Enhancing Computer Science Education in Tennessee: Insights and Strategic Directions

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Abstract

This poster presents findings from a collaborative research study between the Tennessee STEM Innovation Network (TSIN) and NWEA aimed at enhancing Computer Science (CS) education across Tennessee. The study assessed the effectiveness of the Reach Them All (RTA) initiative in implementing the state's CS law, with a focus on training outcomes, district-level redelivery, and the impact on under-resourced districts. Key findings highlight the importance of support for elementary education, administrator buy-in, and resource distribution. Recommendations are provided for future strategic directions to strengthen CS education statewide.

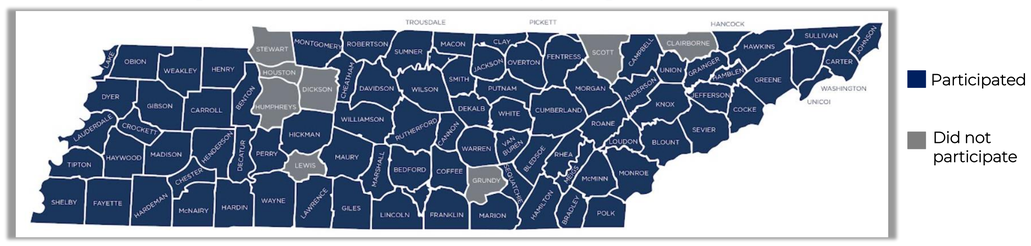
From August 2022 through June 2024, TSIN partnered with NWEA to evaluate a state-wide computer science integration initiative titled: **Reach Them All.** Over the course of the 2022–2023 and 2023–2024 academic years, we implemented an evaluation plan based on surveys, classroom observations, and portfolios of classroom artifacts. We also analyzed planning documents collected from districts and conducted conversations with Reach Them All Delegates and Ambassadors. This report summarizes what we have learned about an ambitious, wide-reaching professional learning program.

Throughout the program evaluation, we focused on three intended outcomes for computer science instruction in Tennessee:

1. Teachers develop a foundational understanding of computational thinking and computer science concepts.
2. Teachers discover connections between what they teach and computational thinking and computer science concepts. Teachers use these connections to integrate computational thinking and computer science concepts into their classrooms.
3. Teachers cultivate a mindset that expects all students to participate in computational thinking and computer science.

TSIN recruited Delegates and Ambassadors from across Tennessee to create the capacity necessary to re-deliver professional learning in districts. Delegates served as district-level program representatives, and Ambassadors led professional learning re-delivery in their districts.

Figure 1. Reach Them All Participating Counties



Introduction

Context of the RTA Initiative

The RTA program was launched in response to Tennessee's state-wide focus on CS education following the passage of PC979. The initiative aims to integrate CS into both elementary and secondary education through comprehensive training and resource provision across all Tennessee districts. This study explores the implementation and impact of the RTA program to inform future efforts in scaling and improving CS education.

Partnership with NWEA

TSIN partnered with NWEA due to their expertise in educational research and their national acclaim in assessing and supporting academic growth. Their involvement ensured robust research design and data analysis, helping to validate our findings and provide strategic insights.

Goals of the Study

The study aimed to understand the extent of district-level training redelivery, assess the impact of the RTA program on educators, and identify areas for further support, particularly in under-resourced districts.

Research Design and Participants

The study employed a mixed-methods approach, including surveys, classroom observations, and interviews with district leaders. Data were collected from a representative sample of Tennessee districts, with 84% reporting on training redelivery efforts.

FALL 2022 DELEGATES AND AMBASSADORS: GRADE BANDS TAUGHT

	COUNT	% OF TOTAL
Elementary (P–5)	68	33.3%
Middle (6–8)	56	27.5%
High (9–12)	48	23.5%
Elementary, middle	26	12.7%
Middle, high	5	2.5%
Elementary, middle, high	1	0.5%

Data Collection and Analysis

Surveys were administered to gauge understanding of the CS law, training modality preferences, and resource needs. Classroom observations were conducted in 18 districts to evaluate CS instruction quality and student engagement. Data were analyzed to identify patterns and areas for improvement.

Figure 2. Classroom Observation Walkthrough Rubric

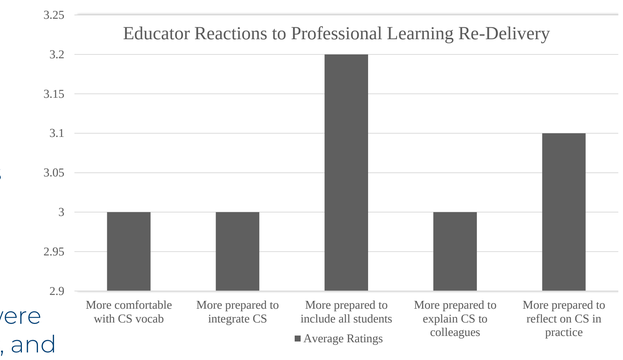
Criteria	Level 1	Level 2	Level 3	Level 4
Essential concepts—Evidence exists that students engage with essential computational thinking or computer science concepts with vocabulary use (for example, but not limited to: decomposition, algorithmic thinking, abstraction, pattern recognition). • *At Level 1*, no evidence exists that the teacher uses essential concepts during instruction. • *At Level 2*, the teacher implies essential concepts during instruction, but there is no evidence that students engage with those concepts. • *At Level 3*, one or more (but not all) students engage with essential concepts during the lesson, or students engage without demonstrating vocabulary use. • *At Level 4*, all students use essential concepts in their reading, writing, speaking, or other communication AND students demonstrate observable vocabulary use.				
Integration—Evidence exists that students understand and demonstrate how computational thinking or computer science integrates into the lesson. • *At Level 1*, the teacher does not integrate computational thinking or computer science into the lesson, or the ways in which concepts are integrated are unclear. • *At Level 2*, the teacher makes connections to computational thinking or computer science during the lesson, but these are not directly linked to a content area or lesson outside of computer science. • *At Level 3*, the teacher intentionally integrates computational thinking or computer science with a content area, but there is no evidence that students make these connections without teacher support. • *At Level 4*, the teacher intentionally integrates computational thinking or computer science AND students connect these to a content area outside of computer science without teacher support.				

The Classroom Observation Walkthrough Rubric provides a structured tool for evaluating the effective integration of essential CS concepts, like abstraction, in classrooms. It emphasizes CS integration across disciplines and promotes equitable access to high-quality CS learning experiences for all students. The rubric supports educators in fostering an inclusive environment where every learner can engage meaningfully with foundational CS skills.

Results

Professional Development Outcomes

Educators reported their comfort and preparedness "after participating in RTA professional learning" by rating a series of items on a 4-point scale (Strongly Disagree = 1, Strongly Agree = 4). Across these items, educators agreed that they felt more prepared after RTA professional learning (average = 3.0). They were consistent in their responses to these items, and these responses provide direct evidence of the impact of RTA on educators.



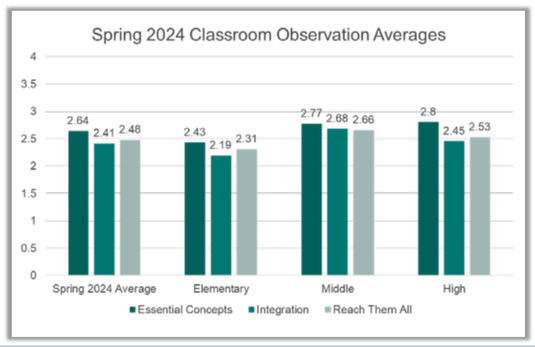
District-Level Redelivery and Outcomes

- Redelivery Rate: 84% of districts had redelivered training at the time of the survey.
- Modality Preferences: In-person training was preferred, with 97% of districts emphasizing the importance of physical kits and resources.
- Understanding of CS Law: Only 47% of educators felt they fully understood the CS law post-training, indicating a need for further clarification and support.

Impact on Under-Resourced Districts

- Resource Disparity: Significant challenges were noted in districts with fewer resources, particularly in integrating CS into elementary education.
- Classroom Observations: Educator use of CS vocabulary and student engagement were high, but professional development gaps were identified, especially in differentiated instruction and integration into existing curricula.

Spring observations expanded the sample size drastically and solidified our evidence of students' experiences of CS instruction. We assessed the stability of our initial findings. Spring term data built on fall term data to suggest that educators addressed Essential Concepts most effectively in their teaching, on average. To a lesser degree, educators integrated CS with other content areas and expressed outward beliefs that all students can engage with and persist in CS.



Conclusion

The study conducted in partnership with NWEA explored the implementation of the RTA program across Tennessee. It aimed to understand district-level redelivery, assess training impact, and identify needs for further support. The findings highlight significant variations in district engagement and the critical need for resources, especially in under-resourced areas. Key recommendations include enhancing resource distribution, focusing on leadership buy-in, and supporting elementary education. TSIN will leverage these insights to drive strategic initiatives and strengthen CS education statewide.

Collaboration for Long-Term Success

Building partnerships with industry and educational stakeholders is essential for sustaining progress. Initiatives like annual conferences, TSIN newsletter, Innovative Leaders Institute, and the Rural STEM Collaborative are critical components of this strategy. Future efforts will focus on developing onboarding processes for industry collaboration and refining additional resource needs.

Cohesive Strategy for CS Education

TSIN will work closely with the Department of Education to plan regional trainings and support CS integration. The ultimate goal is to ensure all students, regardless of background, have access to high-quality CS education that prepares them for future workforce opportunities.

Key Recommendations

1. **Enhance Resource Supports**: Develop a clear crosswalk to identify math, literacy, and science standards connections in alignment with the Tennessee K-12 computer science standards.
2. **Focus on Leadership Buy-In**: Engage district leaders and administrators through targeted professional development and support to ensure long-term commitment to CS education.
3. **Support Elementary Education:** Increase support for elementary-level CS integration, including more sample lessons and instructional materials aligned with state standards.

Next Steps

TSIN will continue to lead efforts in breaking equity barriers through professional learning, resource development, and stakeholder engagement. Strategic initiatives include regional trainings, a CS Walkthrough document, and collaboration with industry leaders to support educators in effectively delivering CS education.

TSIN remains committed to breaking equity barriers in CS education through targeted professional learning, resource development, and stakeholder engagement. By addressing the gaps identified in this study, we can ensure that Tennessee continues to lead in providing equitable and effective CS education for all students.

Acknowledgements

Thanks to NWEA and the District Delegates and Ambassadors that participated in this initiative and the Tennessee Department of Education for providing financial support. Additional thanks to BirdBrain Technologies and Terrapin Tools for Thinking for supporting the grade-banded resource kit development and distribution.

Explore this short video capturing the RTA experience.

Visit www.computersciencetn.org to learn more about TSIN's efforts to provide access to high-quality CS instruction Through a comprehensive set of outreach programs and to download the full NWEA Evaluation Summary Report.