Tennessee STEM Innovation Network

ADVANCING COMPUTER SCIENCE EDUCATION IN TENNESSEE

Insights and Strategic Directions

EXECUTIVE SUMMARY

The “Reach Them All” (RTA) initiative, evaluated over the 2022–2024 academic years, aimed to advance computer science (CS) education in Tennessee. The Tennessee STEM Innovation Network (TSIN), in partnership with Northwest Evaluation Association (NWEA), conducted surveys, classroom observations, and analyzed teacher portfolios to assess the program’s success.

Three key goals emerged through this initiative:

1. Teachers developed a foundational understanding of computational thinking and CS concepts.
2. Teachers connected and integrated these concepts into their existing curriculum.
3. Teachers cultivated a mindset encouraging all students to engage in CS.

Overview of Key Findings

- Teachers reported significant growth in their ability to use computational thinking and CS in practice, despite initial inexperience. The RTA initiative achieved wide geographic reach, with participation from 136 districts across Tennessee.
- Professional learning sessions led to teachers feeling more prepared to integrate CS and engage all students. Classroom observations indicated success in teaching essential CS concepts, though further efforts are needed to deepen integration across subject areas and reach more students.
- Portfolios of student work, however, revealed that CS integration in materials needs further support. Educators felt confident teaching CS but struggled to apply these lessons consistently within other content areas.

INTRODUCTION AND OVERVIEW

Context of the RTA Initiative

State-wide focus on Computer Science education following the CS law.

PC979 requires CS instruction at all levels of the K-12 experience building a foundation for integration.

Overview of the RTA program and its implementation across Tennessee districts.

Designed to build educator capacity through targeted professional learning in all districts.

> **Reach Them All made substantial progress toward its stated goals, with educators across 93% of districts participating in professional learning aimed at enhancing computer science education.**
>
> ~ Participant

Importance of integrating Computer Science integration into elementary and secondary education.

Providing integrated CS experiences in all aspects of K-12 learning helps prepare students for the demands of the digital age.

REDELIVERY AND IMPLEMENTATION IN DISTRICTS

Redelivery Plans and District Outcomes

Following the initial professional development provided through the RTA program, 84% of the participating districts successfully redelivered the professional learning to educators within their schools at the time of the survey. These redelivery efforts were a key component of the program's success, ensuring that the knowledge and skills gained by Delegates and Ambassadors were transferred to a wider audience of teachers across the state.

The program achieved wide coverage across Tennessee, with no specific regional dominance in terms of implementation. However, some gaps were noted in rural areas where participation and engagement were lower than expected. This presents an opportunity for future initiatives to focus on increasing outreach and support in rural communities, which often have fewer resources and face unique challenges in integrating computer science education into their curricula.

84%

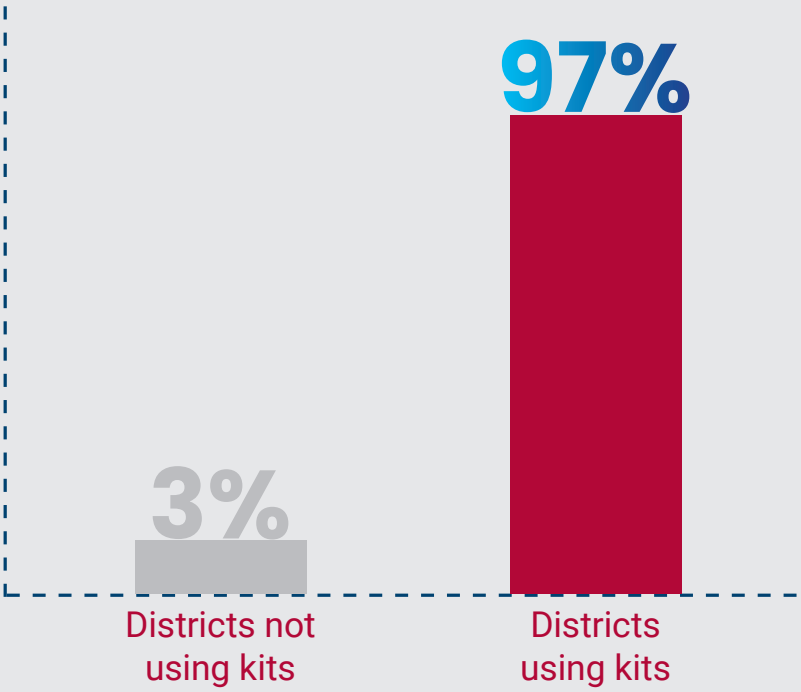
Redelivered Training

The Role of Physical Kits and Resources

One of the major success factors in the redelivery process was the distribution of physical computer science kits, which were crucial for 97% of districts. These kits provided teachers with the tangible tools needed to facilitate computer science lessons and helped bridge the gap between theoretical learning and practical application in the classroom. The kits contained essential materials such as robots, coding cards, and other interactive resources that allowed educators to deliver hands-on computational thinking and coding activities.

The availability of these physical resources significantly impacted the effectiveness of the program's redelivery, ensuring that teachers were not only learning new concepts but also had the means to apply them in their classrooms. This practical approach helped solidify the training content and made it easier for teachers to integrate computational thinking and computer science into their existing lessons, fostering student engagement and understanding.

While the redelivery process was largely successful, the program's reach in rural areas remains an area for improvement. Going forward, addressing these participation gaps and ensuring equitable access to resources like the physical kits will be critical for maximizing the program's statewide impact.

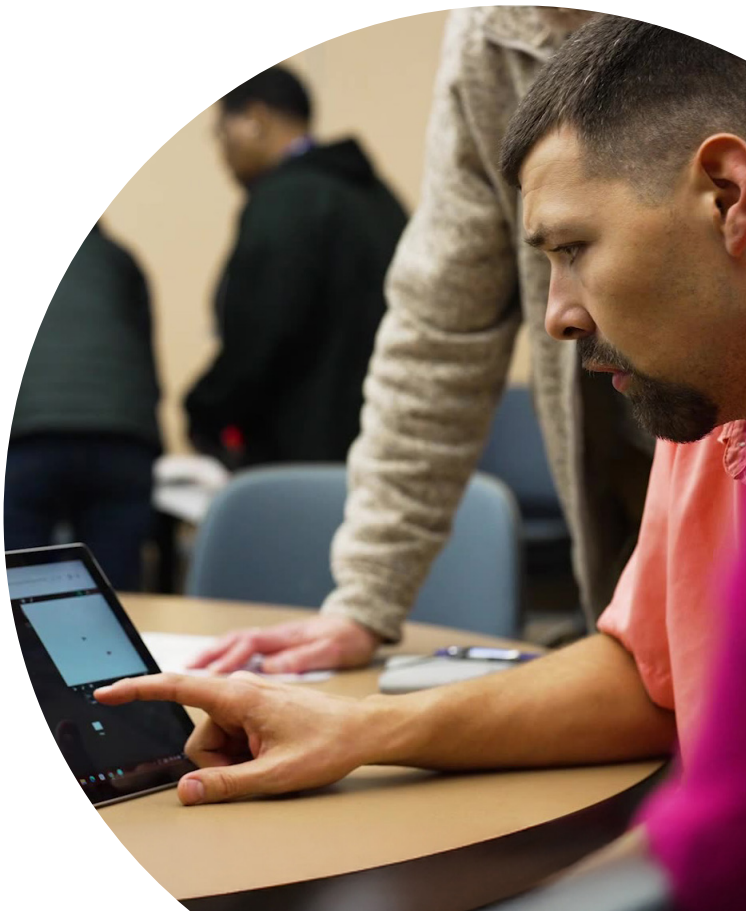


Delegates and Ambassadors exited this formal training experience with positive beliefs in their abilities to teach computer science, while also developing a clearer sense of what would be required of their schools based on state law.

~ Participant

Modality of Redelivery

The Modality of Redelivery in the RTA program revealed varied approaches, with districts utilizing both in-person and virtual professional development sessions. The length of these sessions also differed, ranging from full-day to part-day workshops, each tailored to fit the needs of the district. Key themes covered during redelivery included foundational computer science concepts and integration strategies. However, one major insight from the program was the limited understanding of the CS law among educators. Despite the extensive training, only 47% of educators fully understood the state law requirements regarding computer science education, highlighting the need for more focused efforts in this area moving forward.



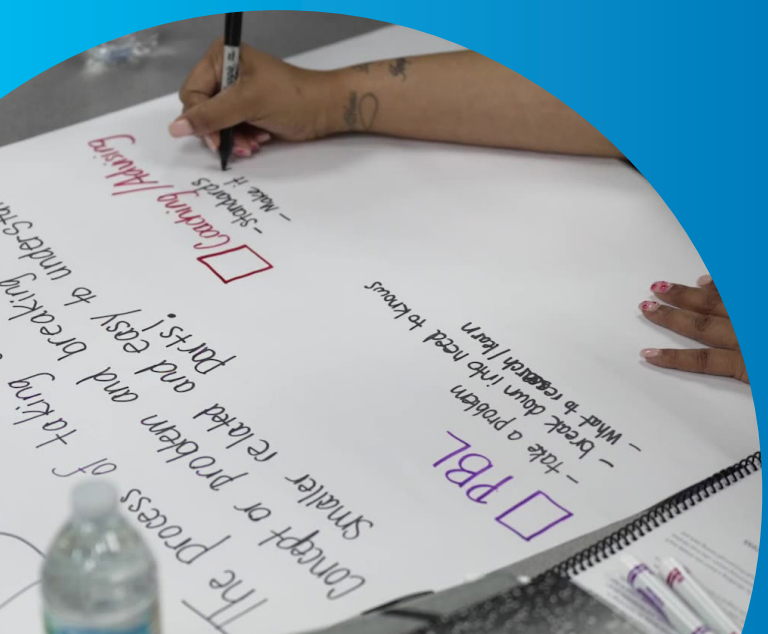
PROFESSIONAL DEVELOPMENT IMPACT IN UNDER-RESOURCED DISTRICTS

Disparity in Resources and Impact

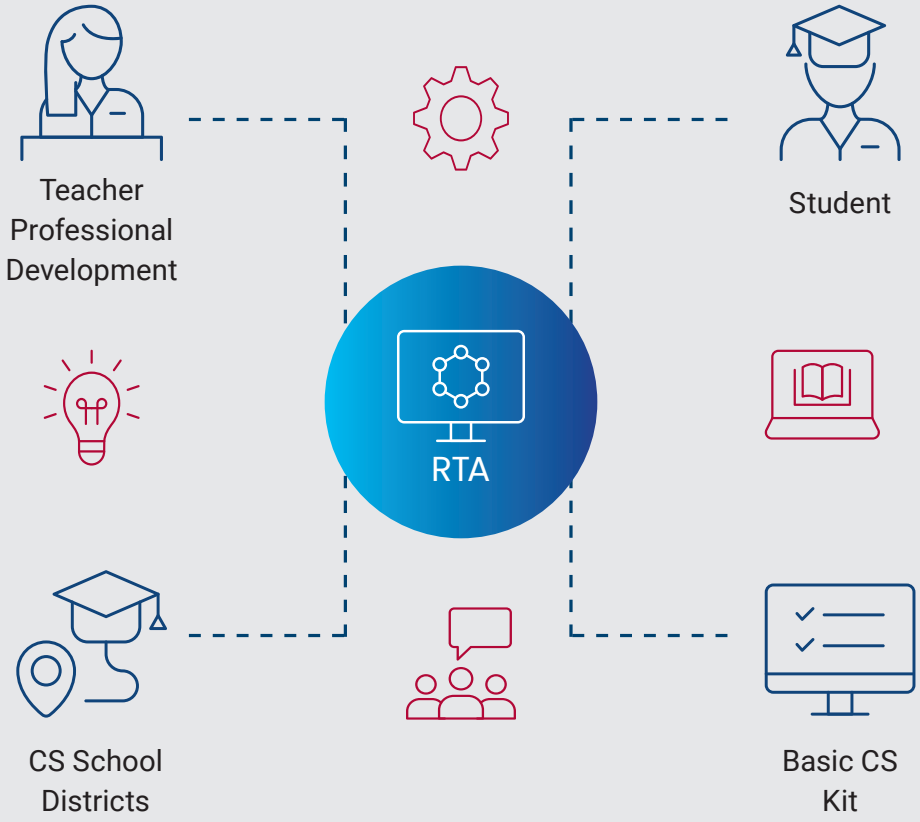
The RTA program had a particularly significant impact on under-resourced districts, where access to professional development and educational resources for CS was previously limited. In many cases, these districts lacked the financial support and infrastructure to implement comprehensive CS education. The RTA initiative provided critical training and resources that helped close the gap, enabling educators to deliver computational thinking and CS concepts to their students.
The distribution of physical CS kits and the hands-on training significantly benefited these districts.

Classroom observations indicated that essential computer science concepts were integrated effectively, but the full integration across other subject areas and encouraging all students to engage remain areas for improvement.

~ Participant



Additionally, elementary education emerged as a priority area for ongoing support. Educators in under-resourced districts, especially at the elementary level, expressed a strong need for continued assistance in integrating CS into their everyday teaching practices. Sustained support will be essential to ensuring that the early introduction of CS becomes a foundational part of the curriculum across all grade levels.



Classroom Observations and Outcomes

Classroom observations were conducted in 18 districts to evaluate the impact of RTA training on CS instruction. The observations revealed that educators in these districts adopted a positive approach to teaching CS and computational thinking. Student engagement was high, with many students effectively using CS vocabulary and demonstrating understanding of key concepts.

- However, despite the progress made, gaps were identified in areas requiring further professional development.
- While many teachers were successful in introducing core CS principles, there remains a need for more targeted training to deepen their knowledge and expand the integration of CS across various subjects.
- **These findings suggest that while the RTA program laid a strong foundation, continued professional learning is essential to fully realize the program's goals.**

PARTICIPANT DEMOGRAPHICS AND AREAS FOR IMPROVEMENT

Demographic Overview of Participants

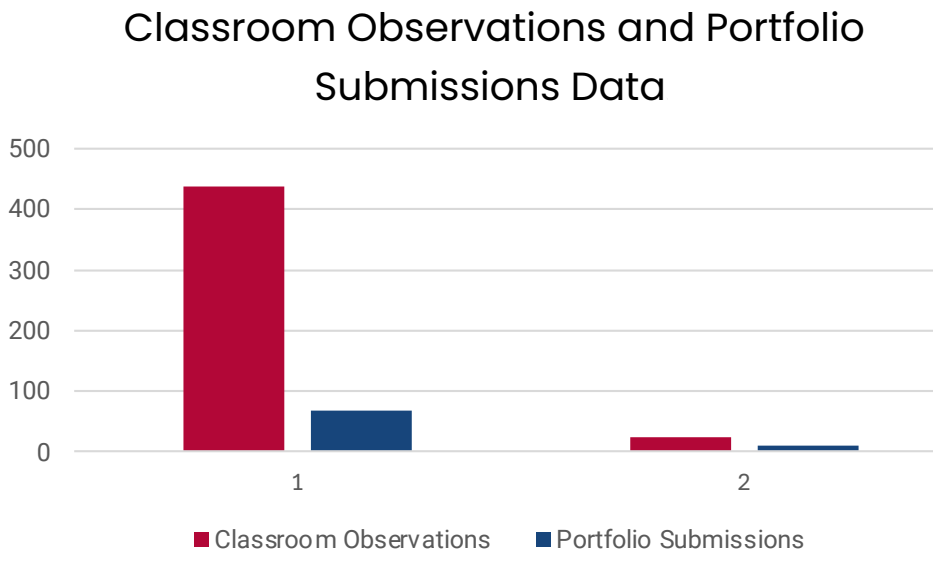
The participants in the RTA program represented a diverse range of educators across Tennessee. The breakdown of participants by grade level showed strong representation from elementary, middle, and high school educators, with a significant portion coming from rural and under-resourced areas. The program reached educators from 136 districts, ensuring a broad geographic coverage across the state. Despite this wide participation, some regions, particularly in rural areas, experienced lower levels of engagement, highlighting a need for increased outreach in these communities.

Areas for Improvement

While the RTA program successfully provided foundational CS education to a wide audience, areas for improvement were noted in terms of administrative and district-level leadership support. For CS education to thrive, it is crucial to have strong buy-in from school administrators and district leaders, who play a key role in allocating resources and prioritizing professional development. Many participants indicated that administrative engagement with CS initiatives was inconsistent, which could hinder long-term sustainability of the program's goals.

Additionally, elementary educators expressed the need for more targeted support in integrating CS into their teaching practices. While progress has been made in introducing computational thinking to younger students, sustained efforts are necessary to embed these concepts into the elementary curriculum fully.

Gaps in professional development (PD), particularly in classroom observations, revealed that educators require further PD to align their teaching with CS standards and ensure continuous improvement.



Contemporary Relevance of CS Instruction

The relevance of computer science instruction in today's digital age cannot be overstated. The RTA program highlighted the growing need for students to acquire digital-age skills that align with the demands of the modern workforce. As Tennessee continues to evolve into a hub for technology and innovation, it is critical that CS education prepares students for the jobs of the future.

Participants recognized that teaching computational thinking and CS is not just about technical skills but about equipping students with problem-solving abilities and adaptability, which are crucial for thriving in the digital economy. As such, further alignment with modern learning practices is essential, ensuring that students are prepared for a workforce increasingly driven by technology and innovation.

FUTURE DIRECTIONS AND RECOMMENDATIONS

Highlights

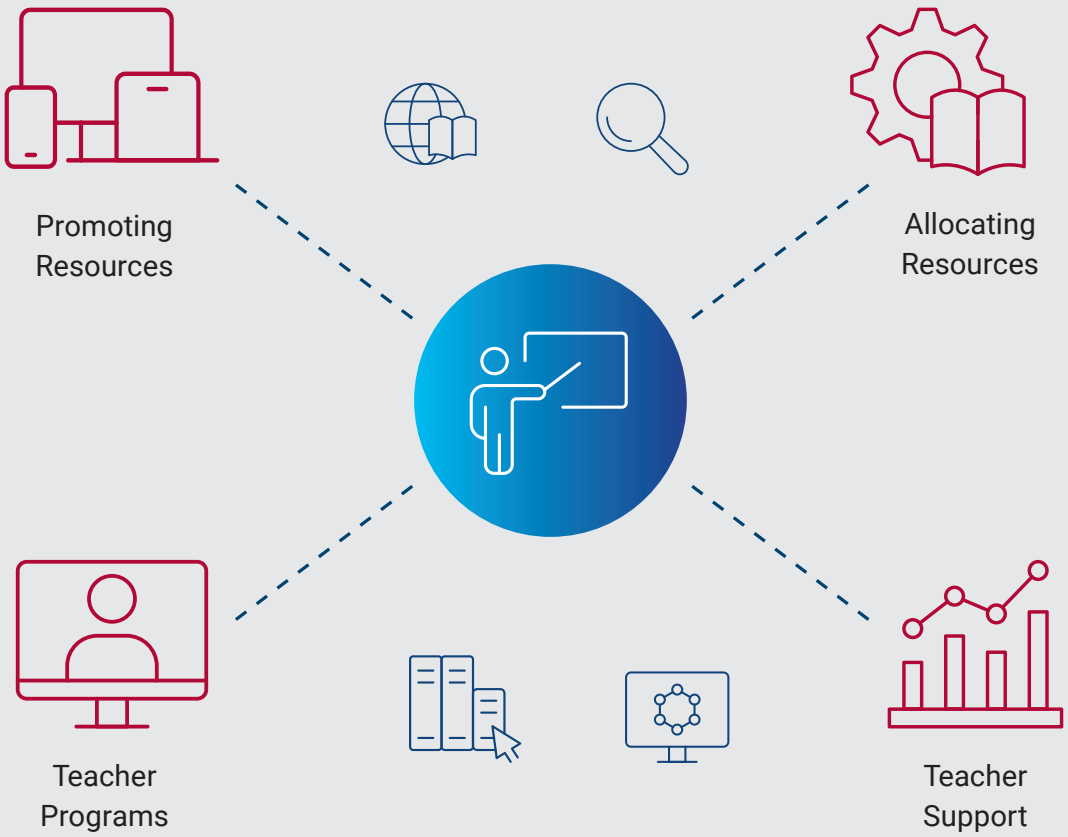
The survey data collected from the RTA program participants indicated that districts require additional resources to continue integrating CS education effectively.
A significant portion of educators expressed a need for more sample lessons and instructional materials that they could directly implement in their classrooms. These materials would help streamline the process of integrating CS concepts into the curriculum and provide a practical framework for educators, especially those in under-resourced or rural districts.

In addition to materials, the development of crosswalks—resources that link CS education to existing math, literacy, and science standards—was identified as a critical next step. These crosswalks would enable teachers to seamlessly incorporate computational thinking and CS into subjects they are already teaching, allowing for a more integrated and interdisciplinary approach to education. By connecting CS with core subjects, educators can help students see the relevance of computational thinking across various disciplines.

Focus on Leadership and Administrator Buy-In

One of the most pressing challenges identified in the program evaluation is the need for increased leadership engagement. The long-term success of CS education in Tennessee hinges on the commitment and support of school and district leaders. Administrators play a pivotal role in prioritizing professional development, allocating resources, and ensuring that CS education is integrated into the broader educational framework.

Survey results highlighted the inconsistent involvement of school leadership in the implementation of CS programs, which in some cases limited the program's reach and impact. For the RTA initiative to have sustained success, it is crucial for district and school administrators to take an active role in supporting teachers, advocating for resources, and promoting CS education as a priority for their schools.



Recommendations for Sustaining Success

Resource Development

Provide districts with ready-to-use lesson plans, crosswalks that integrate CS with core subjects, and instructional materials that make it easier for teachers to adopt and teach CS concepts.

Ongoing Professional Development

Establish long-term training programs that provide both foundational and advanced CS education for teachers. This will ensure educators are continually developing their skills and are able to keep up with advancements in CS education.

Leadership Training and Advocacy

Implement leadership training programs aimed at district-level administrators and school leaders. This will build their capacity to support CS education initiatives, drive district-wide implementation, and secure the necessary funding and resources to sustain the program.

Partnerships and Stakeholder Engagement

Strengthen partnerships with local businesses, universities, and technology companies to provide additional support, resources, and opportunities for students. Engaging the wider community will help promote CS education as a vital part of Tennessee's future workforce development.

STAKEHOLDER ENGAGEMENT AND DEEPENING COLLABORATION

Long-Term Success through Stakeholder Engagement

The long-term success of the RTA initiative hinges on deepening partnerships with industry leaders, educational institutions, and other stakeholders. Building strong collaborations with the private sector and technology companies will help enhance the resources and expertise available to educators. A key focus moving forward is to develop clear onboarding processes that facilitate collaboration between industry professionals and educators, ensuring that the latest technological advancements and industry needs are reflected in classroom instruction.

Existing Initiatives

Several existing initiatives support these efforts:

- **CSME:** A program focused on computer science education.
- **TSIN Delegate Newsletter:** A regular communication tool to keep educators informed and engaged.
- **Integration Guide Continuation:** Tools to help integrate computer science into various subjects.
- **CS ILI and Rural STEM Collaborative CS Track:** Special initiatives to bring computer science education to rural areas, ensuring equitable access to resources.
- **CSEP Support and Kira Learning Courses:** Resources for educators to enhance their computer science instruction.
- **NSF ROccem Curriculum:** A curriculum developed with support from the National Science Foundation to advance computer science education.
- **Model Lesson Development and Video Library:** Development of ready-to-use lesson plans and a library of instructional videos to support teachers in implementing computer science education in their classrooms.

NEXT STEPS AND RECOMMENDATIONS FOR SUSTAINABILITY

Supporting Districts and Educators

To continue advancing CS education across Tennessee, the next steps for TN involve developing and distributing training centered around the CS Walkthrough document/rubric. This tool will help educators assess and improve their implementation of CS concepts in the classroom. In addition, a webinar series and regional training sessions should be created to support ongoing professional development. These sessions will align with existing CS-focused initiatives, such as the CS ILI (Computer Science Instructional Leadership Initiative) and the Rural STEM Collaborative, to ensure cohesive and comprehensive support for educators across the state.

Cohesive Strategy and Long-Term Goals

TSIN plays a vital role in breaking down equity barriers in under-resourced districts. Ensuring that all students, regardless of their geographic or economic situation, have access to quality CS education is a central goal. TSIN should engage the STEM Executive Council to provide strategic input and direction. A key recommendation is to organize a 2-day regional training event, focusing on further integrating CS into the curriculum. This event will provide targeted support and professional development for educators, particularly in under-resourced areas, to help bridge the equity gap and ensure that CS education is accessible to all students.

> **I noticed that computational thinking practices are interconnected. Every single one applies to so many aspects of real life and we use these skills daily.**
>
> ~ Participant

CONCLUSION

The Reach Them All initiative has laid a strong foundation for advancing computer science education across Tennessee. However, the work is far from complete. Moving forward, the most critical next steps involve continuous improvement through strategic professional development and resource allocation. Providing educators with ongoing training, especially through the use of the CS Walkthrough document and regional training initiatives, will be essential to embedding computational thinking and CS into everyday teaching practices.

TSIN remains committed to breaking down the equity barriers that exist in under-resourced districts, ensuring that all students, regardless of their location or circumstances, have access to high-quality CS education. By supporting districts through tailored professional learning opportunities, increased resource distribution, and collaborative partnerships with industry leaders and educational stakeholders, TSIN will continue to drive the future of CS education in Tennessee.

These efforts will help ensure that Tennessee's students are not only prepared for the digital age but are also positioned to succeed in a rapidly evolving workforce. As TSIN strengthens its initiatives, the ongoing focus on expanding access, and long-term support will ensure that every student can benefit from the opportunities that computer science education provides.

ABOUT TSIN

The Tennessee STEM Innovation Network (TSIN) supports the growth and quality of STEM education in Tennessee. TSIN is a partnership between the Tennessee Department of Education and Battelle that develops high-quality STEM programming to ensure that Tennessee students are prepared for success in college and career and ready for the future of their choosing.

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