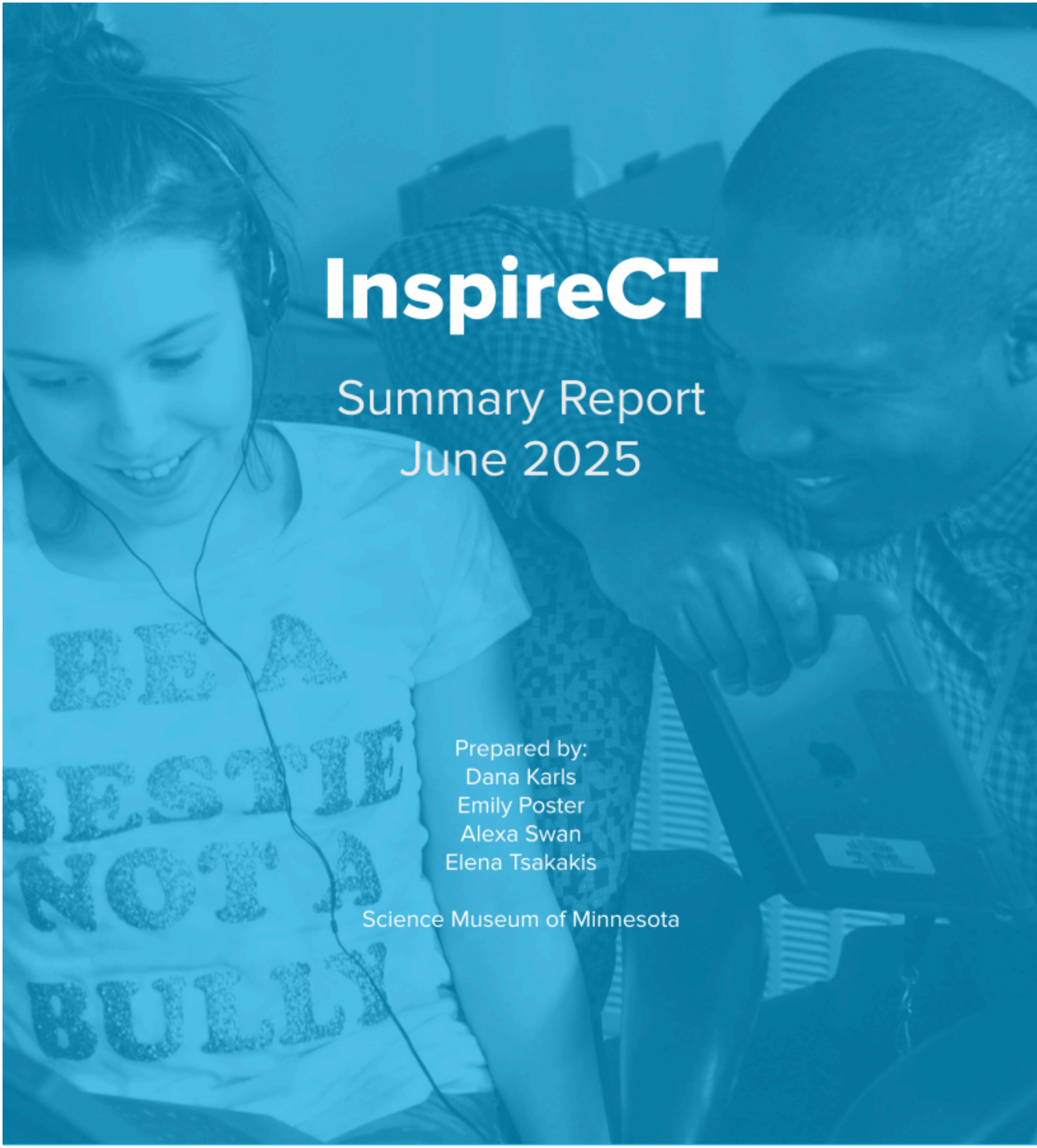

InspireCT

Summary Report
June 2025

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Science Museum of Minnesota

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What is InspireCT?

Executive Summary

InspireCT: Inspiring STEM Learning through Applied Computational Thinking is a strategic initiative to increase and sustain effective and equitable computational thinking (CT) education. As a multiyear, cross-organizational partnership between the Science Museum of Minnesota, Minneapolis and Hopkins Public Schools, and the Cargill Foundation, we work together to improve STEM education across multiple levels of the public education system, with a focus on intersectionality and closing opportunity gaps for historically marginalized groups. Our stakeholders share a vision for increasing equitable CT education and teacher training to ensure all students are prepared for college, careers, and full civic participation.

Since 1987, the Cargill Foundation and the Science Museum of Minnesota (SMM) have collaborated to promote high-quality STEM education in Minnesota schools. InspireCT is grounded in this legacy which includes the 2008-2018 *Engineering is Elementary Alliance for Curriculum Implementation and Support*, and in other SMM-led projects such as the National Science Foundation-funded *LinCT: Linking Educators, Youth, and Learners in Computational Thinking*.

The InspireCT project began in 2018 and includes SMM-led and co-taught CT residencies in Minneapolis and Hopkins Public Schools, all-school CT family events, CT school assemblies, teacher training workshops and summits, and a wealth of resources and support for sustained CT education in Minnesota classrooms.

In its first seven years, the InspireCT project has achieved noteworthy results:

- More than 23,000 engagements with students and teachers through programming, professional development, and ongoing instruction from InspireCT-trained teachers.
- Students who engage with InspireCT in their classrooms show increased interest in STEM and demonstrate increased proficiency in CT skills, persistence, and 21st century skills such as creativity and collaboration.
- Teachers trained through InspireCT have an increased understanding of CT and feel more prepared and confident to continue teaching CT in their classrooms.

InspireCT's teacher and student programs are essential to Minnesota schools. SMM is committed to continuing to support our local learners through program offerings and continued advocacy for funding and policy change.

Defining Computational Thinking

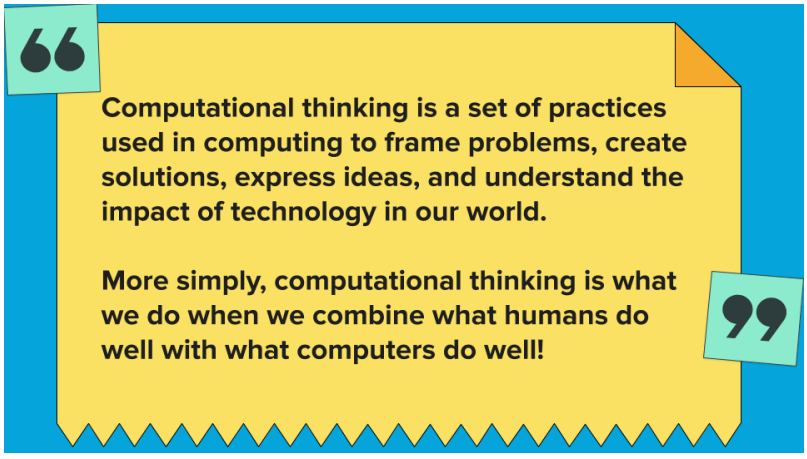
We define computational thinking as **a set of practices used in computing to frame problems, create solutions, express ideas, and understand the impact of technology in our world**.

We identify four specific CT Practices to guide educators and students:

- **Data Collection and Analysis** centers around how we can use computers to collect, organize, and make meaning of digital information.
- **Abstracting and Modularizing** allows us to extract essential details and repeatable patterns from a more complex system in order to collaborate and find reusable components.
- **Algorithm Design** prompts us to articulate the ordered steps that make up a particular process and refine that process for automation.
- **Debugging** allows us to test our solutions and work through problems as they arise.

While computer science is the study of and use of computers, computational thinking encompasses a more foundational set of skills and processes that enable students to think critically and logically, navigate complex problems, and orient toward curiosity and problem-solving. Computational thinking is often used in the development of code, and can also be much more broadly applied to a wide range of academic disciplines.

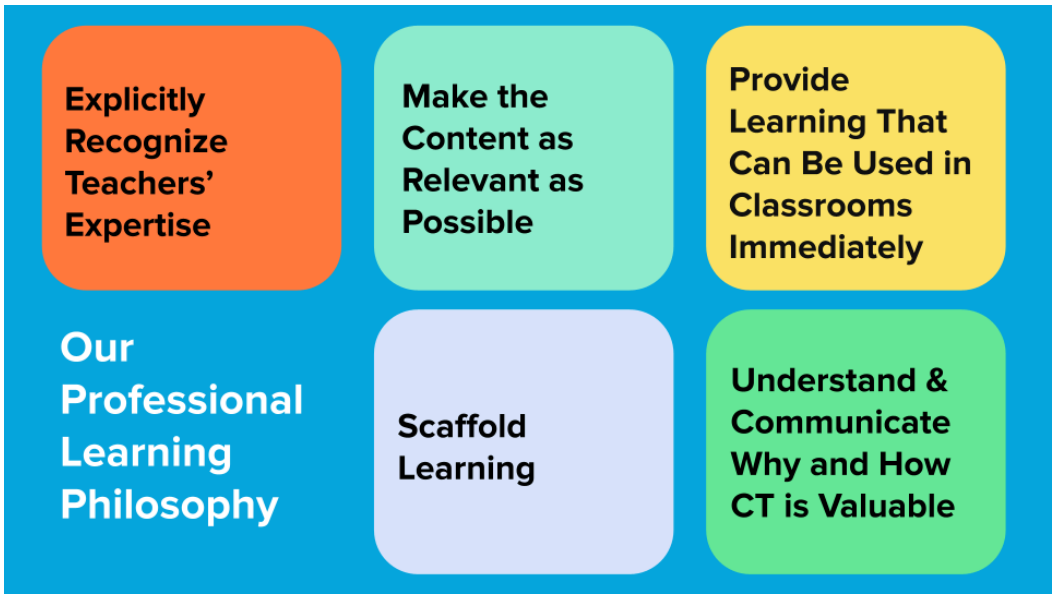
The need to integrate CT into K-12 education is urgent and motivated by **economic and workforce development, citizenship and civic engagement, equity and social justice, interdisciplinary competencies and literacies, school reform, and the improvement of peoples' lives**.



Our Approach to Professional Learning

Foundational to InspireCT is the cross-organizational partnership between SMM, school districts, and the Cargill Foundation. This approach to partnership underlies our professional learning philosophy as well. When we work with teachers, we respect each other as partners in STEM education, so it is essential to us that we explicitly recognize teachers' expertise, make the content as relevant as possible, provide knowledge and resources that can be used in classrooms immediately, scaffold the learning experiences, and understand and communicate why and how CT is vital to students' lives.

Working in partnership, we came together to respond to this question: *How do we best support and prepare educators to teach a necessary content area that's new to most of them?* These conversations shaped our goals and our learning outcomes for teacher and student programs, and as the conversations continued, we developed ever more adaptable and responsive educational experiences. Through week-long professional development (PD) summits, co-taught residencies, and providing a wealth of CT educational resources, we approach CT education from a multitude of perspectives which prioritize both student and teacher learning and empowerment.

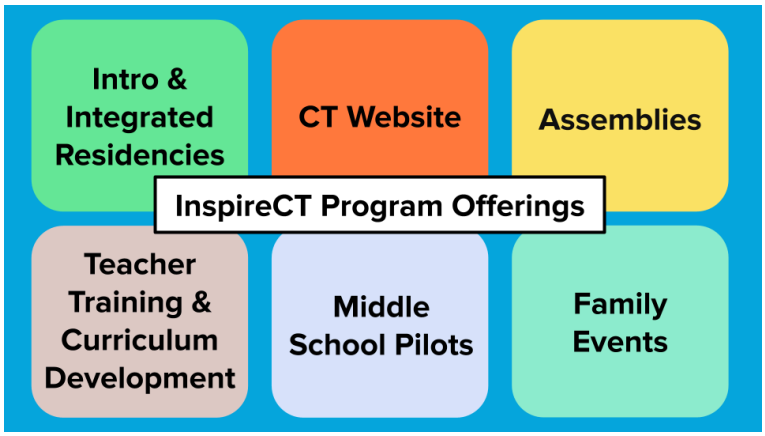


Program Structure & Design

Our vision of utilizing CT in all classrooms entails complete integration of CT educational tools into a district's existing curricula across disciplines. Working with curricula at the district level is essential for closing opportunity gaps between very different classrooms, schools, and neighborhoods. Integrating CT learning into curricula for other subject areas is critical to sustainability at the elementary level, where classroom teachers are generalists working within precise parameters (including mandated daily schedules that leave little time for adding new content).

In developing the program structure and design, we collaborated with educators to create learning experiences and resources that are integrated into already-existing educational standards, which empowers teachers to incorporate CT education into their classrooms without adding additional demands to their plate. Even more importantly, this integration establishes opportunity for more impactful instruction and learning, supporting students in reinforcing connections between CT and other vital subject areas, such as literacy and math.

Our prioritization of partnership-building and collaboration greatly amplifies the impact of the initiative, where together we are able to build and share CT educational experiences and resources that draw upon the expertise and insight of our rich and diverse community of teachers, instructors, and learners. Project evaluation supported these efforts by providing formative feedback to support program revisions and growth as well as providing summative-style data to understand the effectiveness.



Program offerings evolved over time and were adapted to meet the needs of our community, while maintaining a focus on student achievement, teacher growth, and district sustainability. Early CT residencies including "Introduction to Computational Thinking" were designed to build comfort with CT and STEM education for more teachers and students. We continued to build on the success of this residency, partnering with district public educators in the co-creation and development of more advanced curricula, with

CT practices and concepts being integrated into literacy, math, and social emotional learning, which yielded three integrated CT residencies, co-taught between museum educators and classroom teachers. Additionally, we developed a CT school assembly, a CT family event, and CT website, which work as compliments to our CT residencies, or as standalone offerings to bring CT learning experiences to larger audiences.

Background on Scratch

When designing our curricula, which heavily features block-based coding experiences for beginner CT teachers and learners, we decided on Scratch as our coding platform. Scratch is "the world's largest coding community for children and a coding language with a simple visual interface that allows young people to create digital stories, games, and animations." We chose to utilize this software for our CT work for several reasons: Scratch was designed for educational purposes, allows for open-ended and creative uses, and — most importantly — is highly accessible for a diverse range of learners and language speakers. This accessibility was critical to us in our choice to build programming around the platform, as it is available in over 70 languages and has an easily understood and simple interface that encourages exploration and hands-on learning, ultimately making Scratch the perfect coding platform to use for building accessible, customizable, and engaging programming for new and experienced CT learners and educators.

Program Offerings

Intro & Integrated Residencies

Residencies are four days long and co-taught between museum instructors and classroom teachers. Science Museum staff spends 60 minutes per day with each class, modeling CT lessons and pedagogies.

Residencies are built around curriculum co-created in partnership with Minneapolis and Hopkins Public School educators and are **integrated into existing math, literacy, and social-emotional learning educational standards**. Our integrated residency units include "Understanding Feelings" (a CT and social-emotional learning unit), "Observing Nature" (a CT and literacy unit), and "Lines, Polygons, and Play" (a CT and math unit).

As **a co-taught classroom experience, residencies are designed to be both a CT immersion for students and a CT professional development opportunity for classroom teachers**, who may be new to coding, computer science, and CT. Our units are packed with resources and scaffolded to welcome and support both new and experienced CT educators and students alike. SMM immersive residencies have been shown to improve STEM outcomes for both the students directly participating, and also for students later taught by teachers who participated in a residency.

Teacher Training & Curriculum Development

One of the most transformative aspects of InspireCT is its partnership between museum educators and classroom teachers. Developing and delivering STEM training for classroom teachers has long been a strength of the Science Museum of Minnesota. In our school partnerships, more innovative approaches like residencies complement traditional teacher workshop offerings. InspireCT built on this strength to develop new week-long Teacher Leadership Summits while continuing to offer introductory professional development (PD) experiences.

InspireCT's success is largely due to its Teacher Leaders: self-selected public school teachers who stepped up to take on the new challenge of CT education and committed their time, effort, and talent to the project. A diverse cadre of Teacher Leaders was recruited from Minneapolis and Hopkins schools and each Leader committed to their grade-level team's participation in a residency, attending a week-long Leadership Summit, piloting new curricula in their classrooms, and providing feedback. In return, they gained:

- Increased understanding of CT and how to integrate it in elementary classrooms using equitable instruction practices
- Insight into how to teach CT and computer science, including creating lessons in partnership with other teachers
- Increased confidence to respond to student interest and excitement for technology while preparing them for STEM learning, potential career pathways, and informed citizenship in our technologically-driven world.

During the Leadership Summits, Teacher Leaders joined museum educators to design InspireCT's innovative curricula, which brings together the respective strengths of classroom and museum educators. **Classroom teachers bring a deep knowledge of cross-disciplinary curricula and academic standards. Museum instructors contribute a strong understanding of inquiry-based learning and concrete applications of STEM.** In addition to effectively integrating CT with other subject areas, this collaboration also allowed us to more fully address issues of equity and accessibility, including emphasizing relevant cultural contexts for student problem-solving and modeling best practices for reducing educational inequities. Rather than attempting to retrofit a pre-existing curriculum, we created fully customized lessons to best meet the needs of our local STEM learners. Teacher Leaders leave the InspireCT project with enhanced skills in CT education and are equipped to continue curriculum integration, contributing to the project's sustainability.

Family Events

Our CT family events feature STEM learning and discovery outside of school hours at partner schools, allowing us to share CT exploration with a wider audience of community and family members. Expert Science Museum educators facilitate fun, hands-on educational experiences for learners of all ages. The 90-minute events feature exciting and interactive activity stations for students and adults to explore together. This **focus on intergenerational learning builds parent/guardian support and awareness of CT skills and career opportunities**, while allowing students to share about what they're learning in school with their families. Our Celebrate Computational Thinking! activities include algorithms, patterns, and coding — all without a computer!

Family event stations also highlight a variety of career paths that use CT practices. Sharing about careers is especially important at family events because research tells us that parents, caregivers, and other adults have a huge impact on a child's choice of and ideas about careers, and that these choices are often being made much earlier than we realize.

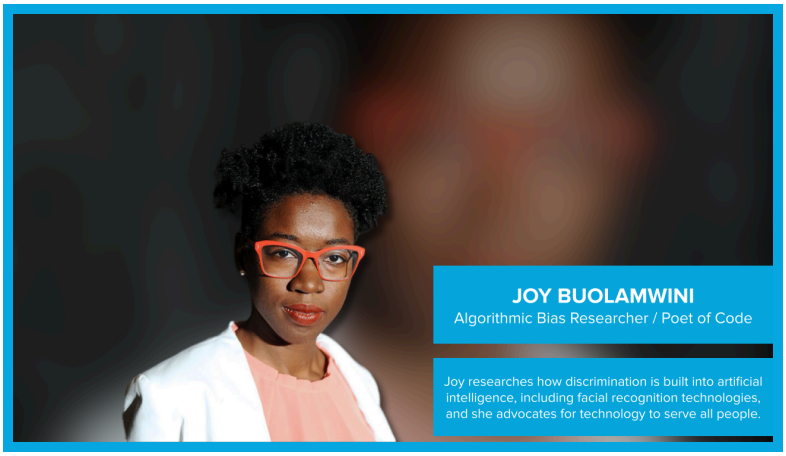
Assemblies

In our Computational Thinking Assembly, students explore how the strengths of humans – like curiosity, empathy, and the ability to process new information – and the strengths of computers – like speed, accuracy, and precision - can be brought together to create powerful solutions to everyday problems. This 50 minute program includes a variety of

interactive demonstrations for up to 250 students and is especially effective as an introduction to our CT residencies, family events, and CT website curricula.

In developing our science learning goals for this assembly, we prioritized the exploration of human biases and how these become integrated into the programs and technologies humans create. In examining human and computer biases, **we delve into the importance of making sure the tools we use and create are equitable and inclusive to all users**, one of our fundamental commitments when approaching CT education.

Throughout the assembly, we also highlight a diverse array of Computational Thinkers, like Joy Buolamwini, who researches how discrimination is built into artificial intelligence, including facial recognition technologies, and advocates for technology to serve all people. Through explorations of biases and spotlighting leaders who are blazing inspiring paths in the tech industry, we hope to instill in students an understanding of their potential to be more than just consumers of technology, but also **creators of innovative tools that make the world a more equitable and inclusive place for everyone**.



Middle School Pilots

Another InspireCT effort has been to pilot CT curriculum and an implementation model for middle school, a need specifically expressed by our school district partners. InspireCT and its predecessor EiE project contributed to very high STEM interest levels for

elementary students, but national educational research shows that STEM interest falls dramatically in middle school, particularly for girls. Our middle school pilots were designed to inform a future implementation model to **effectively transition students, particularly girls and students of color, from elementary to middle school while maintaining high levels of interest in STEM classes and careers**. A significant learning from this work is that the foundations for this transition lie even earlier in elementary students' academic careers. We have learned it will be critical to support districts in vertically aligning CT opportunities from K-8 to empower students in making connections between their CT lessons as they progress through the elementary grades. This vertical alignment provides even more fruitful avenues to build strong student STEM identities that can be sustained into middle school and beyond.

Computational Thinking Website

In an effort to further increase sustainability and accessibility of the project, we've partnered with the SMM marketing team to build a CT website, which serves as **a hub for the wealth of educational resources we've developed with and for educators**. The site features several CT mini lessons for introducing CT concepts to students of all ages, our in-depth integrated units for diving further into CT learning, an Educator Resource Guide, which gathers a wide range of technical and pedagogical supports for educators at all experience levels, and a collection of professional development video offerings from years of CT dissemination. These resources are now available to the public, for free and open use to all educators looking to bring more CT education into their classrooms.

Project Participation

From 2018-2025 InspireCT supported more than **23,000 engagements** with students and teachers through programming, professional development, and ongoing instruction from InspireCT-trained teachers.

Over 9,800 teachers and students engaged directly with InspireCT program offerings over the course of the 7-year project.
The InspireCT program was designed to engage both students and teachers directly in program offerings through residencies, professional development, assemblies, and pilot programs, all while preparing and supporting teachers to continue applying CT content and strategies to their classrooms.

- More than 7,000 students and nearly 300 teachers participated in an in-class residency.
- Student participation in residencies declined during the COVID-19 pandemic and the 2022 teacher strike, but increased steadily for the final 4 years of the project.
- Professional development sessions, including the Leadership Summits, provided 349 teachers with CT-specific background information, lesson plans, resources, and access to SMM instructors.
- There were almost 2,000 engagements with non-residency program offerings including family events, CT assembly programs, and middle school pilots.

Table 1. Participation in **residencies** overall and by year

	Year 1 (18-19)	Year 2 (19-20)	Year 3 (20-21)	Year 4 (21-22)	Year 5 (22-23)	Year 6 (23-24)	Year 7 (24-25)	**Total**
Teachers	47	14	31	21	52	56	60	**281**
Students	1177	295	734	473	1338	1571	1592	**7183**

Table 2. Teacher participation in **professional development** offerings overall and by year

	Year 1 (18-19)	Year 2 (19-20)	Year 3 (20-21)	Year 4 (21-22)	Year 5 (22-23)	Year 6 (23-24)	Year 7 (24-25)	**Total**
Leadership Summits	0	14	13	9	5	0	0	**41**
PD sessions	0	0	45	6	257	0	0	**308**

Note: Summits and PD sessions were front-loaded in the first 5 years of the project to allow for full implementation of the co-created curricula in years 6 and 7

Table 3. Student participation in **additional program offerings** overall and by year

	Year 1 (18-19)	Year 2 (19-20)	Year 3 (20-21)	Year 4 (21-22)	Year 5 (22-23)	Year 6 (23-24)	Year 7 (24-25)	**Total**
Family event* & assembly programs	240	100	0	0	0	0	495	**835**
Pilots	0	405	353	225	125	50	0	**1158**

*Also includes family and community member participants

More than 13,500 students in Minnesota were taught by an InspireCT-trained teacher. A core tenant of the InspireCT program is its focus on teacher education and preparation. The InspireCT program was designed to prepare and support teachers to incorporate computational thinking practices and curriculum into their existing pedagogy well beyond their direct participation in the project. As such, it is vital to acknowledge the ongoing impacts for students beyond those who participated in the project. These are expected to continue beyond the scope of the grant as teachers continue to apply learnings in their classrooms. Estimates were conservatively calculated assuming that participating teachers taught 25 students per year following their first year of participation in InspireCT programming.

Table 4. Students taught by InspireCT-trained teachers overall and by year

	Year 1 (18-19)	Year 2 (19-20)	Year 3 (20-21)	Year 4 (21-22)	Year 5 (22-23)	Year 6 (23-24)	Year 7 (24-25)	**Total**
Students	--	900	1275	1700	2275	3200	4175	**13,525**

Story of the Project

2018-2019

Project Launch

The program had a strong launch in 2018-2019, engaging 1,177 students and 47 teachers in “Code Your Own Adventure” residencies to introduce them to CT education. We also recruited 19 Teacher Leaders - educators committed to collaborating with SMM in long-term professional development, building

resources and equity practices in CS/CT education, and co-creating CT-integrated content area curricula.

In the early years of InspireCT, instruments to measure growth in CT skills and attitudes were unestablished. After extensive research, our evaluation team developed an entirely new instrument by drafting student assessment questions based on constructs in existing literature on CT skills and dispositions and then tested the instrument for validity in classrooms and at SMM with 8-11 year-old students. This instrument was finalized to be used with students before and after participating in a residency throughout the entire grant period. The project launch phase also included drafting and refining instruments to measure teacher impacts from participation in programming and professional development.

Curriculum Topic Study on Computational Thinking

In 2019, a team at the Science Museum of Minnesota conducted a deeply-researched curriculum topic study on CT: Computational Thinking: Synthesis of Curriculum Topic Study. The curriculum topic study was undertaken to clarify understandings of CT among museum education staff, frame CT within the informal museum education context, and inform program development and pedagogy for InspireCT. In stark contrast to more well-established STEM content such as physical forces or experimental design, understanding of CT education is rapidly evolving in both schools and museums. The curriculum topic study process ensured that InspireCT's work would be well-researched, grounded in current best practices, and focused on equitable pedagogy and closing opportunity gaps.

2020-2023

Unique Challenges

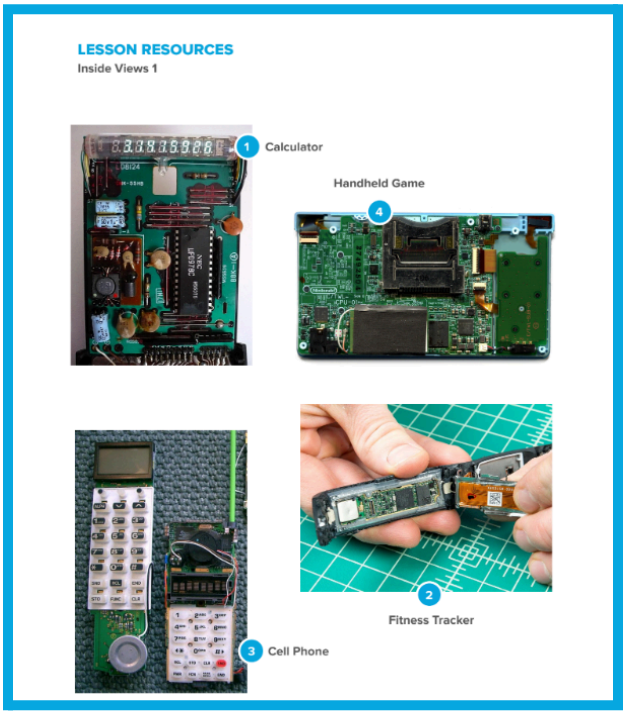
The following years ushered in a series of unique challenges for the project. Our communities were greatly impacted by the COVID-19 pandemic, school closures, and a workers' strike by teachers and education support professionals in Minneapolis Public Schools, which slowed planning and

then froze most program work for weeks in the spring of 2022. Beginning in 2020 and continuing today, Minnesota Public Schools have also been experiencing a period of extreme teacher attrition and staff shortages. This new reality greatly reduced the capacity of schools and teachers to take on new initiatives like InspireCT and slowed the project timeline, making it necessary to extend the grant term to seven years instead of the originally planned five years.

As students returned to school in-person, it quickly became clear that their learning needs had changed dramatically during a time of unprecedented upheaval. Social and emotional skills were underdeveloped for many students during their months of virtual learning, and they struggled with adapting to these new experiences and to the increased stress of adults in their lives.

Additionally, the COVID-19 pandemic significantly affected how SMM conducted business. Staff were greatly reduced to curb expenses during shutdown periods and maintain the museum's long-term viability as one of Minnesota's most significant scientific and cultural resources. With the remaining staff, SMM focused on delivering online services to the community while maintaining a base of operational continuity until it was deemed safe to open again to the public.

Adapting to Shifting Needs



In response to the changing needs of our school districts and communities, the InspireCT project focused on adapting our programming and evaluation plans to these shifting priorities and on how we could serve our community in critically-needed ways, piloting virtual residencies and more adaptable programming to remain accessible to a wider and more diverse audience.

We partnered with Teacher Leaders to create more flexible and stand-alone computer science lessons, which were better able to meet the needs of teachers who were limited in their capacity to take

on a larger initiative, but were still looking for support in bringing CT into their classrooms in more accessible ways.

We also prioritized the conversion of our week-long InspireCT Leadership Summit from in-person delivery to a virtual format and were pleased to hear from survey responses that almost all participants found the virtual summit to be similarly or even more engaging than other in-person trainings they had previously attended. A 2020 Teacher Leader shared, “I think you are doing an amazing [distance learning] summit. It is well structured, balanced, and has both accountability and support.”

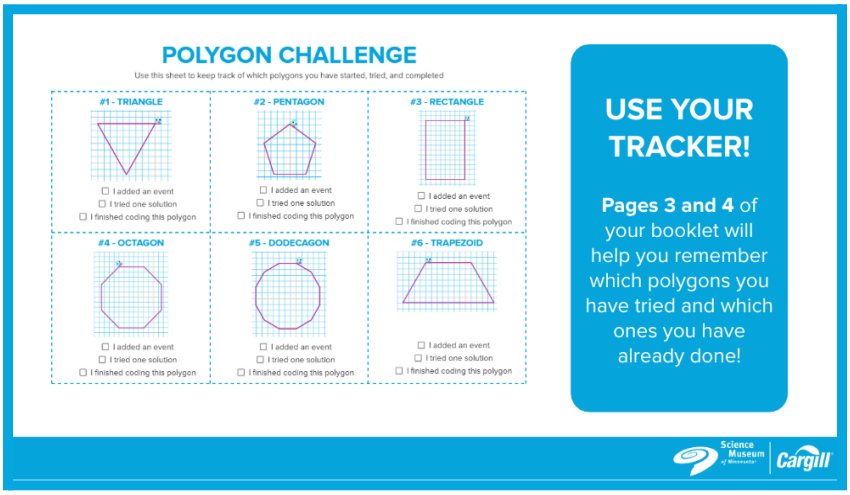
We continued the project’s evaluation efforts during this time and made modifications as needed to meet teacher needs. Some evaluation materials were not completed during this time because teachers were unavailable due to the unique challenges they were experiencing, which can be seen in the gaps in the sample. Survey responses were reviewed frequently with the project team to look for changes to the experience for participants and inform refinement of offerings.

2024-2025

Conclusion of the Grant

After several years of extreme challenges during the grant period, we are proud to have concluded the project with two final years of updated, responsive, and even more successful offerings. The adaptations we made to our programming during these years of upheaval ultimately yielded better results, including more sustainable, adaptable, and accessible curricula, as well as stronger relationships with participants and stakeholders.

During these final two years, we continued our evaluation efforts, including student pre and post residency surveys, teacher post residency surveys, and teacher interviews to measure the effectiveness and impacts of these efforts.



The launch of our three integrated CT residencies during this time has been received by participants with resounding support and enthusiasm. These units are designed with district needs and sustainability in mind, integrating high quality CT learning into already-existing educational standards. Teacher participants and conference attendees have shared in conversation that these opportunities and resources have been eagerly adopted by teachers and students alike, noting that the integrated units are structured to meet a diverse range of learning styles, are scaffolded to keep teachers and new learners in mind, and are some of the highest quality STEM deliverables they've encountered as educators. In post-residency surveys, over 70% of teachers rated their experience with the integrated residencies as outstanding (the highest rating)!

Wider Impact and Sustainability

As the project comes to a close, we've prioritized making our CT resources a permanent and sustainable offering through our CT Website. The website now stands as both a thoughtfully-constructed resource hub for educators of diverse computer science experience levels, as well as a testament to the inspiring and innovative work created by SMM instructors and public school educators over the course of the project, allowing teachers and students to continue to access and benefit from this work well into the future.

Additionally, representatives from the Center for STEM Education at SMM have presented about the project at several computer science education conferences across the country, including the International Society for Technology in Education conference, the Computer Science Teachers Association conference (voted "Best Of" the conference for our presentation on Welcoming Students and Families Through Joyful, Authentic Introduction to Computational Thinking!), and the MNCodes Educator Summit, where we were honored to meet with educators from all over the world and share resources, ideas, and discoveries about our CT programming and initiatives. This opportunity to further extend our reach and share to a wider audience has greatly

amplified the impact of the project, connecting us with educators and CS leaders from around the country, who can now bring InspireCT resources, connections, and insights back to their own classrooms and communities.

Looking Ahead

The Current Landscape of Computer Science Education in Minnesota

Computer science education, and computational thinking in particular, is not just for students who plan to pursue computer science (CS) as a career; it is a vital tool in empowering *all* students for their futures. Computational thinking is a foundational skill that teaches problem solving, communication, and adaptability, which are essential for all students to be successful in whatever career and life path they choose.

CT education in Minnesota is positioned to grow and advance. In the most recent publication of data, Minnesota ranked 49th in the nation in terms of access to foundational computer science opportunities at the high school level. Although many individual educators and organizations are working to expand access to computer science, there is a lack of larger structures and supports across the state for teacher licensure, professional development opportunities and funding, guidance from educational standards, and data and reporting.

SMM and InspireCT recognize this persistent need in our state and appreciate that grant funding alone cannot close the gap, and cannot fund CS and CT education in a long-term and sustainable way; changes in school funding are also required to provide this essential education. To inform state policy around CT education and funding, the InspireCT team invested staff time and successfully advocated for a position for an SMM representative to participate in the Minnesota's Computer Science Education Working Group. This advisory committee was tasked by the state legislature to develop a strategic plan for long-term and sustained growth of computer science education in all kindergarten through grade 12 school districts and charter schools. This group of CS education experts and school representatives convened to write Minnesota's Computer Science State Strategic Plan, which was finalized in March 2024. The plan makes recommendations to the state legislature including: developing K–8 computer science standards, implementing a required middle school computer science course, and establishing region-based communities of learning. The strategic plan also advocates for increased funding, with the goal of supporting equitable scaling of computer science education across the state.

It is critical that more state funding be made available for CS and CT education so that essential teacher training programs like InspireCT's residencies and teacher workshops receive support in a sustainable and reliable manner. Due to the looming state budget shortfall, funding directed for CS education was removed from the 2026-2027 state budget. This legislative decision derailed the plan to transition CS education funding from grants to annual school funding and failed to follow the recommendations of the Computer Science State Strategic Plan. Although current challenges in passing a state budget have created a devastating shortfall in this area of critical investment, the strategic plan and its recommendations stand and should be used to guide decisions about state CS education funding in the 2028-2029 biennium.

What is Still Needed

In conversations with our school district partners and local STEM leaders as well as our evaluation data around sustainability, we hear that there remains a great need for continued support and funding for CT education in our schools. Teacher training continues to be a top priority, with districts looking to further build educators' comfort and confidence in teaching STEM after years of teacher attrition, turnover, and mobility. Computers and their presence in our world are shifting rapidly, and teachers need support in knowing how to teach with and about these evolving technologies. Educators involved with the InspireCT program tell us they do not have these learning and development opportunities elsewhere and hope to continue to receive support through future partnerships with SMM.

> *"We want to continue to have these engaging experiences where [students] can learn 21st century skills and problem solving and creativity and the additional skills that come with it"*
>
> -2025 teacher interviewee

While students are provided opportunities to engage with technology and coding scattered across different grades, there is a lack of connectivity between these experiences. Schools are looking to build and improve upon vertical alignment in computer science education, a way of linking concepts from grade to grade to create a long-term plan for teaching throughout the K-12 journey, and to better support students' sustained interest in STEM classes and careers.

District leaders also desire additional support in bringing more cultural responsiveness and diversity, equity, and inclusion into STEM educational practices and materials. Minnesota Academic Standards, as well as Minnesota Standards of Effective Practice for

educators, have been updated for 2025 to include several racial consciousness requirements, which schools are eager to implement but lack training and support on how to do so meaningfully and effectively. Additionally, a large influx of new language learners, as well as highly mobile students and students with trauma, require schools to seek better ways to support an increasingly diverse population of students with critical needs.

Ultimately, due to teacher attrition and turnover, new and evolving technologies, updated educational standards, and changing student populations and needs, CT residencies and professional learning support remain vital in our public schools. Our school district partners and other schools across the state look to SMM for leadership in STEM, equity, and education. **The passionate and expert STEM educators at the Science Museum of Minnesota are positioned to provide the support, resources, and direction that schools and teachers need.**

Project Evaluation

A core component of the InspireCT project is its project evaluation. Throughout the grant period, this included continuously providing InspireCT staff with formative feedback to support program revisions and growth, as well as providing summative-style data at the end of each year to understand the effectiveness of CT lessons with students, professional growth efforts with educators, and efforts to support sustainability of CT education on teachers and district leaders. This report focuses on the summative evaluation methods and findings completed for all or almost all project years aligned with the project's evaluation questions:

1. How, if at all, do students demonstrate increased...
    a. STEM interest and STEM career interest?
    b. proficiency in CT & 21st century skills like algorithm design, debugging/problem solving, collaboration, creativity, and communication?
    c. persistence through their CT experience?
2. To what extent, if at all, does the InspireCT program
    a. increase teachers' understanding of CT?
    b. increase teachers' confidence in teaching CT?
    c. increase teachers' sense of importance about teaching CT concepts?
3. a. How prepared are teachers to apply equity strategies to their classroom practices in CT?

b. To what extent do teachers report applying equity strategies to their classroom practice in CT?

4. What do teachers and district leaders see as potential supports and challenges for long-term, sustainable efforts to engage students in CT?

Evaluation Methods

Student Evaluation Methods

Students completed pre- and post-residency surveys to measure desired areas of student growth, focusing on increased STEM interest, proficiency, and persistence, as well as 21st century skills. The pre and post surveys were administered to students by teachers in their classrooms before and after the residency experience, respectively. Teachers received a script to read aloud and support their students as they completed the survey. Surveys were typically completed by students using a laptop or tablet, but paper copies were available for use. Consent forms were sent home with students ahead of their participation and guardians were able to opt students out of participating in either of the surveys at any time. Students who did not participate in the surveys still engaged with the CT residency as any other student would.

Student Data Analysis

For student metrics, the pre and post survey data was pooled from all years of the project. This aggregation was done to provide a complete set of self-reported data from students. Additionally, it can be difficult to match student pre and post surveys based on self-reported identifiers from a younger age group, and in some cases students may complete only a pre or post survey, or none at all, and thus a pooled analysis was most accurate to capture student growth.

Student Evaluation Instruments

The pre and post surveys were designed to ask students about their Scratch familiarity and past use (pre), set a baseline and measure student growth on CT practices, 21st century skills, and STEM Career Interest through frequency and agreement questions (pre and post). Four items in the survey were used to ask students to share how they felt about STEM careers, asking “How much do you agree or disagree?” for each statement before and after the InspireCT residency (See Table 2). The final statement assessed how useful students think knowing how to use computers will be in their future job. We also asked students, “How often does this sound like you?” for 9 statements and to what extent they agreed or disagreed with 11 statements about what they felt they could do (as it related to CT), as well as their confidence and feelings around using CT practices.

Not every item is included below as we selected key indicators that align with the evaluation questions that guided this work. Early on in the project, the research team considered examining student Scratch products for evidence of 21st century skills and CT practices. Ultimately, this effort was piloted for a year and discontinued as it felt too narrow to demonstrate how students applied their creativity and individuality in projects.

The pre and post student surveys evolved as the program evolved, and were adapted through think-alouds from a set of original statements intended to identify CT practices in college students. The survey was shortened post 2020 to support educators navigating the COVID-19 pandemic in their classrooms and reduce the extra work.

As the project focuses on elementary school age students, student outcomes are measured through age-appropriate questions. Certain areas of interest, such as improved academic performance, are measured through items related to STEM perseverance and 21st century skills such as creativity, collaboration, and problem-solving, all of which are skills that elementary school age students are able to self report on. For example, we asked students how much they agree with the statement, "I can solve a problem even if it is difficult" as this demonstrates students' STEM perseverance and changes in STEM skills. These questions provided us with insight into how students were learning to work together, and persevere through challenges within a CT context, gaining skills with value well beyond the residency itself.

Teacher Evaluation Methods, Analysis, and Instruments

Teacher impact was measured through a variety of mechanisms to account for the different aspects of the project. In some cases teachers participated in all three aspects of the evaluation, but not always. Surveys were aggregated and analyzed using descriptive analysis while interviews and focus groups were transcribed and thematically coded.

> **Post Leadership Summit Survey:** Teachers were asked to complete a survey at the end of the InspireCT Leadership Summit via an online platform. This survey collected feedback about the overall experience of participating in the summit, what teachers found beneficial or challenging about the summit, explored technology or distance learning strategies, and measured teachers' confidence with CT and implementing CT in their classrooms.
>
> **Post Residency Survey:** At the end of the residency or pilot curriculum, teachers were asked to complete a post retrospective survey via an online survey platform.

This instrument measured the overall experience of the residency from the teacher's perspective and how engaging the residency or pilot was for participants. It also measured how teachers' understanding, confidence, and attitudes towards teaching CT concepts and integrating equity-focused pedagogical approaches was affected by their participation. The survey also asked participants to reflect on the challenges for long-term, sustainable efforts to engage students in CT and identify where support was needed.

Group Discussions/Interviews: During the spring of each year, Teacher Leaders from the InspireCT program were invited to participate in small, virtual group discussions (or interviews) with the program and evaluation teams. Teachers were asked to provide feedback on their experiences with InspireCT programming, reflect on their own confidence around teaching CT, and share what supports and challenges may exist for creating sustainable CT teaching in their schools in the future. Interviews were offered in place of discussion groups based on teacher interest and participation. Also in spring 2022 one interview was conducted with a district staff to gain insights from their perspective related to programming and sustainability.

Sample Size

Across seven years of programming, we received more than 4,400 pre-residency surveys, just over 2,800 post-residency surveys from students, 132 post-residency surveys from teachers, and connected with over 30 teachers in either interviews or focus groups. The total responses for the data in our findings section are slightly off from the response totals below as there were slight changes in the instruments year to year to account for program changes and interests. As such, not every question was asked every year, and the findings are reported from the largest possible sample that received that question but may not be inclusive of every year that data was collected.

Table 5. Sample size by evaluation method, overall and by project year

	Student Pre-Residency surveys	Student Post-Residency surveys	Teacher Post-Residency surveys	Teacher Post-Summit surveys	Teacher Focus Group or Interview participants
Total	**4439**	**2827**	**132**	**41**	**32**
Year 1 (18-19)	235	212	11	14	10
Year 2 (19-2020)*	117	-	20	14	-
Year 3 (20-21)	605	206	20	9	12
Year 4 (21-22)	370	338	14	4	1**
Year 5 (22-23)	980	607	19	-	5
Year 6 (23-24)	1079	696	25	-	3
Year 7 (24-25)	1053	768	23	-	1

*There were no post-residency surveys or focus groups in the spring of 2020 due to the COVID-19 pandemic.

**In 2021-2022, the interview included only 1 district staff member.

Participating schools

Minneapolis Public School District includes 41 elementary schools throughout Minneapolis with around 15,000 students enrolled. Around 62% of elementary school students are BIPOC, 57% are eligible for free or reduced lunch, and about 23% of elementary school students are English language learners. Hopkins Public School District includes 6 elementary schools which enrolls slightly more than 3500 students. Half (50%) of elementary students are BIPOC, 38% are eligible for free or reduced lunch, and 12% of elementary students are English language learners. InspireCT reached 31 MPS

elementary schools, 2 middle schools, and all 6 Hopkins elementary schools. Our findings are aggregated across all participating schools and districts.

Student Data Findings

Students responded to surveys both before and after the residencies in their classrooms. Questions between the pre and post surveys aligned with evaluation questions around STEM interest and STEM career interest, proficiency in CT and 21st century skills, as well as persistence. The findings include both pre and post results from students. We generally saw an increase from pre to post surveys, but not always. It is important to acknowledge that depending on the pre survey findings, an increase is not always feasible or expected, and a lack of increase does not necessarily mean the residency was ineffective; it may simply indicate that students began the residency with an existing interest, skillset, or understanding of the topics presented. Also included in this section are quotes from teacher surveys and interviews about what they noticed around the impact on their students.

At a high level, some key findings are that:

- Students recalled being exposed to STEM careers and showed interest in continuing to engage with STEM content even after the residencies ended.
- Students who participated in a residency demonstrated increased proficiency in CT and 21st century skills such as problem solving, creativity, communication, and collaboration.
- Students who participated in a residency reported an increase in being able to solve difficult problems and continue to work on a problem even with challenges.

How, if at all, do students demonstrate increased STEM interest and STEM career interest?

Students agreed that they would enjoy having a job that uses computers in the future.

On the post-survey, students shared if they had heard about jobs related to computer science throughout the year. This helped us understand if there are discussions about computer science jobs that are salient for this young audience.

- Slightly more than a quarter of student respondents indicated that yes, they had heard about jobs related to computer science throughout the year.
- Overall, only a small portion of students (15%) were certain that they didn't hear about any jobs related to computer science this year (Fig. 1).

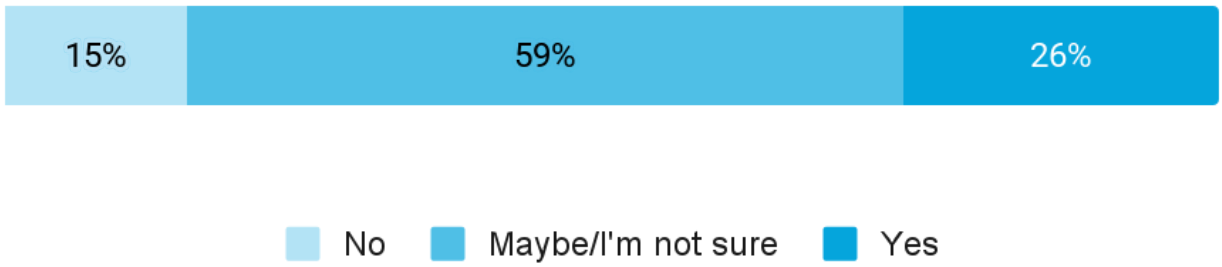


Figure 1. Did you hear about jobs related to computer science this year in school? (Student post-survey; n = 2299)

Students reflected both before and after the residency if they would enjoy having a job that uses computers in the future, sharing the extent to which they agreed with the statement.

- Prior to participating in the CT residency, the majority of student respondents (64%) agreed they would enjoy having a job that used computers when they grew up (Fig. 2).
- This remained consistent after the residency; on the post-residency survey, 64% of students respondents agreed.

This indicates that students remained highly interested in jobs with computers after the residency and wrapped up the experience feeling as though these kinds of jobs would be enjoyable. As not everyone wants a job with computers, it is not surprising to see this number remain consistent, but encouraging that the majority of students agreed these kinds of jobs appear enjoyable both before and after the experience.

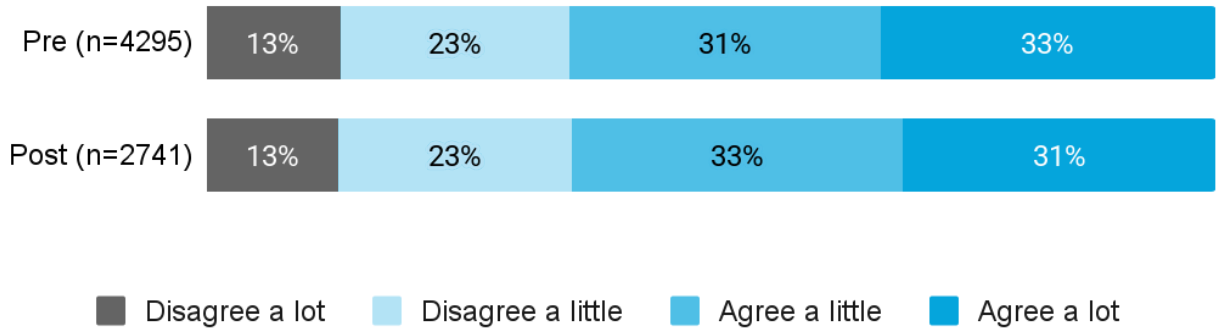


Figure 2. I would enjoy having a job that uses computers when I grow up. (Student pre and post survey)

Students were able to connect CT to STEM interest.

As it can be challenging to measure STEM interest as a whole due to the wide range of topics categorized as STEM, we asked students to reflect on their likelihood to continue using the coding program Scratch after the residency had concluded.

- At the start of the residency, 40% of students indicated that they had used Scratch once or less prior to the residency, and about 37% of students had never heard of the Scratch computer program.
- At the conclusion of the residency, nearly half of student respondents indicated that yes, they were likely to continue using the Scratch computer program even though the residency had concluded (Fig 3).

Figure 3. Do you think you'll keep using Scratch, now that the lessons are over? (Student post survey; n = 2561)

Teachers also shared that the CT lessons sparked a broader interest for many students and led to an increase in students exploring Scratch and using CT practices independently.

> "I had some other kids who have come up to me and said, hey, I went into Scratch, and I was doing this and this and this, and let me show you. So I think it definitely sparked an interest, and actually even to make the connection to – this was something that was academic from school, and I'm still enjoying it. So I think even the underlying that – oh, hey, something from school that's science-related was cool, you know? So I think that was great, too." (2021 focus group participant)
>
> "I would have kids all the time during choice time ask, 'Can I get out my computer and do some computational thinking activities?' And so that was really great. Kids are engaged when they ask for it during their choice time" (2024 interviewee)

Beyond Scratch, teacher reflections illustrate how students were able to apply CT practices outside of the lessons themselves.

"There are so many possibilities for students to use these skills based on their interests. They have been enjoying the Scratch cards that you left us. It has been a great way for them to continue their learning and apply it to a new skill" (2024 residency survey response)

How, if at all, do students demonstrate increased proficiency in CT & 21st century skills like algorithm design, debugging/problem solving, collaboration, creativity, and communication?

Students demonstrated their proficiency in 21st century skills in multiple ways.
Students reflected on their own behaviors before and after participating in the InspireCT residency. They shared how frequently they engaged in behaviors related to 21st century skills such as creativity, collaboration, and problem-solving which overlap with CT practices such as debugging and algorithmic thinking.

After participating in the residency, student respondents indicated that they were able to use creative problem solving more often than prior.

- Post-residency, slightly more than half of the student respondents shared that they 'usually' could come up with creative ways to solve a problem.
- This was a 6-point increase from pre-residency, where 45% of students indicated they were usually able to come up with creative problem solving strategies.

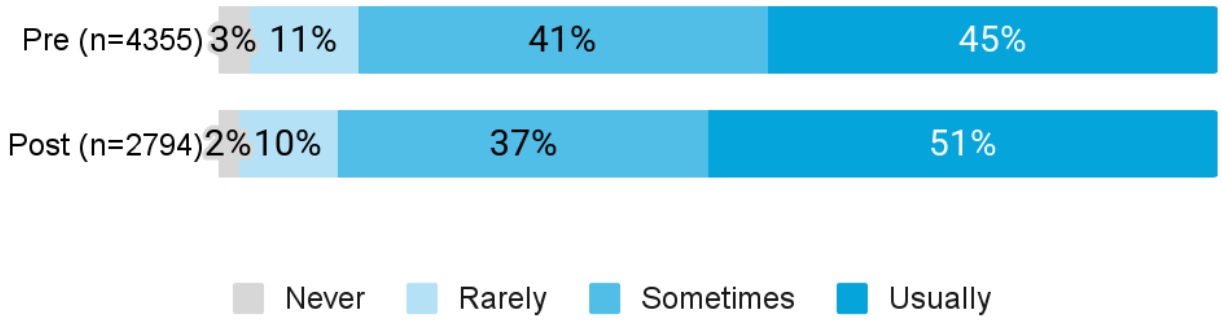


Figure 4. I can come up with creative ways to solve a problem (Student pre and post survey)

Teacher reflections provided insight into how students demonstrated skill growth in the classroom. Teachers noted that the residency provided students with an opportunity to be creative and problem solve on their own:

"I have students really being creative and doing things on their own, figuring out what are the next steps and ways to get to that next step" (2024 interviewee) "Students were excited to experiment and see what they could do. The exploration and creativity was far greater than other online lessons" (2021 residency survey response)

Students combined 21st century skills with CT practices.

Students also reflected on the 21st century skills of collaboration and communication within problem solving both before and after the residency, indicating slight increases in the frequency of related behaviors for both. These findings demonstrate that students may be more frequently collaborating and communicating with peers when solving problems, and are combining 21st century skills with CT practices.

- After the residency, 45% of student respondents responded that they usually can talk to a classmate about something they're stuck on; a 3-point increase from the pre survey.
    - Only 6% of student respondents indicated that they 'never' talk to a classmate about something they're stuck on; an encouraging 1-point decrease from prior to the residency.
- Similarly, nearly 40% of student respondents shared that they can usually come up with more ideas when they work with others; a 3-point increase from prior to participating in the residency (Fig 6).

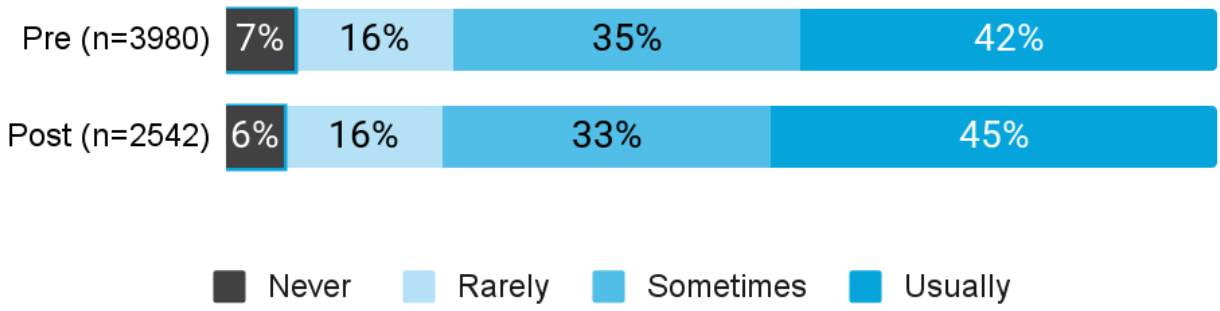


Figure 5. I can talk to a classmate about something I'm stuck on (Student pre and post survey)

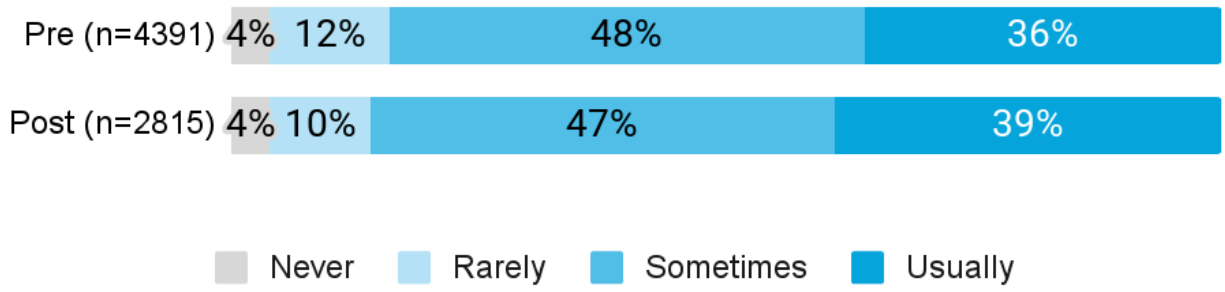


Figure 6. I can come up with more ideas when I work with others (Student pre and post survey)

After the residency, teachers also reflected on how students collaborated to solve problems together throughout the residency and take charge of their own learning...

> "...there's really a willingness – if some kid figures something out, there is definitely a willingness to blurt it out, and share, and, oh, this is how you fix it, or, oh, did you try this, or did you try that, or did you try the next thing?" (2021 focus group participant)

> "Sometimes we get nervous to let the kids drive, to let them be in charge of their own learning, because again, we have this idea in our heads of what it's going to look like. And seeing how the students...taught one another, allowing them to take the driver's seat a little bit more in this type of unit where... they get to drive what they want to learn." (2021 focus group participant)

...as well as how they worked together to think about problems in new ways.

> "Students were addressing debugging strategies in small groups. Students were able to create original content and share how they did it. It is definitely a different way of thinking about problem solving" (2021 residency survey response)

> "They continue to get feedback from each other. They make changes based on what other kids tell them. Some of 'em made algorithm games for fun!" (2021 focus group participant)

> "Different students were able to offer tips and show others tools they had discovered. Great to see the collaboration- hard to get that in other areas of their academic day with such enthusiasm." (2021 residency survey response)

Students agreed that Scratch was easy to use after participating in the CT residency.
Students demonstrated Scratch proficiency as a result of the residency; more than half of students shared that Scratch was easy to use (Fig. 7). Teachers reflected that students were able to gain proficiency in CT due to the adaptability of Scratch and the lessons to meet students where they were at. One teacher interviewed in 2025 shared:

> "Everyone did it, and my newcomer was able to be involved and to code and even put some English words into the talking bubble. There are naturally differentiated kids that are picking it up faster, they can just make more complex ones... I just like that aspect...there's an entry level for everybody but there's not really a ceiling."

Figure 7. How easy or not easy was Scratch to use? (Student post survey; n = 2592)

How, if at all, do students demonstrate increased persistence through their CT experience?

Students agreed that they were able to solve difficult problems, and usually continue work on a problem even with challenges.
Students reflected on persistence through CT in both the pre and post survey answering questions about how often they can continue to work on problems without an answer, and their confidence in solving new or difficult problems.

- After the residency, the majority of student respondents shared that they usually continued working on a problem even if they didn't know the answer yet; this was a 4-point increase from prior to the residency.

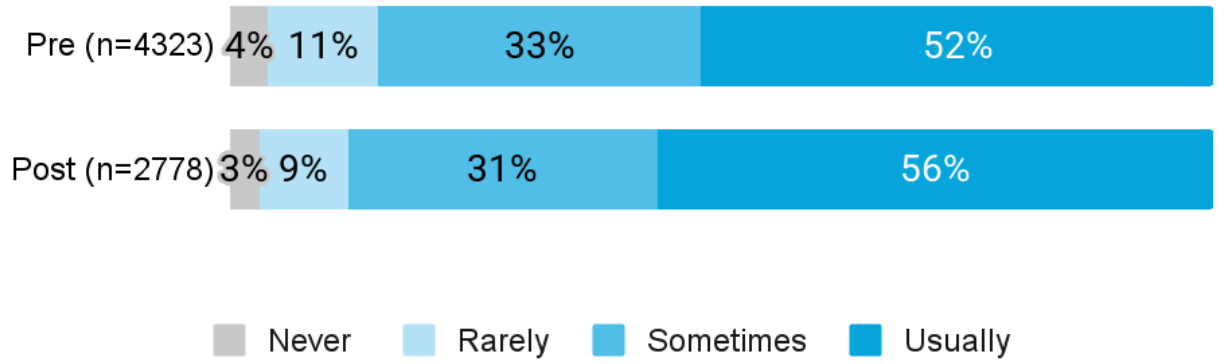


Figure 8. I can keep working on a problem even if I don't know the answer yet (Student pre and post survey)

Teacher reflections provided insights into how students were demonstrating persistence throughout their CT lessons. One teacher in 2023 explained in their residency survey that students were always interested in sharing their projects, even if they were still navigating challenges or addressing bugs:

> "My students were constantly asking questions. Whether it was simple questions like, 'what is my password' or more complex questions like 'I want my sprite to do this but it's not working.' All of my students were excited to share what they were creating, even if it didn't work or they normally did not want to share."

Students also agreed that they could solve problems that were new, as well as problems that were difficult, demonstrating their ability to persist through problems.

- After participating in the residency; the majority of student respondents (81%) agreed that they felt they could solve a problem that was new to them.
    - 42% of student respondents agreed a lot, a 6-point increase from the pre survey.
- Similarly, 85% of student respondents agreed they could solve a problem that was difficult after participating in the CT residency; the majority of student respondents agreed a lot (Fig 10).
    - This was also an increase from the pre-residency survey by 2-points.

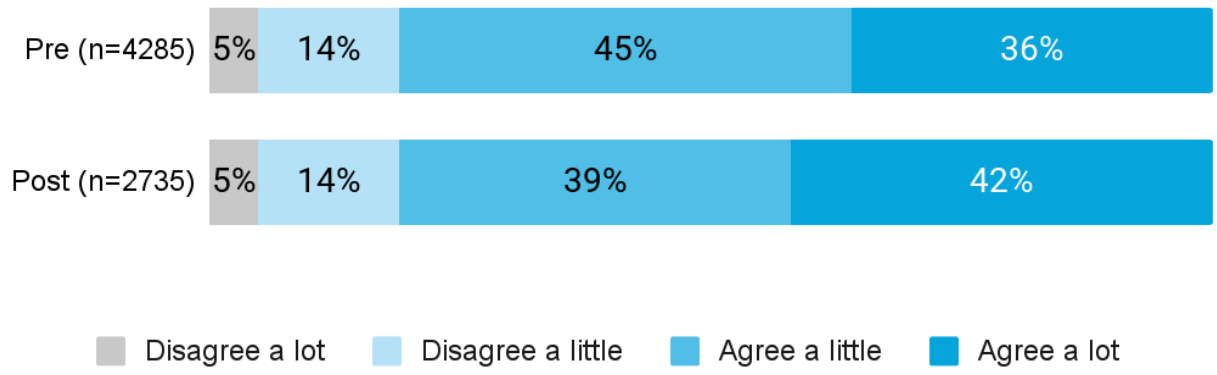


Figure 9. I think I could solve a problem that is new to me (Student pre and post survey)

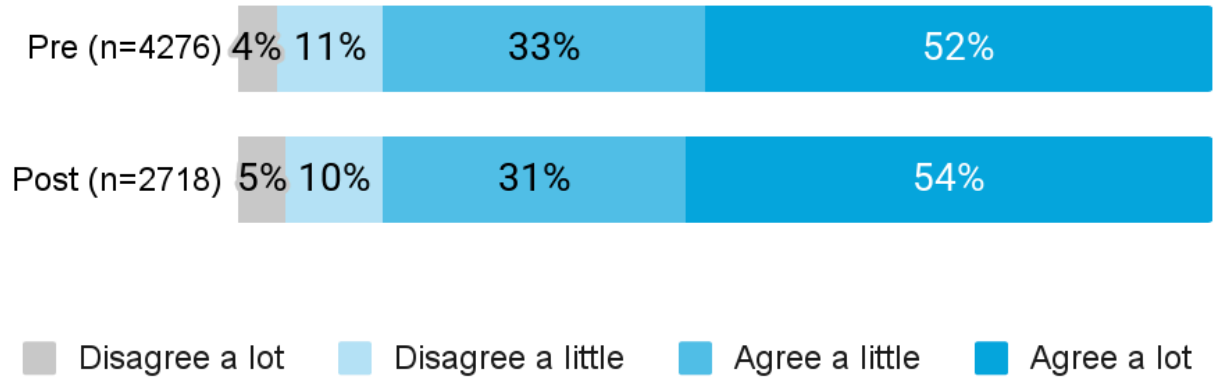


Figure 10. I think I can solve a problem even if it is difficult (Student pre and post survey)

Teacher Impact Findings

Teacher impact was measured through surveys following residencies and summits as well as through focus groups and interviews. The questions in these instruments were aligned to help answer the project's evaluation questions around teacher understanding and importance of CT, teacher confidence and usage of CT, and teacher ability to apply equity strategies to their classroom practice in CT. The findings below are aggregated from across the InspireCT program and organized under each evaluation question.

At a high level, some key findings are that:

- Teachers who participated in a residency or summit were more confident in their understanding of CT and had a stronger belief that teaching CT is important.

- Teachers felt more confident and prepared to teach CT after participation in a residency or summit.
- Teachers saw models of using equity strategies in CT and felt prepared to apply these strategies themselves.

To what extent, if at all, does the InspireCT program increase teachers' understanding of CT?

Teachers who participated in a residency or summit were more confident in their understanding of computational thinking.
We saw strong teacher confidence that they understood CT from participation in either the residency program or the summit professional development.

- 59% of teacher respondents were confident in their understanding of CT after the residency compared to only 17% before.
- 86% of teacher respondents were confident in their understanding of CT after the summit (Fig 12).

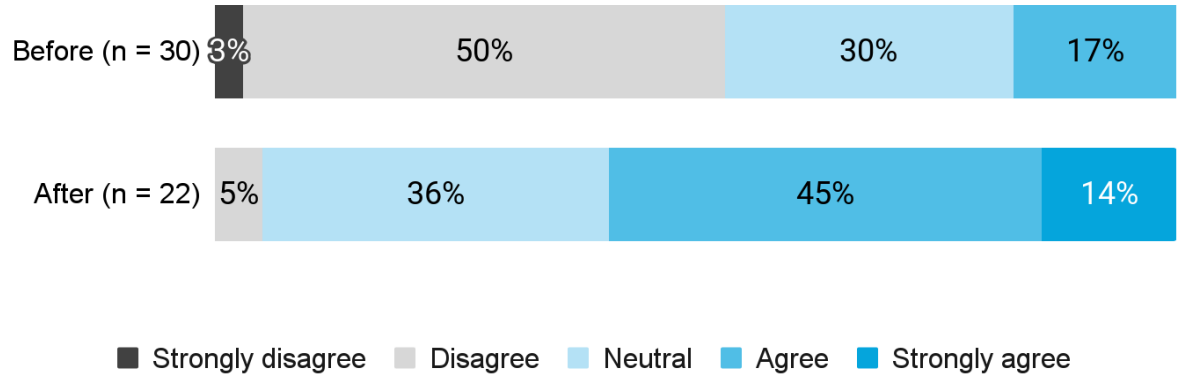


Figure 11. I am confident in my understanding of CT (Residency)

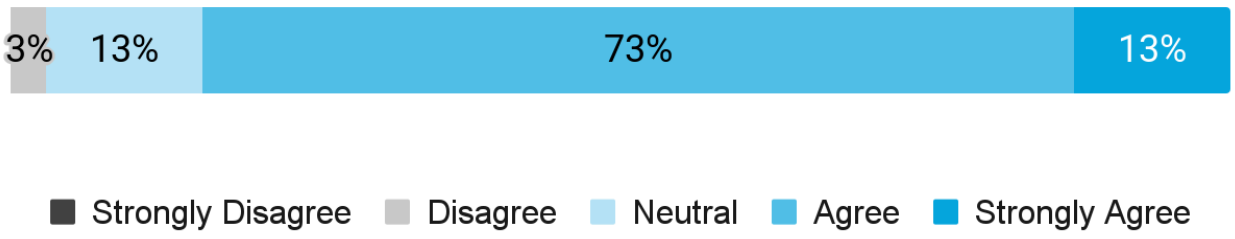


Figure 12. I am confident in my understanding of CT (Summit; n = 40)

Teachers who participated in InspireCT saw the impact that participation had on them. It helped them define and have a much stronger understanding of CT education, as we can see from this interview with a 2024 teacher participant:

> "Initially, I knew almost nothing about [CT]. If you would have said 'what is computational thinking' I probably would have said something like 'computations'. I mean, you're just very very unfamiliar with it. And now I feel like I have a much stronger understanding and recognize it now not just as coding but as an approach to understanding and problem solving and a way of thinking that. I'm still learning and growing in this area, but rather than just a way to code, it's a way to think"

To what extent, if at all, does the InspireCT program increase teachers' sense of importance about teaching CT concepts?

Teachers agreed that teaching CT is important.

After participating in a residency, teachers were asked about how important they think it is for their students to be able to do certain CT practices (Fig 12) and how important CT-related teaching is to them. We saw that teachers believed CT was more important after participating in a residency and believed that these practices were important for their students.

- At least 85% of teacher respondents rated it was important or very important that their students learn about or practice all of the listed CT practices.
- 96% of teacher respondents rated that teaching CT is important or very important after a residency, compared to only 56% before (Fig 14).
- 93% of teacher respondents rated that using CT ideas when teaching other subjects is important or very important after a residency compared to only 57% before (Fig 15)

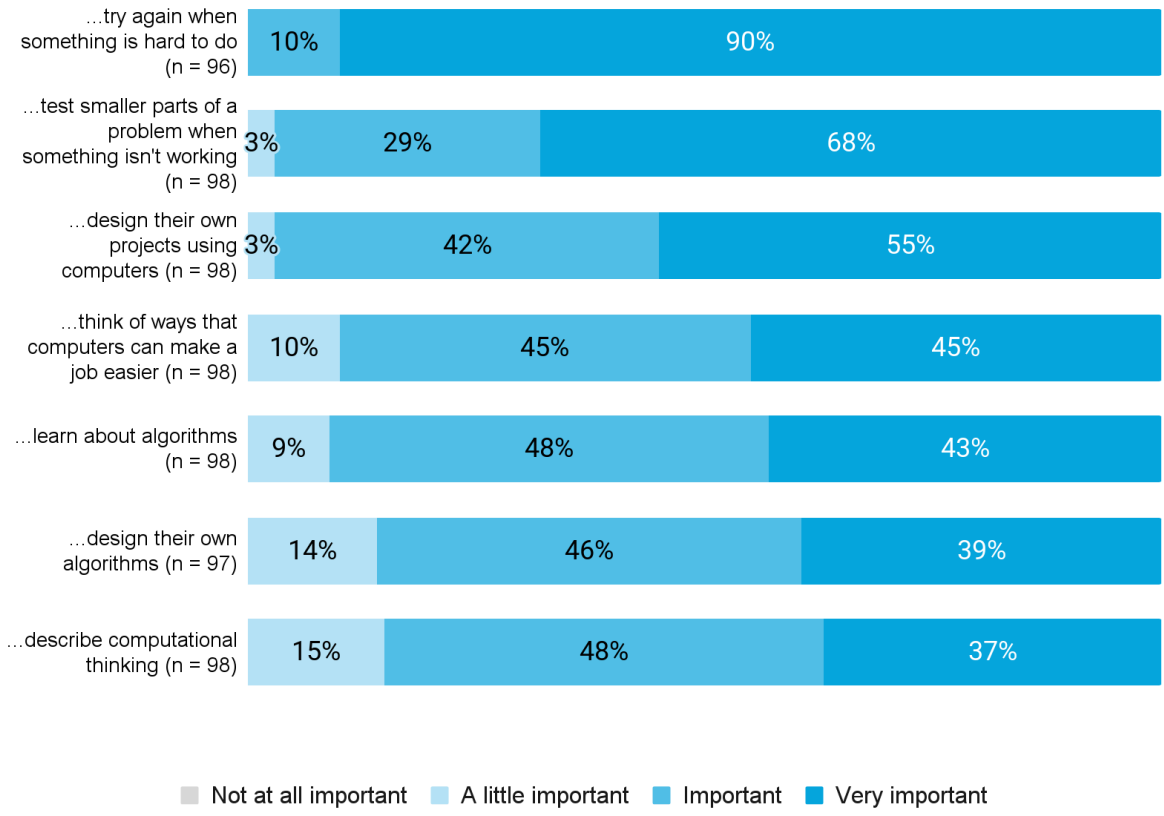


Figure 13. How important is it for your students to be able to... (Residency)

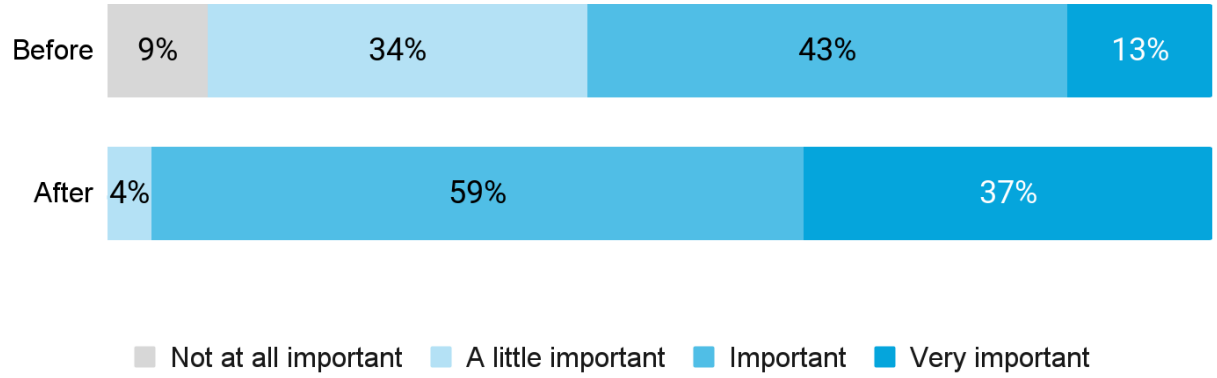


Figure 14. Overall, how important do you feel it is to teach lessons on CT? (Residency; n = 97)

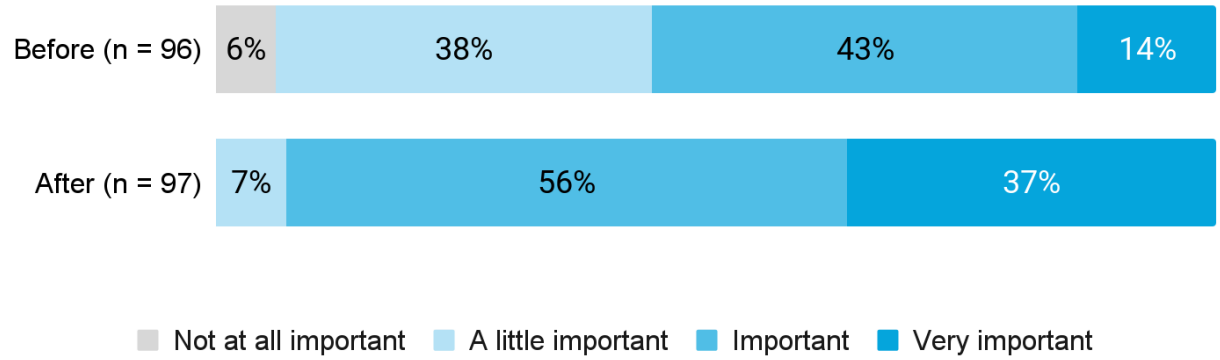


Figure 15. Overall, how important do you feel it is to use ideas from CT when teaching about other subjects? (Residency)

Teachers who participated in InspireCT shared more insight into why they believed that CT education is important and the impact it can have on students:

> "Computational thinking is connected to computer coding but also connected to ways and processes of systematically approaching and problem solving and debugging... steps that we need to do to be successful with that whether we call it debugging or giving it a second try. It's strategies that are good and important. Life strategies for kids." (2024 interviewee)

> "Kids should be driving what we're doing. Maybe we have a little bit of an idea. So this for sure would be one way that they can excel and kind of be in charge of their own learning as they're practicing it. Then teachers can be the one to add the academic language on top of what they're doing and let them know that, okay, 'wow, look at what you're doing. You're able to debug, and you're looking for patterns, and you're doing some research, and you're trying it again.' And I think that that part's great." (2021 focus group participant)

To what extent, if at all, does the InspireCT program increase teachers' confidence in teaching CT?

Teachers felt prepared and confident to continue teaching CT.

After completing a residency or summit program, teachers were asked to reflect on their own skills in regards to teaching CT in the future. We wanted teachers to feel prepared to support their students around CT education and confident that they could teach CT now and in the future. We saw that the InspireCT offerings have this impact:

- At least 43% of teacher respondents felt prepared or very prepared to support students around CT learning and skills after a residency.
- 78% of teacher respondents were confident that they can teach CT effectively after completing the summit (Fig 17).

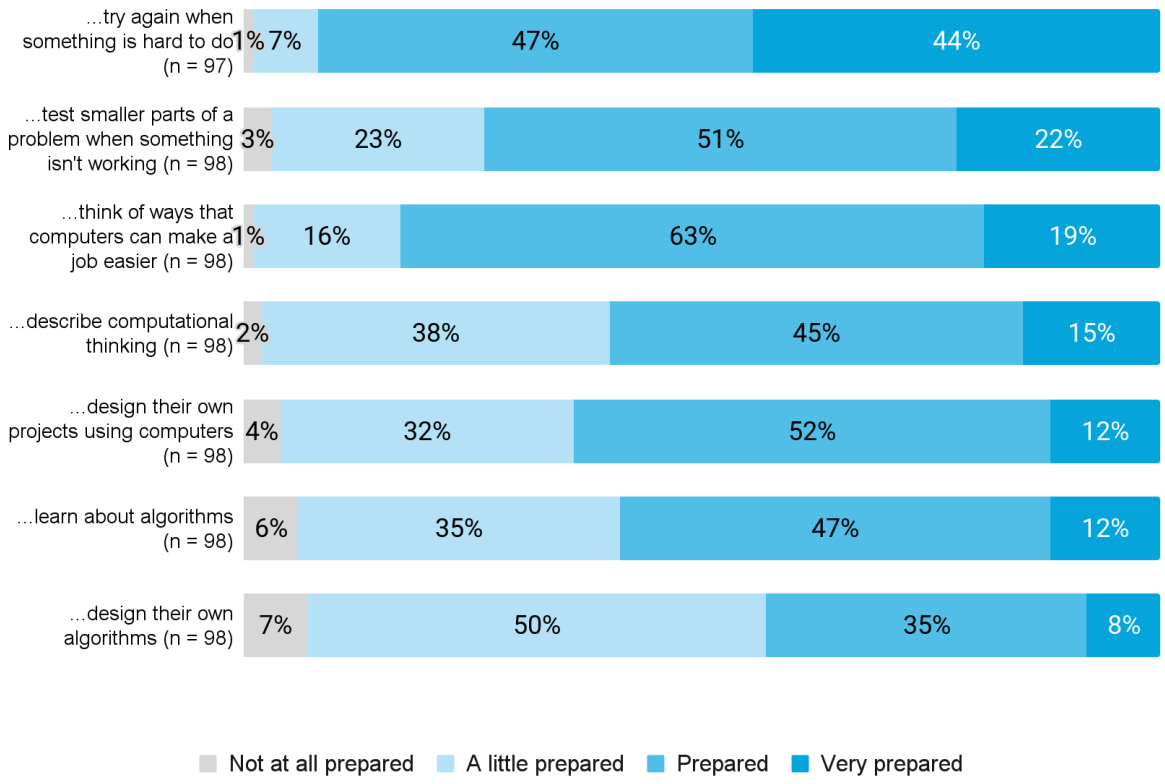


Figure 16. How prepared are you to support students to... (Residency)

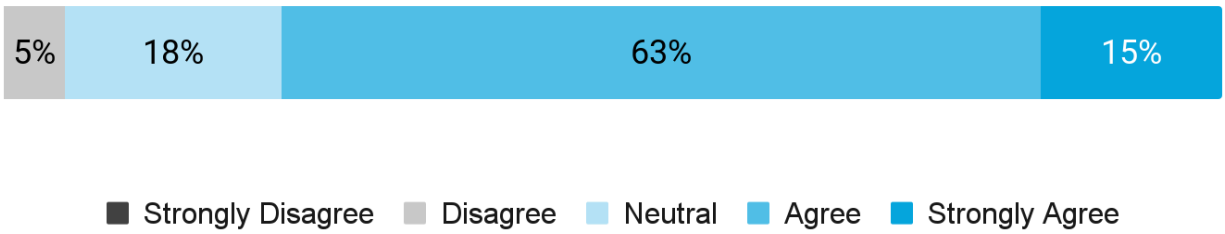


Figure 17. I am confident that I can teach CT effectively (Summit; n = 40)

Teachers appreciated the dedicated time to explore concepts and tools for teaching CT during the summit. In a focus group in 2019, a teacher mentioned:

> "It was kinda like a boot camp, and then we went and did it. So I was afraid but still did it. I thought we were pretty well equipped just with the tools to go and do it. I

still have a lot to learn from this, but I think having the uninterrupted time to just think about it and navigate it, practice it, creates something that was super helpful".

Another teacher in 2021 described how being involved in InspireCT has created a strong foundation for their practice:

> "Who knows what will happen with the new science standards and if we're going to have to be assessing or grading computational thinking and what that will look like... I think that having gone through this training, there's a very good foundation for us compared to people who haven't gone through the training"

District leaders also saw the impact of how the InspireCT program supports teachers to continue teaching CT in their classrooms:

> "I think that the Science Museum has done a great job of formatting. Being able to take something and apply it without much modification - that's when we get more teacher engagement, too. When teachers see how to highlight it in what they're already doing, it can feel much more comfortable." (2022 district staff interviewee)

How prepared are teachers to apply equity strategies to their classroom practices in CT?

Teachers saw examples of how to apply equity strategies to CT and felt prepared to do so themselves.

During a residency, SMM staff showcased how to apply equity strategies to CT education, including showing examples of how STEM can be used as a tool to address inequity. The majority of teachers (77%) agreed or strongly agreed that this came through in the program.

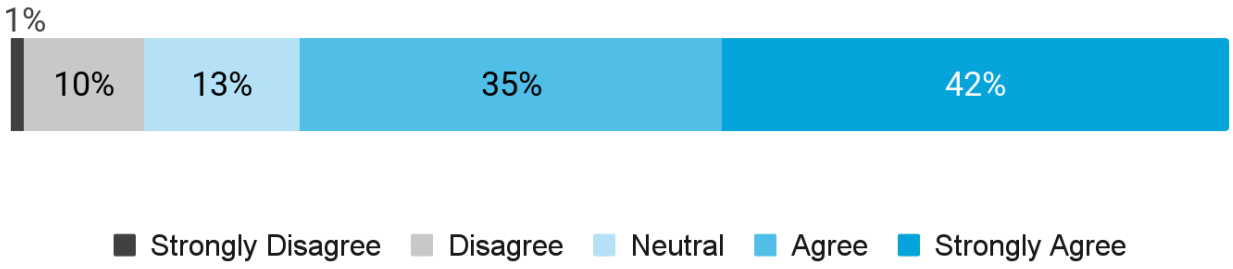


Figure 18. My students saw an example of STEM used as a tool to address inequity (Residency; n = 101)

Applying equity strategies when teaching CT is a component of the summits as well. After attending a summit, 85% of teachers felt confident that they could address the equity aspects of teaching CT moving forward.

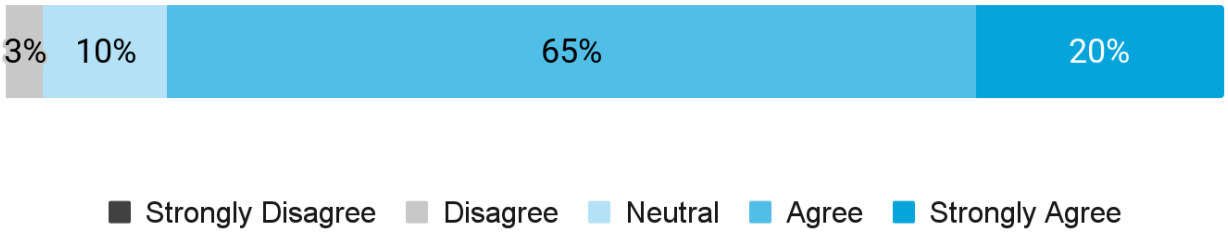


Figure 19. I am confident that I can address the equity aspects of teaching CT (Summit; n = 40)

Teachers appreciated the focus on equity in CT education that InspireCT had and saw the impact this can have on students. One teacher interviewed in 2024 saw InspireCT as a way to connect girls and students of color to computer science in order for them to "have an understanding of what this is so they feel part of it, so they'll select those classes when they get to the secondary level." Two teachers who participated in a focus group in 2023 noted that:

> "I think just having these conversations is helping me realize where I focused on equity. Some of my kids and my students of color who didn't grasp on right away, have started to come around to more of it with time. So just having opportunities was good".
>
> "Kids who have privilege will find their way to computer science…but kids who don't always have that opportunity and then aren't immersed in the vocabulary and then it becomes just a little less accessible to them. So I just think too that we're just really focusing on what we can do in the schools to bring it into it."

District staff also appreciated that InspireCT had a focus on equity:

> "[Equity] was just directly addressed. We watched a video, read an article, and discussed with other folks about how it might have changed our thinking and what we might do to follow up with that." (2022 district staff interviewee)

Sustainability Focused Data Findings

Our last evaluation question was focused on what teachers and district leaders see as supports and challenges for continuing CT education during and beyond the scope of the grant. We asked sustainability related questions about future practice on teacher post-residency surveys and explicitly asked about both supports and challenges during teacher and district interviews and focus groups. Related findings were monitored annually to inform refinements of program offerings and support. We can see from data over the full project years that InspireCT was effective at supporting long-term CT education but that continued support is still needed.

At a high level, some key findings are that:

- Teachers felt more prepared to teach lessons on CT and use ideas from CT when teaching about other subjects in the future after participating in a residency.
- Teachers felt prepared to help other teachers to teach CT integrated curriculum in future years after participating in a summit.
- Teachers who participated in a residency rated that they are likely to continue teaching lessons using CT and believe that it's likely their districts will continue supporting CT education.
- Teachers want continued resources around CT education as well as more alignment and strategic direction across their schools and districts.

What do teachers and district leaders see as potential supports and challenges for long-term sustainable efforts to engage students in CT?

Participation in a residency or summit from SMM supported teachers to continue teaching CT in their classrooms.

In order to continue teaching CT in their classrooms after a residency, teachers need to feel confident and prepared to do so. We can see from the post-surveys that:

- 56% of teacher respondents felt prepared or very prepared to teach lessons on CT after a residency compared to only 27% before.
- 58% of teacher respondents felt prepared or very prepared to use ideas from CT when teaching about other subjects after a residency compared to only 27% before (Fig 21).

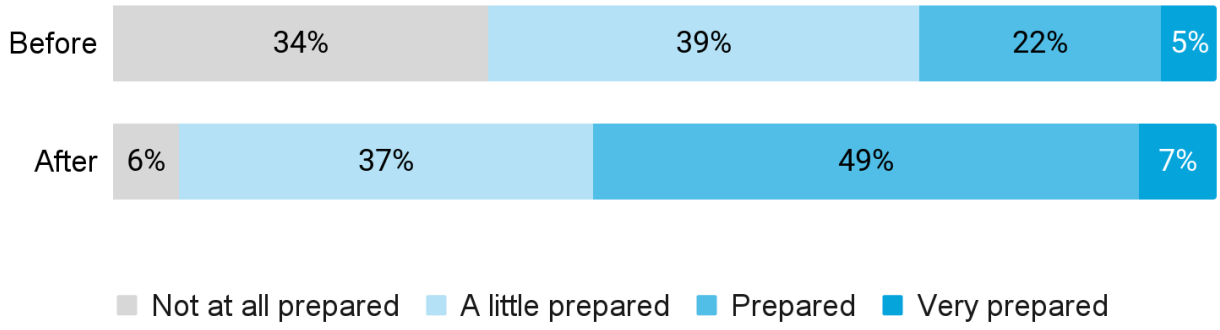


Figure 20. How prepared are you to teach lessons on CT? (Residency; n = 97)

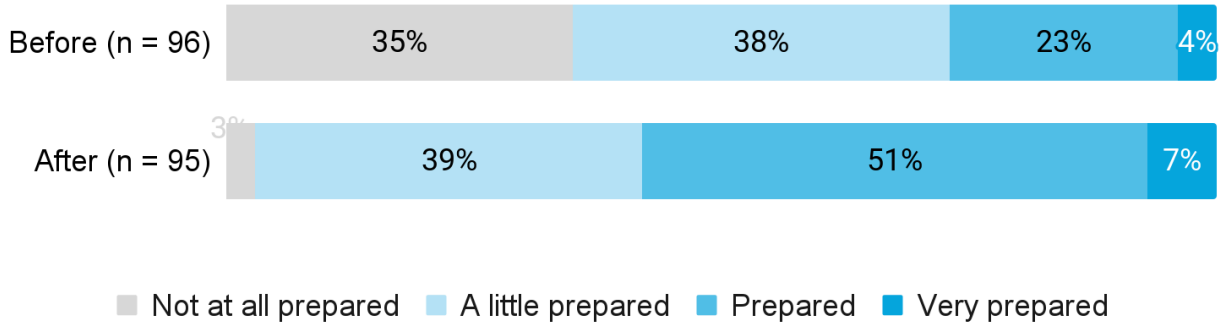


Figure 21. How prepared are you to use ideas from CT when teaching about other subjects? (Residency)

CT education was introduced and supported through InspireCT in ways that help teachers see the connections across different topics and subject areas. One teacher described this in a 2021 focus group:

> "Debugging is applicable to anything, just that you're problem solving those areas. And then coding, and coming up with an algorithm for different things - that transfers to a lot of different areas. I would like to try this in math next".

Teachers also appreciated that continuing CT education from InspireCT feels in line with the direction they think they should be pushing their teaching practice:

> "[Teachers] need to do a lot more listening to the kids and let them share what their experience is and allow them that creative space. And so, Scratch doesn't need to be attached to literacy. It could be artistic. It could be athletic. It could be scientific. It could be social studies. You can attach it to a lot of different places." (2021 focus group participant)

The model of the InspireCT program provided stronger supports for continued usage compared to other professional development programs:

> "The support and materials and you being here today and the accountability of me and the follow through...I mean, I can't tell you how many times I've been to some PD thing and it's like 'oh that's great' and I put it back on the shelf and go 'that was nice'. I think the model that you have in terms of professional development with the supports, the contact with the kids, the modeling not only with us, going through the process so we have a better understanding of what the kids are going through, but then also just being there to support through, is a really effective way to teach teachers how to do something." (2021 focus group participant)

Teachers also appreciated the resources and support from SMM provided during InspireCT beyond general participation in the program. One teacher from a focus group in 2021 said:

> "I feel like I had a lot of support and was really grateful for the continued support, not just during the training but as we were implementing it. I feel like everyone made themselves very available by email and really willing to answer questions, reaching out to us...That was really great."

Teachers planned to continue using what they learned in InspireCT and shared ways they have started to do so.

After participating in a residency or summit, teachers were asked about what they might do in the future around CT education. Teachers shared that they are ready and interested in teaching CT integrated with other subjects. From surveys, we see that:

- The majority (79%) of teacher respondents rated that it's likely or very likely their district will continue to support teaching CT.
- More than half (58%) of teacher respondents rated that it's likely or very likely that they will teach lessons on other subjects using CT; 27% say the same for lessons focused on CT.
- 60% of teacher respondents agreed or strongly agreed that they are prepared to help other teachers teach CT integrated curriculum in the future (Fig 23).

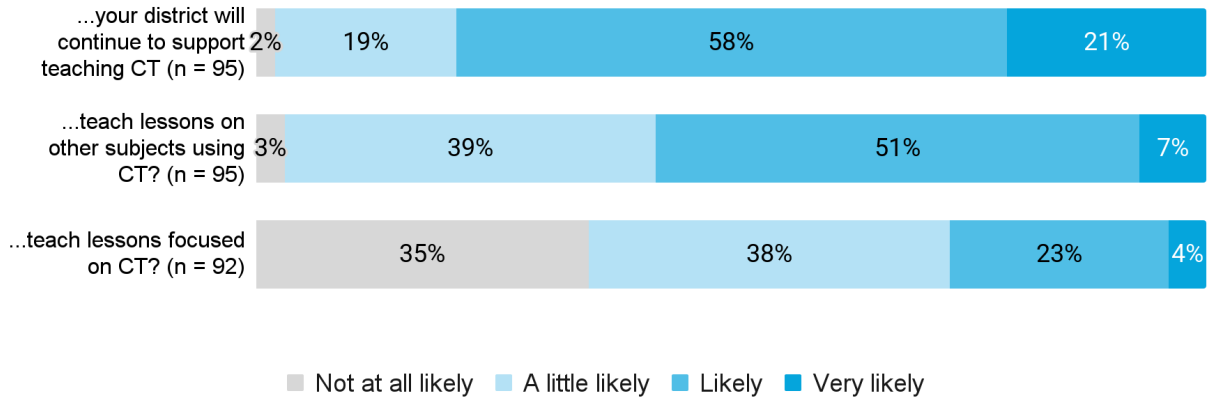


Figure 22. When your involvement with InspireCT is done, how likely is it that you will... (Residency; n = 97)

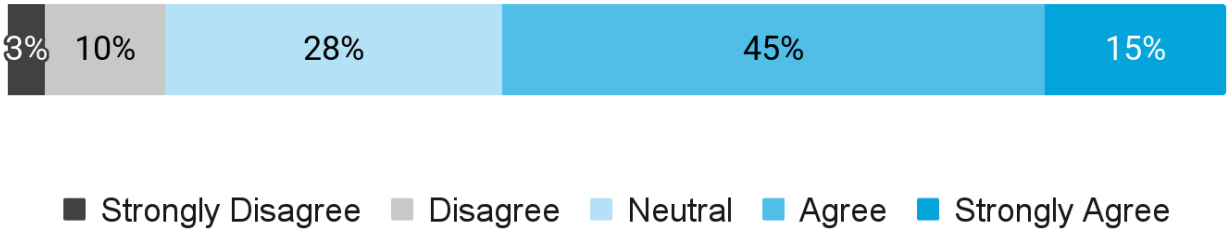


Figure 23. I am prepared to help other teachers to teach CT integrated curriculum in future years (Summit; n=40)

A teacher interviewed in 2024 described a time they continued teaching CT after being involved with the InspireCT program:

> "My third grade team and I decided that we would each specialize in something and so my mind went to the InspireCT lessons, knowing my class the previous year had really loved them and it was supporting MN state standards in math and I felt confident again. This was the only experience I'd had, but I felt confident between the residency and the summit that I could very effectively teach this so that's what I did...Every single group loved it, again the kids that had success were not always the typical kids that usually have success. Their excitement about geometry and understanding how to tell their Sprite to make these shapes was just very, very strong excitement and I think really strong comprehension of what they were doing."

Teachers and district staff requested continued direction and resources to sustain their efforts to engage students around CT.

From a review of focus group and interview conversations from 2019-2023, teachers most frequently mentioned they wanted:

- Continued access or additional resources related to CT (40%)
- Alignment with other content areas and across grade levels (34%)
- A team approach for CT education in their schools to support accountability of usage (29%)
- More direction around long-term efforts from their districts (26%)

It appears that teachers who participated in InspireCT believe that CT is important but the challenge now is the capacity of teachers to learn, change practice, and implement.

> "I feel like our teachers understand the need to expose kids to this and give them the chance. They see me doing it and then they'll do it to some extent in their spaces. I think that they just have so much on their plates right now that to really do more with it is just a lot, so it's just that they're full and so they might have the appetite but there's no capacity to do the next thing." (2024 interviewee)

District staff also see the need for more alignment of CT education across schools and direction around long term efforts. One district staff interviewed in 2022 said:

> "We have two content days in August. [SMM staff] can share content to our teachers and we had to fight really hard to get one hour. One of the biggest barriers is that top people… say they care about science, but they give less time to pursue this. This groundwork will mean that more people will learn, but they need to give more time. How to integrate is not really talked about - they just do it and it's vague and that results in it being done very differently at every elementary school."

> "One of the struggles is that it is really challenging to move work forward systematically. How do we roll it out to a bigger level? [District] struggles with that. One potential solution is laying the framework early with a district. Having them agree how much PD time each grade level gets and when. How many classroom visits with how many teachers at which schools. It helps to have agreement that gets us to a goal."

Teachers who have been involved in InspireCT shared that they are bought in and want to support other teachers around CT education:

> "I will not be in the classroom next year; I will be an instructional coach… I can

> definitely see using [CT] with coaching different teachers or even with supporting teachers as they move through the new science standards". (2021 focus group participant)

They can see these efforts being more impactful with additional alignment and direction from the district. One teacher interviewed in 2024 shared that:

> "[We] were doing it because we know that it's good for kids and we're interested in it, but even us telling other people like 'hey you should get this residency', 'hey you should be incorporating computer science lessons'. We're not in charge. You know what I mean? You have to do with a person to almost mandate it or the person that's in charge. So in some ways it needs to come from the top down, the support for it anyways".

Evaluation Conclusions

Across multiple years of evaluation, it is evident that both students and teachers grow and learn from the InspireCT offerings. Teachers leave the residencies and summits with not only a better understanding of CT, but feeling confident and prepared to support their students around CT education. Students engaged through residencies demonstrate increased frequency of collaborative behavior with classmates, increased persistence in problem-solving, and an overall interest in continuing to explore CT practices. These outcomes, when paired with narrative experiences of teachers, students, SMM staff, and project partners, illustrate the ability of comprehensive, collaborative, and responsive educational programming to support students and teachers in Minnesota.

Sharing Project Learning

2018

Jones-Rizzi, J. (Oct, 2018). BITCON: Blacks in Technology Conference. Reception opening remarks, Saint Paul, MN.

2019

Science Museum of Minnesota. (Feb, 2019). Engineering is Elementary Lets Kids - And Their Teachers - Experience the Extraordinary Wonders of Engineering. *Plugged In News*. Blog post and video.

Hopkins Public Schools. (Mar, 2019). Science Museum Embeds Computational Thinking into Elementary Curriculum. *HPS District News*. News article.

Goeke, M. & Haupt, G. (Nov, 2019). Developing a Common Survey for Varying Computational Thinking Experiences. *American Evaluation Association Conference*. Poster presentation, Minneapolis, MN.

2021

Bequette, M., Dominguez, J., & King, Z. (Jul, 2021). The Audience has Left the Building: Online Learning and Evaluation. *Visitor Studies Association Conference*. Conference presentation, Online.

Dominguez, J. & Roberston, S. (Jul, 2021). Machine Versus Mind: Computational Thinking (CT) Explored Through Scratch Coding Methods. *Visitor Studies Association Conference*. Poster presentation, Online.

2023

Aliamer, M. and Poster, E. (Apr, 2023). Introduction to Computational Thinking. *MN Codes Summit*. Conference workshop, Online.

Dominguez, J. & Tsakakis, E. (Jul, 2023) Teachers as Experts: Understanding Student Learning in Computational Thinking. *Visitor Studies Association Conference*. Poster presentation, Online.

Aliamer, M., et al. (Oct, 2023) Computer Science Education Policy, Plans, and Progress. *Eye on the Ball: Equitable, End to End, Tech Talent Development Conference*. Conference presentation, Minneapolis, MN.

2024

Aliamer, M. and Poster, E. (Apr, 2024). What Can We Build Together and How? *MN Codes Summit*. Conference discussion session, Online.

Aliamer, M., Karls, D., and Poster, E. (Apr, 2024). Expansive Avenues: Welcoming Students and Families to CT. *MN Codes Summit*. Conference presentation, Online.

Aliamer, M., Chambers, A., Groenert, J., and Karls, D. (Jun, 2024). When Informal Education Meets Formal Education, Innovative and Extraordinary Things Happen. *International Society for Technology in Education Conference*. Poster presentation, Denver, CO.

Aliamer, M., Elftmann, J., and Poster, E. (Jul, 2024). Expansive Avenues: Welcoming Students and Families Through Joyful, Authentic Introductions to CT. *Computer Science Teachers Association Conference*. Conference presentation, Las Vegas, NV.

Swan, A. (Jul, 2024). Using Evaluation to Support Project Sustainability. *Visitor Studies Association Conference*. Poster presentation, St. Paul, MN.

Aliamer, M. and Meltesen, K. (Aug, 2024). *Empower {MN:CS} Conference*. Playground exhibitor, Minneapolis, MN.

Aliamer, M. and Poster, E. (Sep, 2024). Expansive Avenues: Welcoming Students and Families Through Joyful, Authentic Introductions to CT. *Best of CSTA '24 Professional Learning Series*. Invited conference presentation, Online.

2025

Meltesen, K. and Sween, H. (Apr, 2025). *United, We Rise: Hmong National Development Conference*. Featured exhibition on CT education, Minneapolis, MN.

Karls, D. and Meltesen, K. (Apr, 2025). Remix This! Integrated Computational Thinking Units for SEL, Literacy, and Math. *Empower {MN:CS} Conference*. Conference presentation, Minneapolis, MN.