in rural, high-need school systems this project investigated recruitment, preparation, and support necessary for 6-12 grade teachers to transition into CS from other STEM fields. The project was guided by questions in these three categories:

- Viability
 - o What is the nature of the infrastructure needed to support CS instruction in rural, high-need school systems?
 - o What is the interest among exemplary and certified 6-12 STEM teachers to engage in CS teaching and leadership opportunities and to participate in a Master Teacher learning experience that would enable them to do so?
- Processes
 - o What processes could be used to recruit CS teachers from among the corps of exemplary and certified 6-12 STEM teachers?
 - o What processes could be used to prepare exemplary and certified 6-12 STEM teachers with the CS content and culturally-responsive pedagogical content knowledge to teach CS to all students?
 - o What processes could be used to support the success of new 6-12 CS teachers in the classroom and as teacher leaders?
- Development
 - o What are the design elements and structure of a CS Master Teacher endorsement track for 6-12 teachers that is based on our developing understandings of CS teacher recruitment, preparation and support as well as the needs of rural, high-need schools?

Central to the project was the process of evidence-based decision making that led to the design of a model CS teacher endorsement track, along with a teacher leadership endorsement, embedded within an existing Educational Specialist (EdS) degree program to support the transitioning of teachers into Master CS teachers from other STEM teaching fields. The EdS degree, which is more common in the Southeast and Midwest, is between a Master's degree and Phd or EdD, and, in many districts, provides a pay increase (EdD Programs, 2022).

Methodology

To address the need for CS teacher leaders, a partnership was formed between a four-year university and a technical college. A Noyce capacity building grant was proposed and funded by the NSF, with a plan to gather information about the infrastructure needed to support grades 6-12 CS instruction in rural, high-need schools; interest among STEM teachers to pursue CS teaching and leadership opportunities; and the recruitment, preparation, and support processes pertinent to CS teaching.

The goal of the project was to engage in a structured process leading to the informed development of a CS/leadership program. Team members followed these steps:

- Step 1 (addressed viability): Conducted a needs assessment to determine the infrastructure needed to support CS instruction in rural school systems and interest among exemplary and certified 6-12 STEM teachers to pursue CS teaching and leadership opportunities,
- Step 2 (addressed processes): Investigated recruitment, preparation, and support processes pertinent to CS teaching and leadership, and

- Step 3 (addressed development): Designed a CS Master Teacher endorsement track within an existing EdS degree program that is based on our developing understandings of CS teaching, leadership, and the needs of rural schools.

Project Phases

The project had three phases, aligned with each of the steps listed above. The first phase involved visiting schools (virtually) and collecting information about the infrastructure to support CS instruction in rural school systems from grades 6-12 teachers, technology specialists, school administrators, and school supporters in this Southeastern state. Due to limited school access resulting from the COVID-19 pandemic, 23 interviews were conducted via Zoom with stakeholders from nine different rural school systems before March 2021. School system interviewees are detailed in Table 1. Additionally, one female learning coordinator from a regional support center that provides PD to teachers in some of the included districts was interviewed.

Table 1
School System Interviewees

District	Percent economically disadvantaged	Type of School	Position	Gender	Teaching Subject
A	47	Secondary	Teacher	Male	CS
		Elementary	Teacher	Female	n/a
		Secondary	Career/Technical/Agricultural education director	Male	n/a
B	54	Elementary	Curriculum director	Male	n/a
		Elementary	Curriculum director	Female	n/a
C	18	Secondary	Teacher	Female	CS
D	55	Secondary	Teacher	Male	CS
		Secondary	Teacher	Female	Science and Business
		District level	Technology director/specialist	Male	n/a
		District level	Technology director/specialist	Male	n/a
		Secondary	Career/Technical/Agricultural education director	Female	n/a
E	42	Secondary	Teacher	Female	Math
		District level	Technology director/specialist	Male	n/a
		District level	Technology director/specialist	Female	n/a
F	28	Elementary	Curriculum director	Female	n/a
		Secondary	Curriculum director	Female	n/a
G	44	Middle	Teacher	Female	CS
		Middle	Teacher	Female	CS
		District level	Technology director/specialist	Female	n/a
H	45	District level	Technology director/specialist	Female	n/a
J	50	Secondary	Teacher	Female	Business
		Middle	Teacher	Female	CS
		Elementary	Teacher	Male	n/a

Information sought included CS teacher interest, availability, qualifications, learning opportunities for teachers in CS content as well as in school and professional learning community leadership, and administrative and community support for CS instruction. The focus was on infrastructure to support CS instruction in high-need rural school systems. The project involved the development and refinement of interview protocols for interviews with School System Leaders, Teachers, and School Supporters. The interview protocols were built from protocols and surveys used in other NSF Noyce projects and described in the CS education literature (Burton & Johnson, 2010; Criswell et al., 2017; Lotter et al., 2020; Yadav et al., 2016). The interview protocols are presented in the Appendix.

The second phase of the project addressed recruitment, preparation, and support processes for CS teachers in rural school systems. To begin, data pertaining to programs that prepare CS teachers and those that provide leadership training to STEM teachers were collected. Programs were examined, with a focus on program structure, context, and content as well as outcomes. Attention was given to programs that support the transition of teachers into CS teaching from other fields with outcomes related to (1) culturally-responsive pedagogical knowledge to engage all students in CS learning and (2) leadership understandings and skills to support and sustain CS instruction within rural, high-need schools.

Next, data pertaining to the recruitment of participants to programs that prepare CS teachers and that provide leadership training to STEM teachers were collected. Phase two data in this area consisted of documenting different approaches to recruiting experienced, exemplary and certified teachers into programs that prepare them as CS teachers and those that provide leadership training to STEM teachers. Finally, data were gathered regarding strategies that support the success and persistence of new CS teachers and strategies that enable STEM (including CS) teacher leaders to position themselves as critical members of school and school system leadership teams and to promote the legacy of STEM (including CS) instructional programming and support leadership succession.

The third phase involved the design of a CS Master Teacher endorsement track within an existing EdS degree program, along with contextually-appropriate strategies that will be used to recruit exemplary and certified 6-12 STEM teachers to the program's CS Master Teacher endorsement track and support their post-program experiences.

With the lifting of COVID-19 restrictions in March 2021, one researcher visited middle and high schools in five districts, accompanied by either the superintendent, assistant superintendent, or curriculum coordinator. Meetings were held with school principals, curriculum coordinators, and teachers to discuss the program. Visits with three additional superintendents were made during regional superintendent gatherings. The visits allowed confirmation of the interview data and interpretations, validation of the design of the CS endorsement track within the EdS degree program, and identification of teacher participants for a program to develop CS Master Teacher Fellows.

Data Collection and Analysis

Of significance to our information gathering efforts and directly to the design of our endorsement track is the cultural milieu of K-12 education in rural school systems. Many students are members of groups traditionally underrepresented in STEM fields, particularly CS (Code.org et al., 2020). Experienced STEM teachers, like those we hope to involve in the program, may not reflect the diversity of their students (Tio, 2018), which could impact their students' learning

opportunities and success. Yet, many experienced teachers in rural areas have ties to the local community (Monk, 2007). These ties tend to ensure their longevity in the local school system and enable opportunities for long-term collaborations. Historically, rural school systems have suffered from lack of resources and isolation (National Association of State Boards of Education, 2016). These factors may mitigate against curricular and instructional innovation and improvement. Besides the review of research, these considerations influenced the collection and analysis of data as well as the design of the CS Master Teacher endorsement track.

Question set 1. Data collection and analysis: Infrastructure and teacher interest

This question set aligns with phase one. Researchers identified the data sources and interviews protocol items, informed by literature related to interview protocol design (e.g., Castillo-Montoya, 2016), strategic and representative sampling (e.g., Check & Schutt, 2012), and qualitative data analysis (e.g., Creswell & Guetterman, 2019).

To understand the infrastructure needed to support CS instruction in rural high-need school systems of this Southeastern state, researchers interviewed the leadership of a sample of nine school systems (see School System Leader Interview, Appendix). This sample represented about one-third of the 30 rural, high-need rural school systems to be the target of the program. Data gathered from the School System Leader Interview protocol was used to guide requests for two other interviews—one with 6-12 STEM teachers (Teacher Interview, Appendix) and the second with regional support centers and technical college staff members that serve the rural area (School Supporters Interview, Appendix). The Teacher Interview protocol was used to collect information from certified 6-12 STEM teachers with at least three years of teaching experience in the sampled school systems. The School Supporters Interview was conducted with staff and faculty working with rural, high-need school systems to support CS or teacher leadership efforts.

The interview data were analyzed qualitatively using descriptive coding (Creswell & Guetterman, 2019) to understand (a) the infrastructure needed to support CS instruction in rural, high-need school systems, including elements from outside the school system, such as regional support center and technical college staff, and (b) the interest among experienced and certified grades 6-12 STEM teachers in preparing for CS teaching and leadership as well as benefits and challenges associated with their decision. One researcher coded interview transcripts using NVIVO, scrutinizing interviewees' comments in response to questions on the interview protocols. Initial codes were developed based on the areas of interest in the research questions, which corresponded with questions in the protocols. Codes were further refined based on interview responses, with new codes added until saturation was reached. Data were shared with three other researchers who checked the consistency of coded material within each of the codes, as suggested by Krathwohl (2009). Discussions were held until agreement was reached on the coded interviews. Attention within the analysis was directed to understanding how to increase the diversity of teacher participants along with the benefits and challenges that may impact participation.

Question set 2. Data collection and analysis: CS recruitment, preparation, and support

This question set aligns with phase two. A set of Teacher Interview questions asked about affordances and challenges that 6-12 STEM teachers associate with participation in an endorsement track that leads to CS certification as well as incentives that may encourage their participation. Similarly, School Supporter and School System Leader Interview questions asked about recruiting strategies found or believed to be successful in recruiting a diverse cadre of teachers to participate in voluntary PD, especially PD that focuses on CS and teacher leadership.

In addition, the Teacher, School Supporter and School System Leader Interviews included questions about the concepts and topics that should be included in a CS endorsement track as well as desirable means of content delivery and ongoing support for CS teaching and teacher leadership. These data were analyzed using the same method as described for Question set 1 above to understand the views of teachers, supporters, and school leaders regarding recruitment for a CS endorsement track and the content and delivery of a CS endorsement track.

Additionally, information was collected from the existing CS endorsement tracks embedded in degree programs and stand-alone CS endorsement programs operated by universities and regional support centers throughout this Southeastern state. Information sought was about teacher recruitment, endorsement track components, and the qualifications of endorsement track instructors. From these CS endorsement providers, information was also sought about CS endorsement track completers, with attention to the kinds and duration of support provided them. Information collected from these providers was compared with state CS certification requirements and guidelines proffered by national and state leaders in CS education (e.g., Coding.org., Georgia Learns, CS4GA). The information was sought from online sources. However, telephone conversations and email exchanges were also used as needed to secure the desired information.

The reviews of CS endorsement tracks and stand-alone CS endorsement programs were integrated with the interview findings as well as state certification requirements and information gathered from CS education leaders. The CS endorsement tracks and stand-alone CS endorsement programs were compared to determine commonalities and unique strategies and features. Information synthesized from these sources and coupled with the data gathered via interviews was used to guide the design of the CS endorsement track, including recruiting approaches and means of supporting CS teaching and leadership.

Question set 3. CS Master Teacher endorsement track design

Phase three, designing a viable CS Master Teacher endorsement track, required multiple points of consideration. Understandings constructed as a result of the project's data collection and analysis phases provide guidance regarding the infrastructure needed to support CS teaching, means for recruiting CS teachers from the corps of 6-12 STEM teachers, and the processes for preparing and supporting CS teachers for the classroom and leadership roles.

Standards that govern the approval of CS endorsement programs in this Southeastern state were reviewed and guided the development of a CS endorsement program. In addition, investigated were means for embedding the CS endorsement and an instructional coaching endorsement in an EdS degree suitable for grades 6-12 STEM teachers.

Results

In order to assess the need and readiness to implement this project, the researchers conducted targeted interviews with individuals potentially impacted by the project. Over 20 interviews were conducted with questions focused on the four areas of research – infrastructure to support technology initiative in this rural area, technology content preparation for P-12 CS requirements, teacher and leadership development for CS focused roles, and support to participants following credentialing. The interviewees were representative of individuals in the target area and included principals, teachers, technology leaders, school district and regional support center leaders, and technical college representatives. These individuals responded to questions that would provide

guidance to the next steps of the project. The interviews were conducted in a question/discussion format to specifically determine the needs of teachers and school systems in the rural area.

Viability

Infrastructure to support technology initiative

For phase one, in discussions with representatives from the partner districts and regional support centers with regards to technology availability, questions were posed related to the availability of hardware and internet service within the area of the grant target. Of the more than 20 interviews conducted, 12 discussed this topic. Most of the respondents, 8 out of 12, characterized their hardware availability as minimal. Seven out of eight stated that wi fi options were minimal or unavailable. Comments from interviewees included those that highlighted in-school challenges, such as, "...we have one laptop cart for the whole grade level with 25 teachers sharing," as well as strengths, as seen in these comments: "...our wi fi infrastructure is huge. It's very important to us", "...we have the best infrastructure, the best resources, the best online learning resources I think available" and "...we have no connectivity issues at all."

However, the following comments demonstrate that technology access in the community is lacking: "But when they get away from our school campus. Then the ball game changes. Big time. And that's where we're at a disadvantage", and "...between 40 and 50% of our kids have good reliable fast internet connectivity at their home." Additionally, one respondent commented that a large number of students, as well as some teachers, in their rural area did not have internet access at home at all. Districts have tried to address this lack of access by providing hotspots, as seen in this comment: "...we can either send it [hotspot] home with kids or place them on buses in strategic locations throughout the county."

Interest among teachers

Incentives played an important part in appealing to experienced STEM teachers. Offering an online program with flexibility built in to the courses would increase interest, as teachers were reluctant to engage in a program that would require travel and did not take their needs into consideration. One interviewee mentioned the importance of additional coursework to "...build that coaching piece," increasing teacher interest by possibly offering an additional instructional coaching endorsement. Teachers and administrators also expressed their desires for CS education, as seen in these comments: "...So any type of professional development that can teach me how to be better at allowing my students to produce things. That's what they like to do in that class. It made it more interesting for them" and "...But ideally, if I had some teachers who could get the endorsement, they would be more comfortable in what they were doing and it would be, it would be better."

Recruitment, Preparation and Support Processes

Recruitment potential

Of the over 20 interviews, 18 spoke to the importance of developing a recruitment strategy. The topics that arose during the interview discussions included that alignment to current teaching or STEM topics would make the program more compelling, which was mentioned by 13 interviewees. For example, comments included: "...how computer science is used in biology or mathematics or physics" and "...data science and data analytics and everything really has a place in every single subject, you know, for the STEM fields." Another important recruiting strategy that was mentioned during the interviews was the option through the grant to offer a stipend or

tuition for completion of the endorsement, as seen in this comment: "...So I think doing something like that, it just shows that you're putting an actual value on the teachers' time."

Technology content preparation for P-12 CS requirements

This Southeastern state requires that CS courses be offered in middle and high schools. Beginning in the 2021-2022 school year each local school system was required to have at least one high school in its school system that offers a CS science class, and all middle schools in the school system were required to offer instruction in exploratory CS. Each state charter school that has high school students must offer a course in CS and each charter school that serves middle school students must offer a class in exploratory CS. Beginning in the 2022-2023 school year each local school system was required to have at least 50% of their high schools offer a course in CS and in the 2023-2024 school year, all high schools are required to offer a course in CS.

Interviews with individuals in the target area included questions about preparation for the upcoming state requirement that CS be offered in every district. Respondents stated that though most had heard of this new requirement that little had taken place in order to prepare for full implementation. Some districts have access to the CS endorsement, mainly through area technical colleges and regional support centers. Even though rural areas had access to the CS Endorsement, most technical colleges and regional support centers offered it in a face-to-face format. Those that were interviewed indicated that this was a barrier to completion due to travel time and costs associated with enrolling. As a result of this barrier, only a small number of teachers in our target area had completed the endorsement.

Interviewees had over 40 comments about preparations that were taking place in order to meet the CS requirements, such as past PD: "...I went to the AP Summer Institute for the class itself so that I could teach you know that particular AP class. And that was helpful in as far as you know, the course itself" and "...by going to a couple of technology conferences and things like that. That's kind of where I would go to the code.org class or I would go to the ... robotic class and that kind of thing."

Culturally responsive pedagogy content

Content that was responsive to the needs of students and their communities was one focus of interviewees' wishes. For example, one administrator mentioned "Find community businesses that rely on CS...see a potential career associated with CS" as important components of building a CS program within the school or district. Another comment mentioned areas of interest to students such as "...gaming, robotics, agricultural aspect...farmers using drones." Other possible areas of interest in the specific rural communities include military and medicine, two career pathways available to interested students. To address these areas of opportunity for rural students, researchers partnered with a medical school, an agricultural extension, and a local military base to provide field trips and information to teachers in the EdS program, and their students. Teachers in the EdS program will also be provided guidance on establishing student organizations and community partnerships.

Teacher & leadership development to support CS focused roles

A major focus of this endorsement development was to determine the interest/value in developing those enrolled in the CS Endorsement for a leadership role following credentialing. Many of the interview respondents, especially those who are currently teaching, felt very strongly about having specific information about how to support others and serve in a leadership role in CS after earning the endorsement. Some of the interviewees were already being called upon by their

district to assist on CS development teams or were serving to support new teachers in CS. They were positive about offering this support; however, they felt they needed additional knowledge about serving in these roles. Comments included: "...helping the teachers that are in the endorsement to see themselves, not as just teachers, but as teacher leaders. And to build those skills and to be able to communicate" and "...if they were to get endorsed, I would love for them to be the expert in that field to provide some professional learning to other teachers as well as administrators as well to do that."

Support to participants following credentialing

It became clear as the interviews were being conducted that the participants had varying levels of commitment to participating in an endorsement. Some of these feelings were due to the lack of contact/support from instructors of the courses, others because of feeling that they did not have sufficient information to lead their classroom CS instruction. What came to light from many of the interview participants was a need for follow-up support/coaching. Many commented that just having someone to talk to about CS instruction/lessons or to hear about successes was critical in the outcome of this project. Positive comments about having a mentor include: "... He's somebody that I can go to, because I know that he's had that problem before or with a project that he used to do. Like, I can't get it to work. You know, brainstorming" and "...it just provides that safety net for these teachers that are jumping into something that they've never done before and having somebody that they can go to and have a conversation with I think is really important."

CS Master Teacher Endorsement Track Development

Additional goals included developing a program that would enable completers to obtain a CS endorsement as well as an instructional coaching endorsement on their teaching license. Resources used to inform creation of the endorsement were reviews of CS endorsement tracks and stand-alone CS endorsement programs, interview findings, state certification requirements, and information gathered from CS education leaders. Researchers also analyzed the CS tracks available to high school students, and the CS endorsement practice test and information. Advice and desires for included components in the program, as seen in interviews, were content that could be incorporated into an existing math or science course, synchronous online courses, office hours so teachers could ask questions outside of class time, and ideally a length of three courses for the endorsement, with multiple program entry points. Faculty also defined key assessments and points within the program where those will be administered, in order to assess teacher progress as well as program success. Three faculty members from a local technical college will provide mentoring for teachers as they learn and practice CS content. Partnerships with a medical school, agricultural extension and military base were formed to provide relevant experiences to teachers and their students. Additionally, field experiences were incorporated into the coursework.

Struggles with the creation of the CS endorsement included the initial desire to include relevant content knowledge at a depth appropriate for a CS student in college, as well as adequate practice in pedagogical dimensions such as lesson creation, anticipation of student errors, planned purposeful questions, practice teaching the lessons, assessment, and analysis of student work. An initial program plan was created, with options for three, four or five courses. Discussions of interview results and information about existing programs, as well as university program constraints on the length of endorsement programs, led to the final creation of a three-course sequence. The division of content for the three courses, as determined by the state CS teacher certification standards, was undertaken several times, in an attempt to have a logical structure for the endorsement program. The realization that the proportion of standards devoted

to a specific topic did not have to be matched by the proportion of those standards in the courses allowed for the development of a program with emphasis on areas of most importance to teaching CS in high schools, along with adding CS content into existing STEM-related disciplines, as was desired by teachers (see Table 2). Once it was decided that the endorsement would be three courses, design began on incorporating the CS endorsement along with an instructional coaching endorsement into an EdS program, to provide the necessary instruction and support for developing master CS teachers.

Table 2
CS Endorsement Courses

Course title	Course description	Rationale
Securely Navigating the Digital World (no prerequisite)	This course introduces components of computers and networks, including data representations and types of storage. Network components and their effects on performance will be discussed. Computer and network threats and vulnerabilities will be examined. Students will be able to identify safe, secure, ethical digital behavior.	Course content addresses required state standards. Interviewees recommended fitting content into three courses. Teachers indicated that flexibility would increase their interest, so this course was created as a stand-alone course to allow multiple entry points into the three-course endorsement.
Ubiquitous World of Programming (no prerequisite)	The focus of this course is on creating algorithms to solve problems, and developing those algorithms into robust programs. Students will become proficient at using a third-generation programming language, including testing, debugging, and documenting programs according to industry best practices. Students will use their knowledge of program development to plan lessons for P-12 students to use computer science in problem-solving and decision-making situations	Course content addresses required state standards. Two programming courses are provided, as programming knowledge and fluency were desired by teachers. This course begins with algorithms to build confidence in programming and provide a model of CS pedagogy.
Applications and Data Science (prerequisite: Ubiquitous World of Programming)	Programming skills will be used to develop robust programs addressing problems in the community or in the areas of mathematics, business, and various science disciplines. Students will create lesson plans and assessments for implementing equitable computer and data science instruction related to those areas. In addition, strategies for developing leadership opportunities to further computer science education, establishing community partnerships, and building student organizations will be discussed.	Course content addresses required state standards. This course continues to build confidence in teachers while providing content related to current area of teaching, such as business, math, or science, as requested in interviews. This course also addresses interviewees' desire for relevance to students by providing guidance on community partnerships and creating student organizations.

Discussion

A process of evidence-based decision-making, informed by interviews conducted with stakeholders, resulted in the design and development of a model CS and instructional coaching teacher endorsement sequence within an EdS program. The sequence supports the transitioning of grades 6-12 teachers into CS from other STEM teaching fields, positioning them to be leaders in incorporating CS instruction into their schools. The aim of the EdS degree program is to increase the number and diversity of well-prepared CS teachers and their leadership potential for rural, high-need school systems. The development of a program for CS teacher leaders was similar to that seen in the Criswell et al. (2018) project developing STEM teacher leaders.

Vivian et al. (2014) found CS endorsements were offered in face-to-face, hybrid, and online formats; to address interview comments that face-to-face format was a barrier, the EdS program will be delivered online. In line with other programs (Columbus State University, undated; Oconee Regional Educational Service Agency [RESA], undated), the CS endorsement is three semesters and includes content, pedagogy, and a CS-focused field experience.

The CS endorsement is situated in a four-semester EdS program that also includes an instructional coaching endorsement. The program will provide learning opportunities specific to CS teacher leadership in schools, such as assessing a school system's CS offerings and alignment of the offerings in grades K-12, and developing and delivering CS-related PD to teachers and school leaders. This answers the desires expressed in interviews for information about how to support others and serve in a leadership role, as well as the call from Criswell et al. (2017) concerning the critical need for teacher leadership development in STEM areas.

Stakeholder interviews revealed multiple considerations when recruiting certified 6-12 STEM teachers to participate in a CS endorsement embedded within an EdS degree program. Interview protocols addressed areas of concern identified in the literature, such as support from their communities (Luft et al., 2011), backgrounds, motives, and experience (Qian et al., 2018). School system leader interviews found that school leaders were supportive of teachers who wished to earn a CS endorsement. Teachers interviewed for the program were living in the communities in which they teach, and thus understand the culture of their students, as recommended for success (Budge, 2006). Teachers were motivated by the potential to increase student engagement, and indicated that stipends would be an additional motivation. For this reason, funding for stipends will be sought. Teachers also indicated that CS endorsement courses need to help teachers connect the CS content they are learning to other STEM courses they teach. For example, biology students could model the growth of bacteria. This ability to integrate CS into other disciplines was highlighted by the US Department of Education (undated) as an important competency for STEM leadership.

The CS endorsement courses were informed by literature on CS teacher preparation, PD, standards, and stakeholder interviews. Coursework includes both content and pedagogy, as recommended by Yadav and Korb (2012). The endorsement courses also highlight CS career options available to 6-12 students living in rural communities. Three career options were identified as medical fields, agriculture, and the military, and researchers focused on finding candidates for partnerships and working to solidify those partnerships. These partnerships will provide community connections, experiences and resources, which are particular needs of rural areas (Lotter et al., 2020). The CS endorsement meets tenets of successful PD as outlined in Desimone (2009), such as content focus, duration, and collective participation. The cohort of teachers will support each other as they move through the program together, focused on CS, for three semesters.

Interviews revealed that teachers desired some form of collaboration and mentoring, which will be provided with some synchronous and collaborative sessions. Mentoring will continue after the endorsement, in the form of follow-up support and instructional coaching. Instructors from a local technical college will provide mentoring for the first cohort, and, in turn, the first cohort will provide mentoring for future cohorts. In this way, support for CS education in rural schools is strengthened and sustainable.

Implications

This project responds to the need for well-prepared and certified CS teachers with leadership potential in rural, high-need school systems. Team members used a three-phase investigation of viability, processes, and development to identify obstacles and affordances related to the development of a CS Master Teacher endorsement track. The project highlights a mechanism that over time has the potential to increase CS learning opportunities for students in rural, high-need school systems utilizing well-prepared teachers. An expected outcome of this project was the presentation of an evidence-based process to examine the recruitment, programming, and support associated with the development of CS teachers for rural, high-need school systems. The process provided a better understanding of the affordances and challenges associated CS instruction in rural schools. In addition, a model CS Master Teacher endorsement track to support rural, high-need school systems was designed and coupled with an instructional coaching endorsement in an EdS degree program, to increase the number and diversity of CS teachers in rural, high-need school systems by drawing from the corps of exemplary and certified 6-12 STEM teachers. Through iterative study and discussion of curricular possibilities, CS and education faculty used findings from stakeholder interviews and existing programs to make decisions about the number of courses, course content, and learning outcomes of the CS endorsement portion of the EdS degree program.

Moreover, the project strengthened partnerships between the university, regional support centers, school systems, a technical college, non-profits, and state government agencies. For example, researchers formed close partnerships with eight rural districts, who will commit to recommending teachers for the program in the upcoming year. Partnerships with the state department of education and state-wide CS initiatives will serve to strengthen and guide CS course content, including future learning opportunities in such areas as web design, cybersecurity, and robotics. The continuing partnership with a local technical college will provide mentoring support for teachers in the EdS program. In addition, partnerships with non-profits in the areas of military, medicine and agriculture will provide knowledge of those areas to the teachers, and opportunities for future career pathways for their students. Overall, these partnerships will function to advance the statewide agenda to increase the number and preparedness of CS teachers.

Future Directions

The development of the Master Teacher CS program, which consists of a CS endorsement and an instructional coaching endorsement within an EdS program, has provided an opportunity for teachers in high-needs rural areas to gain credentials in leadership in CS. Future plans include enactment of the described recruiting process to channel existing STEM teachers into the EdS program, through an NSF Master Teaching Fellowship grant. This would provide stipends to teachers, which was mentioned in the recruiting interviews as an incentive. Having a cohort of STEM teachers participating in the EdS program will allow for program evaluation, and give direction for future improvements to the CS endorsement as well as the program as a whole. Continuing research on the effectiveness of the program will include investigations into the

teaching practices of the teachers who complete the EdS program, concerning CS courses as well as the use of CS content in the existing STEM classes taught by the teachers. In addition, opportunities exist for teachers to add to their CS knowledge through future courses provided through partnerships developed in this project.

Limitations

Although portions of the process may be usable to endorsement program designers and researchers in other geographical areas, this project was specifically designed to address the need for CS teachers in rural, high-need school systems. Partnerships were formed with non-profits in the fields of medicine, agriculture, and military, which may not be appropriate partnerships in all geographical areas. Furthermore, state standards were part of the guidance in the content of the CS endorsement. Therefore, the findings relative to technology infrastructure needs, course delivery methods, endorsement content, and situation of the CS endorsement within an EdS program may not generalize to urban or suburban geographical areas, or to rural areas that do not have high-need systems.

References

- Angelle, P. S., & DeHart, C. A. (2011). Teacher perceptions of teacher leadership: Examining differences by experience, degree, and position. *NASSP Bulletin*, 91(2), 141-160. <https://doi.org/10.1177/0192636511415397>
- Berry, B. (2019). Teacher leadership: Prospects and promises. *Phi Delta Kappan*, 100(7), 49-55. <https://doi.org/10.1177/0031721719841339>
- Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, 33(8), 3-15.
- Buczynski, S., & Hansen, C. B. (2010). Impact of professional development on teacher practice: Uncovering connections. *Teaching and Teacher Education*, 26(3), 599-607.
- Budge, K. (2006). Rural leaders, rural places: Problem, privilege, and possibility. *Journal of Research in Rural Education*, 21(13), 1-10.
- Burton, M., & Johnson, A. S. (2010). "Where else would we teach?": Portraits of two teachers in the rural south. *Journal of Teacher Education*, 61(4), 376-386. <https://doi.org/10.1177/0022487110372362>
- Castillo-Montoya, M. (2016). Preparing for Interview Research: The Interview Protocol Refinement Framework. *The Qualitative Report*, 21(5), 811-831. <https://doi.org/10.46743/2160-3715/2016.2337>
- Charleston, L. J., Charleston, S. A., & Jackson, J. F. L. (2017). Using culturally responsive practices to broaden participation in the educational pipeline: Addressing the unfinished business of Brown in the field of computing science. *The Journal of Negro Education*, 83(3), 400-419.
- Check, J., & Schutt, R. (2012) *Research methods in education*. SAGE Publications, Inc.
- Code.org. (2017a). Recommendations for states developing computer science teacher pathways. <https://code.org/files/TeacherPathwayRecommendations.pdf>
- Code.org. (2017b). Universities aren't preparing enough computer science teachers. <https://medium.com/@codeorg/universities-arent-preparing-enough-computer-science-teachers-dd5bc34a79aa>
- Code.org Advocacy Coalition & CSTA. (2018). 2018 state of computer science education. <https://advocacy.code.org/>
- Code.org Advocacy Coalition (2021). See what's happening in your state. <https://advocacy.code.org/>

- Code.org, CSTA, & ECEP Alliance. (2020). 2020 state of computer science education: Illuminating disparities. <https://advocacy.code.org/stateofcs>
- Columbus State University (undated). Computer science endorsement. https://te.columbusstate.edu/endorsement_computer_science.php
- Criswell, B. A., Rushton, G. T., McDonald, S. P., & Gul, T. (2017). A clearer vision: Creating and evolving a model to support the development of science teacher leaders. *Research in Science Education*, (1), 1-27. <https://doi.org/10.1007/s11165-016-9588-9>
- Criswell, B. A., Rushton, G. T., Nachtigall, D., Staggs, S., Alemdar, M., & Capelli, C. J. (2018). Strengthening the vision: Examining the understanding of a framework for teacher leadership development for experienced teachers. *Science Education*, 102(6), 1265-1287.
- Creswell, J. W. & Guetterman, T. C. (2019). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*, (6th ed.). Pearson Education.
- Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher*, 38(3), 181-199. <https://doi.org/10.3102/0013189X08331140>
- EdD Programs. (2022). Ed.S. vs Ed.D. programs: What is an Education Specialist (EdS) degree? <https://www.eddprograms.org/eds-degrees/#How-to-Choose-EdS-and-EdD>
- Garcia, E. & Weiss, E. (2019). The teacher shortage is real, large and growing, and worse than we thought: The first report in "The Perfect Storm in Teacher Labor Market" series. Economic Policy Institute. <https://www.epi.org/publication/the-teacher-shortage-is-real-large-and-growing-and-worse-than-we-thought-the-first-report-in-the-perfect-storm-in-the-teacher-labor-market-series/>
- K-12 Computer Science Framework. (2016). <http://www.k12cs.org>.
- Knapp, M. S. (2003). Professional development as a policy pathway. *Review of Educational Research*, 27(1), 109-157. <https://doi.org/10.3102/0091732X027001109>
- Krathwohl, D. R. (2009). *Methods of educational and social science research* (3rd ed.). Waveland Press, Inc.
- Ladson-Billings, G. (1995). But that's just good teaching! The case for culturally relevant pedagogy. *Theory Into Practice*, 34(3), 159-165. <https://www.jstor.org/stable/1476635>
- Lotter C, Yow J. A., Lee M., Zeis J. G., & Irvin M. J. (2020). Rural teacher leadership in science and mathematics. *School Science and Mathematics*, 120, 29-44. <https://doi.org/10.1111/ssm.12383>
- Luft, J. A., Whitworth, B. A., Berry, A., Navy, S., & Kind, V. (2019). Science education trajectories: Charting the course for teachers, educators, researchers, and policy makers. *Journal of Science Teacher Education*, 30(1), 63-79. <http://doi.org/10.1080/1046560X.2018.1535226>
- Luft, J. A., Wong, S. S., & Semken, S. (2011). Rethinking Recruitment: The Comprehensive and Strategic Recruitment of Secondary Science Teachers. *Journal of Science Teacher Education*, 22(5), 459-474. <https://doi.org/10.1007/s10972-011-9243-2>
- Mezirow, J. (1978). Perspective transformation. *Adult Education*, 28(2), 100-110. Retrieved from <https://doi.org/10.1177/074171367802800202>
- Mezirow, J. (2012). Learning to think like an adult: Core concepts of transformation theory. In E. W. Taylor & P. Cranton (Eds.), *The handbook of transformative learning: Theory, research, and practice* (pp. 73-98). Jossey Bass.
- Monk, D. H. (2007). Recruiting and retaining high-quality teachers in rural areas. *The Future of Children*, 17(1), 155-174. Retrieved from

<https://www.jstor.org/stable/pdf/4150024.pdf?refreqid=excelsior%3A3d411280ee4e8d10047d9aa032064fbd>

- Montoya, A. (2017). Computer science for all: Opportunities through a diverse teaching workforce. *Harvard Kennedy School Journal of Hispanic Policy*, 22, 47-62.
- National Association of State Boards of Education. (2016). Educating students in rural America: Capitalizing on strengths, overcoming barriers. National Association of State Boards of Education. <https://wsuwp-uploads.s3.amazonaws.com/uploads/sites/90/2015/09/Educating-Students-in-Rural-America-Capitalizing-on-Strengths-Overcoming-Barriers.pdf>
- Oconee RESA. (undated). Computer science endorsement. https://www.ciclt.net/sn/resa/recl_application.aspx?CL_ID=102939&ClientCode=oconee
- Qian, Z., Hambrusch, S., Yadav, A. & Gretter, S. (2018). Who needs what: Recommendations for designing effective online professional development for computer science teachers. *Journal of Research on Technology in Education*, 50(2), 164-181. <https://doi.org/10.1080/15391523.2018.1433565>
- Tio, R. (2018). 2017 Georgia K-12 teacher and leader workforce report. The Governor's Office of Student Achievement. <https://gosa.georgia.gov/sites/gosa.georgia.gov/files/2017%20K-12%20Teacher%20and%20Leader%20Workforce%20Report%2020180105.pdf>
- U. S. Department of Education. (undated). What knowledge, skills, and dispositions are required to be a STEM teacher leader? <https://innovation.ed.gov/what-we-do/stem/building-stem-teacher-leadership/skills-and-dispositions/>
- Vivian, R., Falkner, K., & Falkner, N. (2014). Addressing the challenges of a new digital technologies curriculum: MOOCs as a scalable solution for teacher professional development. *Research in Learning Technology*, 22, 1-19.
- Wenner, J. A., & Campbell, T. (2017). The theoretical and empirical basis of teacher leadership: A review of the literature. *Review of Educational Research*, 87(1), 134-171. <https://doi.org/10.3102/0034654316653478>
- Whitworth, B. A., & Chiu, J. (2015). Professional development and teacher change: The missing leadership link. *Journal of Science Teacher Education*, 26(2) 121-137. <https://www.tandfonline.com/doi/full/10.1007/s10972-014-9411-2>
- Yadav, A., Gretter, S., Hambrusch, S., & Sands, P. (2016). Expanding computer science education in schools: Understanding teacher experiences and challenges. *Computer Science Education*, 26(4), 235-254. <http://dx.doi.org/10.1080/08993408.2016.1257418>
- Yadav, A. & Korb, J. T. (2012). Learning to teach computer science: The need for a methods course. *Communications of the Association for Computing Machinery*, 55(11), 31-33. <https://cacm.acm.org/magazines/2012/11/156579-learning-to-teach-computer-science/fulltext?mobile=false>

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Appendix

Interview Protocols

School System Leader Interview

What are your school system's CS offerings?

What are the number, qualifications, certifications, and years of service of grades 6-12 teachers teaching CS courses?

What are the instructional materials used by teachers of CS courses?

What are the CS and leadership professional development opportunities for 6-12 teachers in your school system?

What opportunities for teacher leadership of CS instruction exist within the school system?

What is the likely interest among the school system's 6-12 STEM teachers to participate in an endorsement program that leads to CS certification?

What are the affordances and challenges associated with 6-12 STEM teachers' participation in an endorsement program that leads to CS certification?

To what extent does your school system collaborate with RESAs, technical colleges, and Mercer University in supporting CS instruction and teacher leadership development?

What recruiting strategies have you found or think might be successful in recruiting a diverse cadre of teachers to participate in voluntary PD, especially PD that focuses on CS and teacher leadership?

What concepts and topics should be included in a CS endorsement program?

What are desirable means of content delivery and ongoing support for CS teaching and teacher leadership?

Teacher Interview

How many years have you been teaching?

In what areas have you taught and what certifications do you hold?

What have been your experiences in school leadership?

What is your interest in participating in an endorsement program that leads to CS certification? What do you see as the benefits and challenges associated with your participation?

What incentives might encourage you to participate in an endorsement program that leads to CS certification and leadership development?

What recruiting strategies do you think might be successful in recruiting a diverse cadre of teachers to participate in voluntary PD, especially PD that focuses on CS and teacher leadership?

What concepts and topics should be included in a CS endorsement program?

What are desirable means of content delivery and ongoing support for CS teaching and teacher leadership?

School Supporters (e.g., university faculty and support center staff) Interview

What is the nature of the CS support you have provided to area schools?

What are the number and background of the teachers you supported in CS?

What have been the length and the outcomes of CS or teacher leadership activities and initiatives supported?

What are possible future opportunities to support CS instruction and teacher leadership development in rural school systems?

What is your interest in partnering with Mercer University to support CS instruction and teacher leadership development in rural school systems?

What recruiting strategies have you found or think might be successful in recruiting a diverse cadre of teachers to participate in voluntary PD, especially PD that focuses on CS and teacher leadership?

What concepts and topics should be included in a CS endorsement program?

What are desirable means of content delivery and ongoing support for CS teaching and teacher leadership?
