Table of Contents

Introduction

IDRA proposes the development and evaluation of TechXperts, a five-year Early-Phase Education Innovation and Research (EIR) grant that meets **Absolute Priority 1 (AP 1):** Demonstrates a Rationale, **Absolute Priority 3 (AP 3):** Field-Initiated Innovation Promoting STEM, **Competitive Preference Priority 1 (CPP 1)**: Partnering with Minority-Serving Institutions, and **Competitive Preference Priority 2 (CPP 2):** Addressing the Impact of COVID-19 on Students. TechXperts is a 9th-grade course designed to engage students who are in at-risk situations by positioning them as visible technology leaders on their campuses. This program creates opportunities to broaden participation in STEM and IT fields through a highly experiential leadership experience. To enhance this innovation, the project addresses the need for improved reading skills in STEM/IT pathways. This need is evident as few students who take information technology classes pass entry-level industry-based certifications. This need to address literacy in computing is further evidenced by a study showing a correlation between passing industry-based certifications and students passing 8th grade state assessments (Metcalfe, 2014).

IDRA will implement TechXperts in Brownsville, Hidalgo, La Villa, and Mercedes Independent School Districts (ISDs) in the Rio Grande Valley in south Texas, a persistent poverty region along the Texas-Mexico border, meaning over the last three decades, at least 20% of the population lives below the poverty line. According to the U.S. Census Bureau (2023) for percentage of population living in poverty in the four RGV counties: Hidalgo County has 27.4% (mixed urban and rural), Starr 32.8% (rural county), Willacy 29.0% (rural county), and Cameron 22.6% (mixed urban and rural). These districts serve high populations of high-need Latino students and students in households with low incomes.

IDRA is partnering with Education Service Center (ESC) Region 1, one of 20 state-

directed education technical assistance providers in Texas, and with the University of Texas Rio Grande Valley (UTRGV), a minority-serving institution (MSI). Together we will develop, implement and provide technical assistance for the course. ESC Region 1 serves 38 districts across eight counties. Ninety-eight percent of students in the area are high-need, Title I students, and 96% are Latino. UTRGV is an MSI that serves Texas' Rio Grande Valley and is poised to become the second largest Hispanic-serving institution (HSI) in the nation. TechXperts targets students from groups that are underrepresented in STEM. In alignment with EIR requirements, TechXperts also targets high-need students identified as at-risk of dropping out, because they meet at least two of the Texas Education Agency's "at-risk" indicators (*e.g.,* low attendance, low socio-economic status, in-grade retention, or low scores on state reading assessments).

Partnerships (CPP 1). IDRA, ESC Region 1 and UTRGV will lead curriculum development, professional development and project implementation. ESC Region 1 will assist with on-site technical assistance and recruitment of districts in the Rio Grande Valley. ESC Region 1 is led by [redacted] a nationally known education leader who has been at the forefront of designing and implementing early college district models where all students are expected to graduate college ready. IDRA has partnered with [redacted] in family leadership programs and in the research and documentation of his early college models. We are now proud to collaborate on TechXperts, which follows our shared asset-based vision of providing rich educational opportunities to students who do not generally have access to leadership experiences.

UTRGV is a federally recognized minority-serving institution (**CPP 1**) that primarily serves the communities and residents of the Rio Grande Valley region in South Texas. The university's mission is to provide accessible, high-quality education and resources to the area's diverse population, including cities such as Edinburg, Brownsville, Harlingen, Pharr-San Juan-

Alamo, McAllen, and other surrounding communities. In the Rio Grande Valley, UTRGV plays a crucial role in serving the education needs of a predominantly Latino population and of other underrepresented groups. The university offers affordable and inclusive educational opportunities to students from various cultural, socio-economic, and educational backgrounds, focusing on fostering diversity, equity, and community engagement. Beyond its academic offerings, UTRGV engages with the broader community through research, outreach programs, and partnerships to address regional challenges, promote economic development, and contribute to the overall well-being of the Rio Grande Valley. UTRGV has committed three of its STEM departments – computer science, information systems, and informatics and engineering systems – to support TechXperts. While we realize that memorandum of agreement (MOA) are sometimes preferred indicators of institutional support, school districts and service centers have review processes longer than this competition allows. For this reason, our management table includes development of an MOA once the project is funded.

Our school district partners are Brownsville, Hidalgo, La Villa, and Mercedes Independent School Districts. Our past projects with these and other districts in the Rio Grande Valley have been impactful for students in at-risk situations. We have implemented youth leadership and family engagement programs as well as documented their successes in implementing visionary early college high school models. Brownsville ISD, being the largest will implement the project in at least five campuses. We have received letters of support from all except La Villa due to time constraints. Per our management plan, all districts will commit collaborate in designing Memoranda of Agreement. Also, our relationship with Education Service Center One will allow us to recruit additional campuses, if necessary, as they are a trusted hub for technical assistance in the region.

Evidence-based Reading Modules (CPP 2). As with the rest of the country, Texas continues to lag since the COVID-19 pandemic. Latino and Black students did not meet NAEP reading scores before the pandemic and have remained below proficiency standards. TechXperts includes evidence-based reading modules in response to this continuing need. However, we do so not to provide remedial assistance but, to address an issue that emerged from our literature review concerning high school students' performance in passing industry-based certifications (IBC), *e.g.,* CompTIA ITF+, CompTIA A+. As we further discuss in the Significance section, there is a correlation between students' performance in 8th-grade reading tests and success in passing IBC exams. The research shows that students who don't pass the 8th grade reading test do not pass the IBC exam. We aim to address this empirical need through our high engagement tech support model and evidence-based reading modules that are tied to the experiential learning TechXperts provides.

To strengthen our response to this need, we are basing these modules on What Works Clearinghouse (WWC) practice guides. This competition only requires a "strong rationale" for the evidence requirement through a well-defined logic model (See Appendix G). However, to anchor this component on evidence-based practices and lay the foundation for a future EIR mid-phase submission that requires a higher level of evidence, IDRA will specifically use the WWC practice guide, *Providing Reading Interventions for Students in Grades 4-9* (WWC-PS4-9), as the basis for reading instruction modules. IDRA will base the development of the modules on **Recommendation 3,** "Routinely use a set of comprehension-building practices to help students make sense of the text." This recommendation has been characterized by the WWC as showing "strong evidence" to increase student's reading comprehension. Using these strategies in our modules, we will help TechXperts students as they work to understand technical manuals, IT

concepts, and problem-solving scenarios. By using these strategies, students will improve their technical reading comprehension and critical thinking skills. This strategy is not only designed to assist students with STEM education and career development, but it will also help students in closing lingering literacy gaps exacerbated by the pandemic (CPP 2).

Significance

Development or demonstration of promising new strategies that build on existing strategies

IDRA's TechXperts core feature is an elective course for 9th-grade students who are in at-risk situations from partner school districts in the Rio Grande Valley (RGV). The program has several innovative components, which we will discuss in this proposal. However, the two features that make this project unique for widespread adoption are (1) student-led technology support (**AP 3**), and (2) evidence-based reading modules (**CP 2**).

Student-led Technology Support (AP3). The program's central innovative component is the new elective course where students in at-risk situations will lead technology campus support. The experiences of providing technology support on campus and being recognized as leaders will increase students' STEM identity and engagement. This idea is based on IDRA's expertise in bringing youth who are not the "usual suspects" into full participation in fields of study previously unimagined by schools and students themselves.

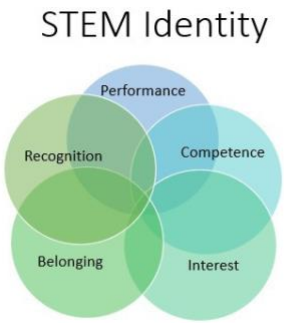
Evidence-based Reading Modules (CPP 2). The rapid growth in employment opportunities within the computer and information technology fields contrasts sharply with the low success rates of students passing critical industry-based certification exams like CompTIA A+ and CompTIA ITF+ in Texas. The data indicates a significant gap in the educational pathways and pedagogy needed to prepare students for these careers. Notably, students who passed their 8th-grade English language arts reading state assessments were more likely to succeed in these

certifications. This correlation highlights the critical need for integrating reading instruction within IT courses to improve student outcomes and readiness for STEM careers. We touch upon this issue in this Significance Section: **Evidence-Based Reading Modules: The Need for Reading in STEM (CPP 2)** and propose the creation of eight modules in the Quality of Project Design section.

Promoting STEM Education (AP 3). TechXperts is a high-quality course providing experiential hands-on project-based learning (PBL) and technology support workforce development experiences that will challenge and enrich student learning, STEM identity and engagement. The concept of **STEM identity** has assumed important significance over the past decade with a continued urgency for understanding how it develops, particularly for groups who historically have been underrepresented in the STEM fields (Castro & Collins, 2020; Kim et al., 2018; Ortiz et al., 2019; Steinke, 2017).

Carlone & Johnson (2007) initially developed an advanced framework for "computing identity" wherein performance, competence and recognition were interrelated constructs in which individuals narrate features of their STEM identity (see Exhibit 1). That framework was further developed and expanded as "STEM identity" by adding interest in STEM as a fourth construct (Hazari et al., 2010; Mahadeo et al., 2020). Mahadeo et al. (2020) found that interest informed students' emerging identity as IT professionals. The most recent research emphasizes the importance of another construct – a sense of belonging – as critical for cohesive identities that enable students to express and be acknowledged for their multiple identities while also developing disciplinary and professional identities (Cohen et al., 2021; Ong et al., 2018; Strayhorn, 2019).

Exhibit 1

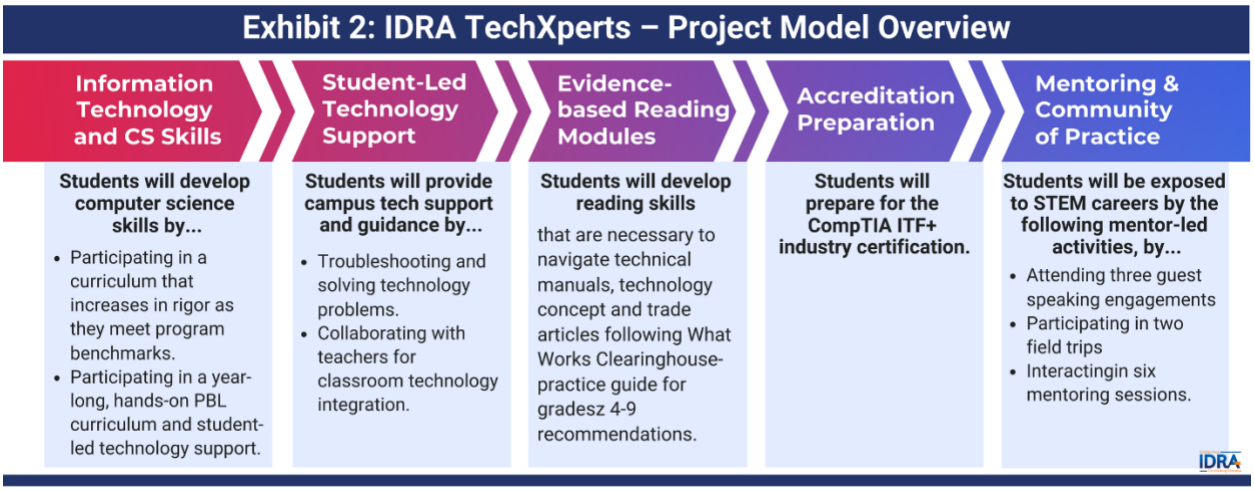


Cohen, Hazari, Mahadeo, Sonnert & Sadler, 2021

[redacted]

TechXperts addresses these constructs by providing experiences where students perform meaningful STEM tasks by providing tech support, building competence, being recognized for their work and deepening their sense of belonging to a group of aspiring technology experts – TechXperts.

IDRA's TechXperts draws on the wealth of research on STEM identity that informs our design of a program that enhances student engagement, computer science knowledge, and leadership education for youth in high school settings. Research emphasizes that providing a high-quality curriculum is only one component. Students also must ***experience*** **STEM successes** and leadership. Students who would have otherwise been excluded from STEM coursework – and later from occupations and earnings – then reclaim their opportunity to complete a rigorous course sequence that will prepare them for STEM pursuits upon graduation. TechXperts will engage students in a variety of project-based, experiential learning opportunities designed to encourage critical thinking, persistence, and self-identification in STEM education and career pathways. Exhibit 2 provides an overview of the model.



TechXperts will significantly expand interest in STEM among students who are in at-risk situations by keeping them engaged to persist in school and in STEM college and career pathways.

Research and field experiences demonstrate the potential of each of these strategies separately (Coleman & Davis, 2020; LaForce et al., 2017). However, their integration as a seamless intervention that can be implemented at scale, with measurable impacts for public high school students, offers a critical innovation for the field.

IDRA's **Valued Youth Partnership** (VYP) and two student-led technology programs (Chrome Squad and Help Desk) provide opportunities for students to assume roles of responsibility and leadership. These programs demonstrate that when schools value student voice, students thrive and succeed, especially those who are in at-risk situations. When given support and exposed to successful experiences, students rise to the challenge. IDRA has a four decades-long track record through VYP of guiding students to meet high expectations, which their schools did not initially share for them, and to succeed in executing complex tasks. VYP challenges students to take on the role of leaders with personal and academic responsibility to learn self-discipline and develop self-efficacy. In VYP, secondary high-need youth, many of whom are Black and Latino, are placed as tutors of elementary students in settings where academic and character expectations are high. They become responsible to support their elementary school "tutees" to ensure shared success. The program was named a U.S. Department of Education "Bright Spot in Hispanic Education Fulfilling America's Future." It is listed as a promising practice that encourages collaboration in sharing data-driven approaches, effective partnerships, and peer support and leadership. Evaluations consistently demonstrate increased socio-emotional indicators, such as positive self-perception of academic and leadership abilities among participating students. Results show improved academic performance (66% of tutors improved reading test scores; 57% improved math scores) and school attendance (16% had fewer absences), decreased dropout rates (98% of VYP tutors stay in school), and increased advancement to

college. VYP tutors also improved their sense of self, oriented toward the future, and improved their sense of being productive at their schoolwork, enjoying school more and feeling successful at school (IDRA, 2016-2020). VYP engages students through activities, field trips and guest speakers that explore college culture and STEM pathways. IDRA has successfully implemented that model in 18 states in the continental United States, as well as in Great Britain, Brazil and Puerto Rico.

Two successful technology programs, the **Help Desk at Burlington High School** in Massachusetts, and **Chrome Squad at Royse City High School** in Texas, both of which are student- led district technology support teams, contain many program components that align with our TechXperts model. TechXperts will establish a student-led technology program through a formal elective course that meets graduation credit requirements. A teacher facilitator will lead authentic learning experiences for students and will support their hands-on PBL and workforce development learning activities. Also, IDRA will initiate a **community of practice** and ongoing professional development for teachers and students alike. Students will become partners in pedagogy, where everyone is learning together (Office of Education Technology, n.d.). TechXperts students will serve as **role models** through their campus position as on-site campus technology-support specialists.

The Royse City High School and the Help Desk at Burlington High School are cited here as promising practices since they provide real world technology experiences. Royse City High School reports that the Chrome Squad leaves a lasting impact on participating students. They learn professionalism from being in a work environment in the school's student-led technology-supported Connected 4 Learning Lounge (C4L). Customer service is at the organization's core, so students gain knowledge in how to effectively communicate verbally and 4 Learning Lounge

(C4L).

Like the Help Desk model, TechXperts aims to engage students in mentorship experiences with industry professionals by using our existing partnership within our RGV Digital Workforce Coalition. TechXperts will recruit students who may or may not be initially interested in STEM and who are often overlooked and not included in STEM opportunities. We do this so they can benefit from experiential learning and technology exploration opportunities, expanding access to students typically excluded from STEM. TechXperts does not focus on the usual "star" students but rather hypothesizes that all students can succeed within STEM studies and continue through STEM college and career pathways given the proper support. The context of TechXperts differs from the other two programs, which served mostly suburban student populations. Royse City High School is situated in Garland, a suburb of Dallas with an over 50% white population. At Burlington High School, Help Desk students already expressed STEM interest. While we cite the Royse City High School and the Help Desk at Burlington High School as promising practices, there is a lack of scholarship or evidence as to their impact. We cite them as part of our review of the existing literature and to provide a context of current practices. These are seen as practices for those students who self-select into STEM, almost as enrichment for those students whose interest in STEM is instinctual. It is our hypothesis that these practices should be expanded to include students who have not expressed STEM interest.

Through TechXperts, students can experience the labor market and continue their high school education with the experience and self-confidence to persevere. In today's labor market, 85% to 90% of middle-skills jobs require digital skills. Those are jobs that do not necessarily require a college degree but offer opportunities for upward mobility. These are "new collar" jobs that offer an entry into the middle class and beyond. In addition, the Brookings Institute released

a report in February 2023 demonstrating how jobs in the United States have dramatically increased the need for digitalization – that is the level of digital skills required for jobs across industries (Brookings, 2023). These are jobs that also offer higher wages. However, the report reveals that the RGV (the McAllen/Edinburg MSA and the Brownsville/Harlingen MSA) have the lowest digitalization scores. The report stresses the need to focus on regions of the country that score low on digitalization and to deliberately design opportunities so those regions can participate in the digital economy, thus creating shared prosperity and a more resilient U.S. economy. In short, TechXperts provides STEM pathways in computing, and its rationale is based on three leadership and STEM models that have shown effectiveness in building leadership, STEM identity and engagement.

Evidence Based Reading Modules: The Need for Reading in STEM (CPP 2). Employment in the computer and information technology fields is expected to increase at a much faster rate than the average for all jobs. Given current trends, each year, on average, there will be about 377,500 job openings in these fields, driven by growth and the need to replace workers who permanently leave their positions (U.S. Bureau of Labor Statistics, 2024). Yet, our educational system is struggling to keep up with this demand.

In Texas, an analysis[1] of the current high school course enrollment in computer science, computer maintenance, computer networking, and IT troubleshooting averages 4,500 students per year. Depending on district course offerings and pathways, the majority of these students are able to take industry-based certification exams as early as 9th-grade. The latest available results of how many students have passed CompTIA A+ and CompTIA ITF+ certifications are concerning.

Exhibit 3: Industry-Based Certification

[1] We limited this analysis to courses that concentrate on information technology, *e.g.,* hardware, networking, technology support.

	2017	2018	2019	2020	2021
CompTIA IT Fundamentals (ITF+)			45	48	76
CompTIA A+	45	140	73	51	52
					Data source: TEA (2024)

Given the number of students who are taking classes to prepare them for STEM and IT education and careers, there are disconnects and problems in the pathways and pedagogy. Of students afforded the education and participation in Texas STEM/IT courses, only about 1% pass these tests, which are requirements to full participation in these careers.

One study analyzed the passing rates of students taking industry-based certifications in a predominantly, low-income district in the Gulf Coast Region of Texas (Metcalfe, 2014). The findings for the information technology certifications – *e.g.,* CompTIA A+ – revealed that students most likely to succeed had passed their 8th grade English language arts reading (ELAR) state reading assessments. In turn, the students who did not succeed on information technology certifications overwhelmingly had not passed 8th-grade ELAR exams. If we accept that accreditations like industry-based certification are a significant indicator for future STEM participation and, importantly, career development, then this finding should be addressed. To this end, TechXperts proposes to include evidence-based reading modules to assist students in their STEM journeys.

We wish to emphasize that the importance and significance of this project has far-reaching consequences. In Texas and across the nation, there has been a push to create career pathways that do not require four-year degrees through Career and Technical Education (CTE) or statewide changes in graduation requirement such as Texas' Foundation High School Program which radically altered course requirements (Arrington, 2018). Often, these pathways decrease the rigor

of academic requirements in literacy and mathematics ([redacted] & Bahena, 2018). The data suggests that a decrease in rigor has consequences for students choosing to take STEM/IT pathways that require industry-based certifications. While this course is not intended to fulfill CTE pathways, the target student population is the same- students in at-risk situations. The findings from this resulting study can inform how states and districts can serve our students underrepresented in STEM/IT careers with experiential learning and high academic supports and expectations.

Quality of Project Design

Conceptual framework underlying the proposed research or demonstration activities

The TechXperts conceptual framework is based on the following theory of action: The combined effect of the program's five main components, (1) information technology and computer science curriculum, (2) student-led tech support, (3) evidence-based reading modules, (4) accreditation preparation, and (5) mentoring and community of practice, will improve student participants' STEM identity and engagement and will positively affect reading instruction.

IDRA posits that participation in TechXperts will positively impact students' STEM identity, campus community engagement, and academic achievement. Specifically, we assert that the program will increase students' continued selection STEM/CS classes or STEM graduation endorsements and improve their scores on end-of-course English exams. This framework is summarized by the program's logic model (see Appendix G), which provides an overview of key project resources, components, outputs, and outcomes, including short- and long-term measures for program participants. The logic model illustrates how positive outcomes are associated with the key components of TechXperts: student curriculum, integrated evidence-based reading instruction, teacher supports, mentoring, and student technology supports that stem from the

review of relevant foundational research on student leadership.

Logic Model Key Components: Demonstrates a Rationale (AP 1)

The following summarizes the TechXperts rationale through IDRA's logic model (Appendix G). It is based on the Institute of Educational Sciences' latest recommendations published in *Conducting Implementation Research in Impact Studies of Education Interventions: A Guide for Researchers* (Hill et al., 2023). The TechXperts instructional development team will be comprised of IDRA staff, an ESC Region 1 consultant, and UTRGV professors. The instructional development team will create the student curriculum for a 9th-grade elective course through which students will gain deep understanding of computer science/IT applications and build their STEM identity and engagement by providing student-led tech support to campus staff.

Students will be immersed in a curriculum that adheres to CompTIA ITF+ standards, enabling them to engage in applied technology troubleshooting by resolving issues teachers face on campus. The TechXperts instructional development team also will be responsible for creating professional development resources for TechXperts course teachers and mentors. IDRA will offer professional development training covering project-based learning, digital citizenship, technology support, and industry IT standards in alignment with CompTIA ITF+ certification. Additionally, IDRA aims to foster a community of practice to boost collaborative learning. Mentors will cultivate enduring relationships with students, undergo culturally and linguistically responsive training, and acquire knowledge in asset-based strategies.

The section below elaborates on how the project addresses **AP 1** by detailing TechXperts' critical components and articulating the latest research on STEM identity, PBL practices, evidence-based reading strategies and mentoring networks that support those components.

Building STEM Identity Through Student-Led Technology Support. TechXperts

students will adopt a STEM identity and, more likely, develop greater interest in a STEM-related education or career pathways. TechXperts is grounded in research by Mahadeo's et al., expounding on students' STEM identity, which examines how students' computing performance is a function of their belief in their ability to successfully accomplish the tasks and understand the material (2020). TechXperts builds STEM identity and engagement through our student-led technology support practice where participants provide technical assistance to teachers and fellow students on their campus. In a hallmark study about student-led technology leadership, a cohort of students in Pennsylvania provided onsite technical support to teachers to help them transform their teaching practices (Breiner, 2009). The design enlisted 6th and 7th graders to serve as the first cohort chosen by a nomination process. A group of teacher advisors supported the students. The students worked as advocates to take their skills back to their respective classrooms. They came from varying campuses within the district rather than just one school. Data revealed as one outcome of the program that the "technology wizards participated in or led at least two professional development training sessions with teachers, and five of the students participated in or led trainings for teachers four or more times" (Breiner, 2009). This finding provided a clear indication that the students gained a deeper understanding of technology, and teachers implemented more technological interventions to transform their practices. Other models, such as the student-led help desk at Burlington High School, offer students a personalized curriculum to enhance their digital skills and leverage their expertise to assist teachers in their classrooms, thereby helping to develop students' STEM identity. The TechXperts program draws inspiration from those successful models while establishing its unique approach to promote leadership skills, technology literacy and STEM identity.

Building Positive Outcomes Around Project-Based Learning. PBL creates dynamic

classrooms in ways that grow cognitive and non-cognitive skills simultaneously (Avilés & Al-Gasem, 2016). When properly implemented, PBL boosts long-term knowledge retention, aids students in performing on par with or better than traditional learners on standardized tests, enhances student problem-solving and cooperation skills, and enhances their attitudes toward learning (Strobel & van Barneveld, 2009; Walker & Leary, 2009). PBL incorporates student voices, embraces authenticity, and facilitates a feedback loop between students and teachers. IDRA previously worked with staff at the newly formed STEM Academy, a middle school in San Antonio primarily serving Black and Latino students with a 70% economically disadvantaged student body, to implement PBL schoolwide. As a result, students performed higher on state assessments than students in the other district schools (Barnett, 2017). Additional research at the intersection of PBL and STEM instruction by Kraicik & Delen (2017) studied programs where teachers created environments that combined engaging students in the learning process with design activities.

Moreover, as an integral component of our interactive PBL approach, student teams will engage in the exciting process of constructing a computer using new components, while also gaining valuable insights by disassembling older computers generously donated by our partners. By implementing this hands-on activity, we aim to provide students with a comprehensive, concrete understanding of computer hardware, fostering practical skills and critical thinking. Too often, computer science courses approach hardware through abstractions so that RAM, storage space, graphics cards, central processing unit (CPU) speed, and other topics are only understood by students who already have an intimate understanding of a computer's inner workings. While it may seem counterintuitive, younger generations (*i.e.,* Generations Z and Alpha) often lack technological understanding of these concepts, according to workforce surveys conducted by Hewlett Packard and others (Tangermann, 2023). This exercise will empower our students to grasp

the intricacies of modern computing systems while instilling a deep appreciation for the sustainable use of technology. Throughout this learning experience, students will both assemble computers and dismantle and analyze older systems, promoting a sustainable and environmentally conscious perspective within the realm of technology. Additionally, this collaborative approach will encourage teamwork, communication, and problem-solving skills as students work in pairs to accomplish the tasks at hand. By sharing ideas and collectively addressing challenges, students will cultivate essential interpersonal skills that are vital for their future academic and professional endeavors.

Evidence-based Reading Strategies (CPP2). We will develop a comprehensive approach to integrate reading modules into the TechXperts program, enhancing students' comprehension skills in alignment with our STEM-focused curriculum. The IDRA development team will create modules based on recommendations from the WWC-PS4-9 (Vaughn et al., 2022). The practice guide provides detailed recommendations for the following reading strategies:

- 3A: Build students' world and word knowledge so they can make sense of the text
- 3B: Consistently provide students with opportunities to ask and answer questions to better understand the text they read
- 3C: Teach students a routine for determining the gist of the text
- 3D: Teach students to monitor their comprehension as they read

While the development team will create iterative processes, guideline documents and protocols to develop and pilot modules, the following section presents a bird's eye view of how these recommendations will influence curriculum development.

• ***3A: Contextualized Reading Content***. The development team will select reading materials that are linked to the core subjects of technology and computer science, which are fundamental to the

TechXperts curriculum. These materials will include current articles on technological innovations, manuals for various software and hardware, and texts that discuss the broader social impact of technology. By embedding these reading tasks directly into the curriculum, we ensure that students will build background knowledge and apply their reading comprehension skills to technical projects and real-world CS problem-solving.

• ***3A & 3C: Structured Comprehension Strategies.*** The team will build a foundation for comprehension by first providing sessions that pre-teach key vocabulary and concepts. This preparation will be crucial for students to fully engage with the technical content of their reading materials. Following this, we will facilitate regular discussion sessions where students can delve deeper into the texts by asking and answering questions. This interaction will reinforce their understanding and encourage a thorough exploration of the content. Additionally, we will teach students strategies for identifying main ideas and summarizing sections of text, equipping them with skills essential for their technological presentations and reports.

• ***3B & 3D: Monitoring Comprehension.*** The curriculum will train students in self-monitoring their comprehension, introducing metacognitive strategies that encourage them to reflect on their reading and learning processes. To support this training, we will integrate brief regular assessments that provide immediate feedback on their comprehension. These assessments will help reinforce their learning and offer opportunities for timely adjustments in their reading strategies.

• ***3A, 3B & 3D: Real-World Application***. We will use students' roles in providing technology support as a practical application of their reading and comprehension skills. When faced with new technological problems, students will engage in research and read about potential solutions, applying their comprehension skills in a meaningful context. Moreover, we will include modules focused on the comprehension and interpretation of technical documentation, preparing them for

IT certification exams and professional practices. This will enhance their ability to communicate complex information effectively, a critical skill in their future careers.

By adopting these approaches, we aim to ensure that the integration of reading modules based on WWC's Recommendation 3 not only enhances students' comprehension skills that have lagged during the pandemic **(CPP2)** but also reinforces the relevance of these skills within their technical education and future career aspirations in the STEM fields.

Building Positive Outcomes Around Mentors in a Community of Practice. Research demonstrates that mentorship in education is critical for youth to build positive relationships with adults. A support network comprised of peers, mentors and other expert professionals is especially critical for STEM-interested students who are eager to pursue STEM pathways but lack an external role model or support system. Expanding the pool of mentors of color is a vital piece of building diversity within the STEM workforce in which women and Black and Latino professionals are traditionally underrepresented (Apriceno et al., 2020). Usually, communities of practice involve professionals. We propose a community of practice that includes students as well, which they will experience through a community of practice and their mentoring activities. Building a strong community of practice that supports student needs and values student voice is an important part of TechXperts. Caldwell Templeton states, "Because of the varied experiences that students endure, in and outside of school, the development of a stable school community is important" (2017, p. xiii). Cultivating communities of practice through mentorship has a significantly positive impact on student-teacher relationships. Authentic experiences with members of the STEM workforce are also an effective way to engage students in meaningful learning (Hsu & Espinoza, 2018). TechXperts will engage with their mentors and the community of practice through mentor-led activities: student attendance at three guest speaking engagements, two field trips, and interaction

in at least six mentoring sessions.

Clearly specified and measurable goals, objectives and outcomes

TechXperts has three project goals: (1) Develop and establish a 9th-grade computer science TechXperts course and materials to increase students' STEM identity and reading skills; (2) Develop and increase TechXperts teachers CS/IT knowledge and pedagogical expertise; (3) and (4) Increase computing identity and reading skills of students through completion of the TechXperts program. Through these goals, by positioning students as technology experts in their schools, TechXperts will build on their STEM identity, improve their capacity to be leaders among their peers, and create relationships with mentors to gain a deeper understanding of the STEM field and professional opportunities. Exhibit 4 summarizes our goals, objectives and outcomes. Teams will comprise the following: (1) Instructional design teams consisting of IDRA staff, content professionals from UTRGV, teachers, and district personnel from our partner schools; and (2) The content advisory team of computer science and reading specialists from each district and campus referred to as "Content experts' advisory team" in our full management table (Appendix J) report on efficacy of documents .

Exhibit 4: TechXperts Program Goals, Objectives and Outcomes

Goals	Objectives	Outcomes
Goal 1: During development year (2025-26), develop and implement a 9th-grade computer science TechXperts course and professional development and materials to increase students' troubleshooting skills through computational thinking, STEM identity and reading skills.	**Objective 1.1:** The instructional design team will create a set of development guidelines, standards alignment processes including CompTIA ITF+ standards, PBL development protocols, community of practice and mentoring protocols and research-based pedagogical documents, for use as guiding documents in development of TechXperts materials and course.	**Outcome 1.1.1:** The content experts advisory team will submit a report on development guideline documents efficacy on the development of the TechXperts course.

	Objective 1.2: TechXperts' instructional design team will create 8 curriculum units consisting of computer science concepts aligned with CompTIA ITF+ standards and 8 accompanying reading modules aligned with WWC standards.	**Outcome 1.1.2:** The content experts advisory team will submit a report on the curriculum's likely impact on students' STEM identity and reading skills.
Goal 2: During pilot (2026-27) and subsequent implementation years (2027-2029), TechXperts teachers will increase their CS/IT knowledge and pedagogical expertise through completion of three-week summer professional development.	**Objective 2.1:** During pilot (2026-27) and subsequent years (2027-2029), instructional design team will conduct three-week summer training with participating TechXperts teachers.	**Outcome 2.1.1:** Teachers participating in professional development will report a 50% increase in confidence in teaching STEM identity and IT skills.
		Outcome 2.1.2: Teachers participating in professional development will report a 50% increase in confidence in literacy and reading strategies as assessed by the STAAR test.
		Outcome 2.1.3: Teacher facilitators will report a 15% increase in confidence in attitudes toward student-led computer science instruction and student-led technical support.
Goal 3: During the pilot and subsequent full implementation years (2027-2029), TechXperts students will increase their computing identity, STEM engagement, and reading skills through completion of the TechXperts program.	**Objective 3.1:** During the pilot year (2025-26) and implementation years (2026-27, 2027-28), TechXperts ESC Region 1 high school students who are in at-risk situations and are in participating schools will improve computing identity, STEM engagement, and reading skills.	**Outcome 3.1.1:** TechXperts students will provide technical support for their campus, which will increase student STEM engagement and problem-solving skills by 20%.
		Outcome 3.1.2: TechXperts students will report a 25% increase in computing identity.
		Outcome 3.1.3: TechXperts students' reading skills will increase 45%.
		Outcome 3.1.4: 45% of TechXperts students will pass the CompTIA ITF+ certification exam.
Goal 4. Conduct random control trial evaluation of TechXperts implementation and impact.	**Objective 4.1**: During planning year, 2025-26 evaluation team will create student recruitment procedures and, in implementation/testing years (2026-27, 2027-28, 2028-29), IDRA evaluation liaison staff will conduct student recruitment activities to include presentations to student body.	**Outcome 4.1.1**: Abt evaluation staff certifies that 100% of IDRA evaluation liaisons and regional partners are trained in recruitment procedures.
		Outcome 4.1.2 IDRA's evaluation liaison team will recruit at least 40 students, per school.
	Objective 4.2: During the springs of implementation/testing years (2026-27,	**Outcome 4.2.1:** Each year, Abt will randomly select at least 20 students

	2027-28, 2028-29), at each participating school, IDRA's evaluation liaison team will recruit students, who meet the project's criteria,* for possible course participation and for comparison.	per campus for a minimum total of 300 for 15 schools, for possible participation in TecXperts course and a 20 students per campus for total of between 300 for comparison. Abt will ensure treatment and control groups achieve baseline equivalence.
	Objective 4.3: During planning/development year (2025-26), Abt and IDRA's evaluation liaison team will collaborate on finalizing (a) data collection instruments and (b) fidelity of implementation measures.	**Outcome 4.3.1**: Abt evaluation staff certifies that 100% of IDRA evaluation liaisons and regional partners are (a) trained in data collection instruments (b) 70% of schools meet fidelity of implementation measures.
	Objective 4.4: During the springs of implementation/testing years (2026-27, 2027- 28, 2028-29), Abt will measure and assess the impact of TechXperts on CS Identity and reading achievement.	**Outcome 4.4.1**: Abt evaluation staff will create yearly and final reports on impact.

The program's outcomes include: (1) increased STEM identity with computer science and technology; (2) increased STEM engagement demonstrated by student selection of the STEM endorsement graduation plan; (3) increased student achievement on reading standardized exams; and (4) increased selection into STEM, computer science, and/or technology studies and career pathways. Additional outcomes for teacher facilitators and mentors will include improved teacher attitudes toward student-led computer science instruction and student-led technical support as well as improved mentor attitudes toward school-industry collaborations. Because of the highly experiential nature of this course, we will measure student attendance as it is our experience that students attendance improves with such endeaors. The overarching goal of TechXperts is to contribute to a STEM identity among students who are in at- risk situations, prepare them to enter the STEM workforce, and ultimately expand the school-to-STEM pipeline.

Project is appropriate and will address the needs of the target population

The TechXperts program aims to develop STEM identity and decrease reading gaps within

traditionally underrepresented students – particularly high-need students who are in at-risk situations – to prepare them for entry into STEM education and career pathways.

The Rio Grande Valley (RGV) is a persistent economically disadvantaged region along the Texas-Mexico border, meaning that, over the last three decades, at least 20% of the population lives below the poverty line. Within the border region, there are multiple *colonias*, which are economically disadvantaged communities that are rural or "rural in nature" and often lack safe housing and basic infrastructure, such as safe drinking water, wastewater, paved roads, and broadband. Many colonias are neighborhoods in unincorporated areas under county jurisdiction. They can also be extra-jurisdictional territories around cities or incorporated communities (small towns). As the Federal Reserve Bank of Dallas noted in the last full report about the status of the colonias in 2015, *Las Colonias in the 21st Century: Progress Along the Texas-Mexico Border*, 61% of colonia residents lived below or near poverty (Barton et al., 2015). Cameron, Hidalgo, and Starr counties are among those along the border with the highest concentration of colonias. The colonias are recognized by federal agencies as vulnerable communities that should be targeted for investment. As detailed in Exhibit 5, the four counties that comprise the RGV region are predominantly Latino.

Exhibit 5: Rio Grande Valley County by Percentage of Hispanic or Latino Population

County	Percent
Cameron County	89.8%
Hidalgo County	92.5%
Starr County	96.1%
Willacy County	88.2%

Source: U.S. Census Bureau. QuickFacts, 2023

Exhibit 6 displays student demographics for the proposed sites: Brownsville ISD, La Villa ISD, and Mercedes ISD in addition to ESC Region 1 and the state of Texas (TEA, 2022c). ESC Region

1's 38 school district's combined enrollment in 2022-23 was 439,336; 96% of the student population was Latino, compared to just 1% Black and 2% White. More than 85% of students enrolled in ESC Region 1 campuses in 2022-23 were economically disadvantaged, compared to 62% of students statewide.

Exhibit 6: Student Demographics by District/Locale, 2022-23

District/Locale	Total Enrollment	Black	Latino	White	Economically Disadvantaged	Emergent Bilingual
Brownsville ISD	37,898	42	37,267	486	33,785	7,760
Hidalgo ISD	3,010	0	<3,010	<10	2,672	2,047
La Villa ISD	566	NA	<570	<10	530	103
Mercedes ISD	4,457	10	4,364	68	4,084	437
ESC Region 1	439,336	6,107	420,760	9,267	376,195	81,357
Texas	5,518,432	706,775	706,775	1,416,240	3,421,217	1,270,533

Source: Texas Education Agency Student Enrollment Reports (PEIMS Standard Reports), 2022-23

TechXperts will address two key needs in Texas' STEM education landscape: (1) the need for underrepresented students to select the STEM endorsement graduation plan; and (2) the need to narrow reading achievement gaps by race/ethnicity.

Need for underrepresented students to select STEM endorsement. There is an urgent need for confronting equity issues concerning the advancement of students of color in STEM. Since 2014, under the state's default high school graduation plan, Texas 8th graders must choose an endorsement (akin to a high school "major") through which students can prepare for future college and/or career choices. STEM is one of five endorsement choices and is the one most aligned with college preparation. However, in 2021-22, only 15% of high school students selected the STEM endorsement. With Black and Latino high school students representing 9% and 46%, respectively, of high school students pursuing the STEM endorsement in 2020-21, Texas schools demonstrate a significant need to invigorate the STEM pipeline for historically

underrepresented students in the field. Disparities in Black and Latino representation in high school STEM graduation plans statewide are mirrored by endorsement selection rates for our partner districts and for ESC Region 1 (TEA, 2021a). In 2020-21, 16% of high school students in ESC Region 1 enrolled in the STEM endorsement. Moreover, 15% of Black high school students and only 16% of Latino high school students in ESC Region 1 selected the STEM endorsement plan (TEA, 2021a), compared to 23% of their white peers. Similar patterns emerged when examining district-level data (TEA, 2021a).

In this next section we discuss the disparate achievement gap that demonstrates persistent learning gaps exacerbated by the pandemic. TechXperts directly prepares students in at-risk situations for STEM higher education and career pathways by improving reading skills.

Need to narrow reading achievement gaps by race/ethnicity. Efforts to narrow achievement gaps have stalled over the last three years during the COVID-19 pandemic. While our target population is 9th grade students, it is important to note 8th grade performance due to the possible correlation between passing 8th grade reading assessments and CompTIA tests.

Exhibit 7 presents state STAAR performance assessment data of our participating districts and ESC Region 1 for grade 8 reading and grade 9 English I end-of-course exams. District data for the three demonstrate similar disparities in reading achievement as state- and region-level data between Latino 8th-grade students and their white peers (Exhibit 7). Gaps for emergent bilingual students (English learners) are high statewide and in ESC Region 1. For all districts, TEA data for Black 8th-grade students were masked for privacy or unavailable.

State assessment data show a detailed perspective on achievement by race/ethnicity and provides context on schools' efforts to address gaps endured through school closures during the pandemic. According to 2020-21 STAAR performance data available in the 2021 Texas

Academic Performance Report (TAPR), 26% fewer Black 8th graders (compared to 27% fewer in 2019) performed at or above grade level on the STAAR reading assessment (TEA, 2021b). Similar statewide trends emerged for Latino 8th graders who demonstrated a gap of 22% fewer on the reading assessment (compared to 22% in 2019) than White students (TEA, 2021b).

Exhibit 7: English Language Arts/Reading Grade 8 and End of Course English I Grade 9, 2021-22

District/Locale	Black	Latino	White	Economically Disadvantaged	Emergent Bilingual
Grade 8 ELAR (Percent "Meets Grade Level or Above")					
Brownsville ISD	*	52%	56%	50%	32%
Hidalgo ISD	-	52%	-	47%	44%
La Villa ISD	-	45%	-	44%	27%
Mercedes ISD	*	34%	*	33%	25%
ESC Region 1	65%	57%	71%	53%	45%
Grade 9 End of Course English I (Percent "Meets Grade Level or Above")					
Brownsville ISD	*	47%	39%	66%	50%
Hidalgo ISD	-	40%	-	33%	30%
La Villa ISD	-	24%	-	26%	12%
Mercedes ISD	*	28%	*	25%	14%
ESC Region 1	65%	57%	71%	53%	45%

*Source: Texas Education Agency STAAR Performance (TAPR), 2021-22. Note: *indicates masked values; – indicates data are not available*

Quality of Project Personnel

Encourages applications for employment from persons who are members of groups that have traditionally been underrepresented

Diversity and non-discrimination are core explicit practices at IDRA. IDRA has a non-discrimination hiring policy and employment policies that require every person to be treated equally regardless of race, color, gender, national origin, religion, sexual orientation, native language, age or disability. IDRA also has a long practice of making accommodations for staff in

accordance with federal disability rights law. In our 51-year history, IDRA has been led by people of color – most recently, by two Latinas. Approximately 90% of our staff identify as people of color, 70% as women, and several as members of the LGBTQ+ and immigrant communities. IDRA actively seeks out a wide range of applicants for staff and consultant positions. We focus on reaching out to groups that have been historically underrepresented through networks of HBCUs, MSIs, professional organizations with diverse membership, and diverse student groups throughout Texas and the rest of the country. IDRA's commitment to diversity and inclusion is evident in our comprehensive hiring practices. One of the key strategies employed is actively participating in job fairs hosted by HBCUs, MSIs and HSIs. By engaging with students and faculty members from these institutions, IDRA aims to foster a diverse and talented pool of candidates. IDRA is dedicated to promoting equal opportunities for individuals from underrepresented groups. With a specific focus on students of color, women, and other marginalized communities, the organization actively reaches out to schools of education, creating connections and building relationships that help identify and attract exceptional talents. Finally, to bolster our STEM capacity, IDRA recognizes the importance of recruiting individuals with specialized skills and knowledge. As a result, the organization actively seeks out qualified candidates from graduate and postgraduate STEM programs across the nation known for their commitment to diversity and inclusion.

Qualifications, including relevant training and experience, of key project personnel.

This section describes who is responsible for two major types of activities: development and implementation. Development activities will be led by the TechXperts instructional development team consisting of the TechXperts program director, curriculum writers and professional development specialists, and representatives of our participating school districts: Brownsville,

Hidalgo and La Villa and Mercedes ISDs. We will execute activities in a collaborative manner, but the instructional design team (IDT) will take the lead on certain activities. The instructional implementation team (IIT), led by the project director in collaboration during development phase. After the IDT will become the IIT as professional development specialists who will execute implementation activities. Evaluation liaisons (EL) will conduct data collection activities throughout the grant cycle. IDRA is currently leading STEM activities through our implementation of STEM initiatives, such as VisionCoders, a coding course for students in at-risk situations, based on research that is similar to TechXperts. We are also one of four Defense Education Consortium Hubs through which we lead STEM instructors to engage in equity STEM projects through externships and projects. Furthermore, IDRA leads the Alamo STEM Ecosystem, which aligns and connects efforts to strengthen and broaden participation in the local STEM pipeline (from cradle to career). IDRA centers and elevates student and family voices for improving underrepresented students' access and sense of belonging in informal and formal STEM education. Exhibit 8 provides an overview of project personnel.

Exhibit 8: Overview of Project Personnel

Name/Title	Experience & Qualifications
[redacted] President & CEO	[redacted] is accountable for IDRA's programs and administration. A civil rights attorney, she previously directed the Southwest office of MALDEF (Mexican American Legal Defense and Educational Fund) and was an attorney at Texas Rio Grande Legal Aid. She is a graduate of the University of Texas at Austin and the Harvard Kennedy School.
[redacted] Project Director	[redacted] leverages almost 20 years of experience to design, develop and administer professional development for educators. Key areas of her work include designing, developing and training in technology integration, technical writing, and technology coaching and mentoring. She served as a training and development technologist at the fourth-largest public school district in Texas: Northside ISD. She led, developed, implemented and supported a wide range of district technology initiatives for that district, which comprises more than 100,000 students and 8,000 professional staff. She also served as digital resources specialist for the Texas Education Service Center, Region 20, where she led multiple statewide programs, including Texas SUCCESS, TexQuest, Learn421 and Digital Knowledge Central (DKC).

Exhibit 8: Overview of Project Personnel	
Name/Title	**Experience & Qualifications**
[redacted] Curriculum Specialist **(IDT & IIT)**	[redacted] has over 20 years of experience in developing and managing youth technology projects. For example, he implemented six community technology centers and managed a Youth Tekkie project where students provided bilingual technology training to families. He has developed and coded management information systems and educational database portals in Linux environments and managed MSSQL databases. He has produced materials and programs similar to and larger in scope than the TechXperts program. [redacted] will lead the development and implementation/technical assistance teams to create materials, manage timelines, and oversee continuous feedback processes.
[redacted] Professional Development Specialist **(IDT & IIT)**	[redacted] will be a contributor to the development of TechXperts' professional development model, curriculum and processes. Because of his deep knowledge in youth projects, he will be central to development activities and their implementation. [redacted] designed and tested youth leadership models and has implemented them throughout Texas and the U.S. South. [redacted]'s vita illustrates the depth and breadth of his success in creating models like TechXperts. He will serve on the development and implementation teams discussed in the Management Plan. Mr. [redacted]'s dedication to asset-based practices for students will have a critical impact on project development and implementation.
[redacted] Professional Development Specialist **(IDT & IIT)**	[redacted] will serve as our reading and literacy expert in the design and implementation of the TechXperts program. [redacted] provides professional development and technical assistance to schools across the nation on effective bilingual education for all students. She designs and delivers interactive training that provides tools for teachers to increase student achievement in bilingual education areas. She also coordinates service delivery to schools across the U.S. South to ensure all students receive an excellent and equitable education, regardless of their national origin, native language or immigration status. Her areas of expertise include bilingual education, ESL (both K-12 and adult learning) programs and educational implementations. [redacted] dedication to educational literacy and program implementation will substantially impact this project's design phase.
[redacted] IDRA Evaluation Liaison	[redacted] has extensive experience in developing and designing impactful youth projects. As IDRA's evaluation liaison, she will assist our external evaluators in designing tools and processes for the evaluation of TechXperts. She is experienced in program evaluation and has a strong background in educational research, survey design, editing, program evaluation, and quantitative analysis. [redacted] is currently a doctoral student in applied demography at the University of Texas at San Antonio, where she conducts research on educational inequities. She earned her master's in educational psychology with a specialization in quantitative methods from the University of Texas at Austin.
[redacted] Design and Implementation Team Lead **(IDT & IIT)**	[redacted] at Education Service Center-Region 1 facilitates collaboration and content creation in STEM and instructional technology. She conducts teacher professional development on various STEM topics, such as PBL, coding, engineering design, robotics, gaming design, and technology integration. Additionally, she manages grants and budgets, organizes STEM student camps and community outreach events, leads conferences, develops online courses, and communicates with stakeholders.
[redacted] External evaluator M.P.P	[redacted] is a skilled manager of program evaluation and research projects. [redacted] experience focuses on secondary to postsecondary transitions, K–12 education, transitions between early childhood education and care settings and

[redacted]

Exhibit 8: Overview of Project Personnel	
Name/Title	**Experience & Qualifications**
	kindergarten and includes a focus on non-academic outcomes such as social-emotional learning and development. [redacted][d] [redacted] has deep expertise with methodological issues, such as study design, instrument development, qualitative data collection and analysis, data collection management, literature reviews and syntheses, and site/program recruitment. With over 20 years of experience spanning the government, non-profit and for-profit sectors, [redacted] has extensive experience in evaluating both programs and policy initiatives and brings expert-level skill in communicating findings across broad groups of education stakeholder audiences.
[redacted] Administrator - Instructional Technology Division of Technology Solutions, Education Service Center Region 1 **(IDT & IIT)**	[redacted] will be a collaborator in designing the online instructional content for the TechXperts program. [redacted] was involved in the Technology Integration Target Grant in partnership with ESC Region 1. While doing the statewide collaboration curriculum writing, he integrated technology into his trainings and created innovative approaches develop effective training for teachers and affective STEM curriculum student camps. He is the LRI/instructional technology director where he oversees the STEM, LRI, Distance Learning department as well products such as DMAC, Eduphoria, TEKSbank, MEGAbyte and Distance Learning Consortium.
[redacted] Interim Department Chair of Informatics and Engineering Systems, University of Texas, Rio Grande Valley **(IDT & IIT)**	[redacted] is the associate chair of the department of informatics and engineering systems with University of Texas – Rio Grande Valley. [redacted] will be instrumental in our partnership between the UTRGV program and TechXperts. He will serve as a mentor, curriculum advisor, and ensure curriculum alignment with industry standard certifications. He is a graduate of Texas A&M University, holding both a master's and a doctorate in mechanical engineering.

Management Plan

Adequacy of the management plan to achieve the objectives of the proposed project on time and within budget, including clearly defined responsibilities, timelines, and milestones

This section gives an overview of how IDRA will manage the project over the life of the grant. IDRA has a systematic planning and implementation approach focused on needs, outcomes, accountability, and continuous evaluation. Each TechXperts goal, objective and activity falls into distinct development, pilot, implementation and development phases. Exhibit 9: Phases Overview outlines the project phases and who we will serve. Appendix J - Management Plan: TechXperts Management Plan connects objectives and activities to deliverables, key staff, and timelines in furtherance of our main goals.

Exhibit 9: Phases Overview

[redacted]

Year	Phase	Goal	Campuses	Classes	Students
1	Phase 1: Development	1 & 2	n/a	n/a	n/a
2	Phase 2: Pilot	1 & 2	2	2	40
3	Phase 3: Implementation & Testing	2 & 3	8	8	160*
4	Phase 3: Implementation & Testing	2 & 3	8	8	160
5	Phase 4: Analysis		n/a	n/a	n/a
				Total	**360**
**The totals described in the evaluation section add up to 640 as they describe totals for Year 3 and 4 (320 taking the TechXperts class and 320 in comparison "business as usual group" not listed on this table.*					

Development Phase: As described in the Management Plan, the instructional design team (IDT) will complete Goal 1 activities during the curriculum development phase. Goal 1 activities are designed to develop and establish the 9th-grade TechXperts course, professional development, and materials to increase students' STEM identity. The IDT responsible for Goal I consists of IDRA's project director, IDRA's curriculum specialist and professional development specialists, an ESC Region 1 consultant, and UTRGV faculty. Those activities fall into the following categories: (1) Prepare all team members to be knowledgeable in all foundational aspects of the project, creation of guidance documents, iterative development protocols, and pedagogical foundations for TechXperts documents; (2) Develop the TechXperts course aligned with CompTIA A+ industry standards; and (3) Develop the TechXperts professional development materials and resources. Evaluation liaison and Abt will collaborate on recruitment procedures for the random control trial evaluation.

Pilot Phase: During the pilot phase, the TechXperts IDT will refine structures created during development phase, such as alignment processes, observation tools and research-based pedagogical documents for use as guiding documents in the pilot year of TechXperts materials and course creation. Teacher facilitators will attend and help refine professional development sessions.

Students will be recruited for the TechXperts class per Objective 4.' RCT procedures. Evaluation liaisons will oversee those recruitment activities. IDRA will implement the course's core components, *e.g.*, student-led tech support and mentoring activities. During this phase, the IDRA instructional development team, IDRA evaluation liaison and the Abt Global evaluation team will collect formative information to refine the course and all processes. During the pilot year we will serve two classes for a minimum of 40 students total- 20 per class.

Implementation Phases: The two implementation years are key for evaluation of the program, as a total of 360 students will take the course during that time . The IDT will become the instructional implementation team (IIT). During these phases, the IIT will collect data, test any modifications, provide technical assistance to teachers, and produce end-of-year reports about needed refinements. These tasks are labor-intensive and require that IDRA's professional development staff collect data across the classes. IDRA staff have extensive experience in this kind of assistance and reporting. TechXperts and comparison students will be recruited for the TechXperts class per Objective 4.'s RCT procedures. Evaluation liaisons will oversee those recruitment activities. Two implementation years, following a pilot year, will enable us to document challenges across the districts to refine course products. These tasks are necessary to produce a curriculum that is replicable and scalable across the nation.

Analysis Phase: We describe the analysis phase in detail in the evaluation section of this proposal. During that phase, Abt Global, our external evaluator, will collect project findings, compile reports, and collaborate with the IDRA instructional implementation team to finalize project evaluation. Abt and IDRA designed the timing of evaluation activities and recommended the flow of iterative development activities. Exhibit 10 shows the recommended activities from the evaluation section for the reader's convenience to show the alignment of development, pilot,

and implementation phases.

Exhibit 10: Project Phases and Associated Evaluation Activities		
Project Phase	**Abt Evaluation Activities**	**Goal of Evaluation Activities**
Phase 1 (Year 1): Development Year	Develop study design plan, draft fidelity measure, data collection procedures	Prepare for evaluation
Phase 2 (Year 2): Pilot study in two schools	**Formative evaluation:** Conduct interviews and focus groups with teachers and students about their experiences	Identify areas for improvement prior to evaluation study; pilot implementation measures
Phase 3 (Years 3 and 4): Evaluation study in eight schools	**Implementation and impact evaluation:** Conduct RCT evaluation of TechXperts effectiveness; conduct study of implementation fidelity	Understand TechXperts effects on reading achievement, STEM engagement and computer programming identity; contextualize impacts using data on implementation fidelity
Phase 4 (Year 5): Reporting and dissemination	Analysis and reporting	Produce final report detailing study findings and lessons learned for replication and testing in future contexts

Budget Management. The project director will ensure that the budget remains efficient and within reasonable estimates of costs. Costs include time for curricular development, professional development and technical assistance; consultant fees; and observation during development and implementation years for effective program delivery and refinement. Given the program's reach across multiple campuses, IDRA will assess costs on a regular and consistent basis. IDRA's monthly budget monitoring processes will serve the iterative nature of the project's goals to develop curriculum, professional development, and technical assistance materials across program sites. IDRA's budget management and financial accountability history have resulted in clean independent external audit reports since its founding in 1973. IDRA is categorized as a low-risk auditee pursuant to federal accounting standards.

Quality of the Project Evaluation

Abt Global (Abt) will conduct an independent, rigorous evaluation of TechXperts using a multi-site randomized control trial (RCT) with student assignment designed to meet WWC version 5.0

Group Design Standards without reservations. The study will take place in eight high school campuses in a large school district in southwest Texas that serves low-income, primarily Latino students. In each school, eligible 9th students interested in TechXperts as an elective course will be identified and randomly assigned to the TechXperts class for the upcoming school year or to another elective class of their choice. The key outcomes for students are interest and engagement in computing and IT study and careers, increased computing identify, improved attendance, and improved performance in ELAR courses and standardized state tests.

Abt has substantial experience designing and conducting large-scale RCTs in the I3 and EIR programs and in national and state evaluations. These RCTs are designed for, and many have been reviewed as, meeting WWC evidence standards without reservations. Abt has deep experience with the WWC through its multiple contracts leading WWC reviews. The proposed director, [redacted], is a highly skilled researcher who has experience as a technical lead on multiple rigorous evaluations of educational interventions and is currently the director on AbtAbt's independent evaluation for an EIR grant in a prior cohort. [redacted] is certified in WWC group design standards, as are all key Abt staff who will be working on the evaluation.

The evaluation of TechXperts will have four phases, as shown in Exhibit 11. The evaluation will begin with a nine-month development phase, starting January 2025) during which Abt will prepare a final design plan, IDRA and Abt together will develop recruitment and randomization procedures, and the fidelity measure and data collection methodologies will be finalized. There will be a pilot study in one school where the recruitment and randomization procedures will be tested, along with the data collection process. During this period, the grantee team will begin recruiting and building relationships with participating schools and executing data sharing agreements with the district.

Exhibit 11: Project Phases and Associated Evaluation Activities		
Project Phase	**Abt Evaluation Activities**	**Goal of Evaluation Activities**
Phase 1 (January 2025-Fall 2026): Development Year	Develop study design plan, randomization procedures draft fidelity measure, data collection procedures	Prepare for evaluation
Phase 2 (Fall 2026-Spring 2027): Pilot study in two schools	**Impact evaluation:** Pilot student recruitment and randomization procedures **Formative evaluation:** Conduct interviews and focus groups with teachers and students about their experiences	Identify areas for improvement prior to evaluation study; pilot implementation measures
Phase 3 (2027-28 and 2028-29): Impact and implementation study in nine schools	**Implementation and impact evaluation:** Conduct RCT study of TechXperts effectiveness; conduct study of implementation fidelity	Understand TechXperts effects on reading achievement, selection of STEM endorsement, earning Computia ITF+ industry certification, attendance, and disciplinary events contextualize impacts using data on implementation fidelity
Phase 4 (2028-29): Reporting and dissemination	Analysis and reporting	Produce final report detailing study findings and lessons learned for replication and testing in future contexts

Starting in January 2027, the evaluation will begin a rigorous two-year impact evaluation designed to meet WWC standards without reservations to examine the impacts of the intervention on students' reading achievement, computational thinking skills, school attendance, and attitudes. In concert with the impact study, there will be an implementation study that will inform future replication and scales-up of TechXperts by examining how and under what conditions the intervention was implemented, whether the program was implemented with fidelity, and what the barriers to and facilitators of high-quality implementation of the intervention were. Exhibit 12 lists the research questions for each component of the evaluation and the key data sources for answering each question.

Exhibit 12: Evaluation Research Questions and Data Sources	
Research Questions	**Outcome Data Sources**
Impact Study	

[redacted]

Impact 1: What is the impact of TechXperts on students' interest/engagement in computing as a career?	Study-administered survey student survey (Technology subscale of STEM Career Interest Survey)
Impact 2: What is the impact of TechXperts on students' computing/IT skills?	Study-administered assessment (Computational Thinking Test)
Impact 3: What is the impact of TechXperts on students' computing identify?	Study administered survey (Computational Identify Scale)
Impact 4: What is the impact of TechXperts on 9th grade school attendance?	Administrative data: Days absent during 9th grade
Impact 5: What is the impact of TechXperts on 9th grade reading skill/achievement?	Administrative data: End of course grade in 9th grade ELA course
Impact 6: What is the impact of TechXperts on students; receipt of CompTIA ITF+ industry certification?	Administrative data: receipt of industry certification
Impact 6: What is the impact of TechXperts on students' understanding of STEM applications within computer science?	Score on CompTIA ITF* industry certification exam
Impact 8: What is the impact of TechXperts on students; receipt of CompTIA ITF+ industry certification?	Administrative data: receipt of industry certification
Impact 9: What is the impact of TechXperts on students' selection of the STEM endorsement graduation plan?	Administrative data: choice of endorsement
Moderators: Do student impacts differ by students' prior achievement, prior experience with computer science or coding, or demographic subgroups?	Administrative data, study-administered assessments and survey, and student baseline survey data
Implementation Study	
Fidelity of support component implementation: Are the key support components of TechXperts implemented with fidelity?	Data on indicators for each key components, as specified in the fidelity of implementation measure. Records of teacher attendance at training, program data on
Fidelity of program implementation: How many TechXperts' modules and other key program components did the students in the intervention group complete? Did dosage vary across schools or cohorts?	Program implementation data collected by implementation team
Mediators: Do schools in which TechXperts was implemented with higher fidelity have better impacts than schools in which TechXperts was implemented with lower fidelity?	

Impact evaluation designed to meet the What Works Clearinghouse (WWC) standards without reservations

Abt will conduct a two-year RCT, designed to meet WWC evidence standards without reservations, to estimate the effects of TechXperts on student outcomes. The study will be conducted in at least eight high-need high schools in a single large school district in Texas. In each high school, rising 9th grade students will be recruited to participate in the study. To be eligible to

participate in the study, students must (1) *not* have met grade-level expectations on the state reading test in the past two years (7th or 8th grade), (2) expressed an interest in participating in TechXperts class as an elective in 9th grade, and (3) returned signed parent consent forms agreeing to participate in the study and provide study data. IDRA and Abt team will work with the school staff to establish students' interest and eligibility for TechXperts and consent to participate in the study *prior to random assignment*. These procedures are outlined Objective 4 and in the Management Table (Appendix J).

In each cohort and school, we expect that at least 40 rising 9th-grade students will be interested in and eligible for TechXperts and will have permission to participate in the study data collection. In each high school in each year of the impact study, the pool of eligible students will will be randomly assigned, half to be in one class section of 20 TechXperts students and half (20 students) to receive business-as-usual services (another elective class offered by the participating schools).

Statistical Power. Each school will contribute two cohorts of students (2027-28 and 2028-29) for a student sample of 640 students (40 students per school in each of the two impact years and five schools- 20 TechXperts and 20 business as usual per cohort year in each of the 8 campuses totals 640 students). With this sample size, the expected minimum detectable effect (MDE) size for analyses of student outcomes will be 0.14[2] (see Appendix J for more details on full statistical power analysis). This is a reasonable and substantively meaningful impacts based on a meta-analysis of over 1,900 effect sizes from 747 RCTs evaluating education interventions for K-12 students with standardized test outcomes, where a median effect size was 0.10 SD (Kraft, 2019).

[2] MDE calculations from *PowerUp! (Dong & Maynard, 2013).* The power calculation assumptions use effect sizes in prior studies of SEL outcomes for elementary grades. Abt created a set of standard assumptions for calculating predicted power. See Appendix J for additional details on sample power assumptions and calculations.

Strategies for Minimizing and Addressing Attrition. Compositional changes to the analytic sample that occur due to attrition are a serious threat to the validity of findings from an RCT. We expect that attrition related to missing outcome data is likely to be low for the outcomes that come from administrative data collected by the districts from all students and its availability should not be impacted by treatment conditions. Also, since the length of the intervention is a single school year for each cohort of students, we expect that attrition related to students or schools leaving the sample in the one-year period is likely to be low. However, IDRA and Abt together will implement several strategies to minimize attrition. First, during recruitment of schools, IDRA will clearly communicate about the data collection requirements and the importance of the continued participation in the evaluation. Also, schools will receive a financial incentive to participate in the evaluation and students will receive a small incentive for data collection participation to maximize response rates. The study team will regularly communicate with participating schools to identify any concerns with attrition early and to co-develop solutions to limit attrition and keep participants engaged. Altogether, these strategies will help ensure that the study will produce strong evidence of TechXperts' effectiveness that will meet WWC standards without reservations.

As part of the analysis of the outcome data, we will calculate overall and differential attrition for each outcome measure and determine whether the study has low attrition (based on WWC attrition thresholds) and, therefore, is eligible to meet standards without reservations. If attrition on any outcome is shown to be high, we will assess baseline equivalence of treatment and control students on that outcome and adjust for observed differences in the analytic impact model to enable the findings to meet WWC standards with reservations.

Measures and Data Collection. All the proposed student outcomes are valid and reliable

and represent WWC-identified outcome domains eligible for WWC review. Exhibit 3 shows the study outcome measures, the corresponding WWC outcome domain, the analytic construct that will be derived from each measure, the reliability of the measure, and the baseline measure that will be used to establish baseline equivalence, if necessary. Although in a low attrition RCT, there is no requirement to establish baseline equivalence of the treatment and control samples, the Abt team will collect baseline measures to ensure that the study will still meet WWC standards with reservations if high attrition is observed and to use in the impact models, even if there is low attrition, to increase precision of impact estimates.

Abt and IDRA will collaborate during the development and pilot phase of the project to monitor project implementation activities and outputs as well as progress toward short-term outcomes for teachers and families so that IDRA can make mid-course corrections if needed. Fidelity of implementation will be assessed by defining a set of quantitative indicators for each key component in the logic model and generating an overall implementation score; in partnership with IDRA, Abt will establish a threshold for each key component that defines adequate implementation fidelity in the study sample. Abt will assess fidelity during each year of the evaluation phase for all treatment schools. This will serve as important feedback to the grantee on challenges to full implementation and where additional teacher training and feedback are needed. Primary sources of fidelity data will include IDRA program records and training logs (see Appendix J for a draft fidelity measure).

Exhibit 13: Proposed Student Outcome Measures

WWC Domain[a]	Outcome Measure	Reliability	Data Collection	Analytic Measure	Baseline Measure
Reading achievement	9th grade end of course grade in English	Standardized state test assumed by the WWC to be reliable	Collected from district or school records, depending on site	Six point scale, from A (6) to F (1)	Score on 8th grade end-of-year state standardized reading assessment

					(Texas STAAR)
Technology and Engineering Literacy	Computational Thinking Test (Román-González et al., 2017)	Cronbach's alpha = 0.793	Study administered in spring of school year	Total raw score	Same measure administered in fall of school year
Student attendance	School attendance	Standard educational indicator assumed by the WWC to be reliable	Collected from district or school records, depending on site	Number of days absent in 9th grade	Number of days absent in 8th grade
Academic dispositions	STEM Career Interest Survey: Technology subscale (Kier, et al., 2014)	Cronbach's alpha = 0.85-0.89	Study administered in spring of school year	Total raw score on technology career interest	Same measure administered in fall of school year
Academic dispositions	Computational Identify Scale (Kong & Wang, 2020)	To be determined using study sample	Study administered in spring of school year	Total raw score on technology career interest	Same measure administered in fall of school year
Industry-Recognized Credential, Certificate, or License	Receipt of CompTIA ITF+ credential	NA	Administrative data from district or school	Binary score	Score on 8th grade end-of-year state standardized assessment (Texas STAAR)

[a] *Based on the WWC Study Review Protocol, Version 5.0.*

The baseline data obtained from administrative data will come from spring 2027 for Cohort 1 and spring 2028 for Cohort 2. For the study-administered measures, the baseline will come from fall 2027 for Cohort 1 and fall 2028 for Cohort 2. All student outcomes will be collected at the end of the year for each cohort: spring of 2027-28 (Cohort 1) and spring of 2028-29 (Cohort 2).

Statistical Analysis Model. We will conduct intent-to-treat analysis on key student outcomes of being randomly assigned to the TechXperts course. To assess the impacts, Abt will use linear regression models, modeling each outcome separately (**Impact RQs 1-4**). While randomization should account for all observed and unobserved differences between the study groups, the regression model will adjust for (1) random assignment blocks based on students' cohort, school, and prior achievement, if feasible, (2) baseline measure of the outcome, and (3)

other student baseline characteristic – such as sex/gender, special education designation, English learner designation, or free- and reduced-price lunch status – to improve the precision of the impact estimates. The full statistical model (shown in detail in Appendix J) will estimate an average intent-to-treat effect across the random assignment blocks, controlling for baseline measure of outcome and other baseline covariates. We will assess whether the treatment impact is statistically significant using a two-tailed t-test at the conventional 0.05 level.

Understanding Differential Impact. To assess the differential impacts of TechXperts on student outcomes (**Moderator RQ**), we will incorporate an interaction of the treatment-by-moderator into the model, where the moderator is an indicator of students' prior achievement, prior experience with computer science or coding, or demographic subgroup of interest.

Assessing the Mediators. Finally, to assess whether fidelity of implementation is correlated with impacts (**Mediator RQ**), we will use a two-step approach. First, we will estimate impacts within each block defined by cohort and school, adjusting for prior achievement and prior interest in programming and computer science, if feasible. Second, we will estimate the relationship between these estimates and a measure of fidelity of implementation using a regression model. See Appendix J for more information on the analytic models.

Other analytic issues. The analysis will include all students with non-missing outcomes data. If there is low attrition, we will use multiple imputation to impute missing baseline data, which is an acceptable approach for dealing with missing data in the WWC standards. Finally, for each analytic sample, Abt will assess baseline equivalence of the study groups and adjust for any differences between 0.05 and 0.25 of standard deviations in the regression models to ensure that all analyses meet WWC standards.

Implementation Study. A key activity of the implementation study will assess the fidelity

of implementation of the key support components of TechXperts that appear in the program logic model. The study team will create a high-quality measure of fidelity of implementation, which includes (a) having a separate measure of fidelity for each of the key components, (b) defining each key component in terms of one or more indicators, (c) specifying a sample-level fidelity threshold for each key component across the indicators, and (d) measuring fidelity at least twice during the project. We plan to measure fidelity of implementation in each treatment school in each of the three cohorts. (See Appendix J for a draft of a measure of the fidelity of implementation of the TechXperts key support components.)

Beyond measuring fidelity of implementation of the key components of TechXperts, as referenced above, the evaluation will collect data from the teacher facilitators in each school about their experience leading the TechXperts course and about the effectiveness of the professional learning supports. This information will be collected in focus groups with teachers in each of the districts, which will be led by grantee staff. The focus group with participating teachers will also inform (1) adaptation needs and implementation barriers, (2) the conditions under which TechXperts is likely to have the greatest impact, and (3) what supports may be needed in sites to maximize the impacts of the intervention.

Providing Guidance for Replication and Testing in Other Settings. Data on fidelity and impacts from this evaluation will provide evidence that TechXperts is ready to be scaled at a broader level in states, districts and schools representing diverse implementation contexts. In addition, the study will conduct analysis examining whether the impact of TechXperts is related to characteristics of schools, classrooms, teachers, and students.

Performance feedback and periodic assessment of progress.

Abt and IDRA will collaborate during the development and pilot phases to monitor project

implementation activities and outputs as well as progress toward short-term outcomes for teachers and students so that IDRA can make mid-course corrections if needed. The data collected to measure fidelity of implementation during the impact study will be discussed with IDRA at the end of each year of the impact study. Information on fidelity will also serve as important feedback to the grantee on challenges to full implementation and where additional teacher training and feedback are needed. The teacher surveys and focus groups will capture teachers' insight into program strengths and challenges.

Articulating Components, Mediators, Outcomes, and Thresholds.

The evaluation design is guided by clearly articulated **key components and key interim outcome** (teacher increased knowledge of computing/IT and/or fidelity of implementation) and student outcomes (interest/engagement in computing) that mediate impacts on student short-term outcomes (interest in computing/IT study and career, improved attendance), medium-term outcomes (increased understanding of STEM applications within computer science; increased computer science knowledge and information technology skills, increased reading skills, increased likelihood of earning CompTIA f ITF+ industry certification), and long-term outcomes (improved achievement in standardized state ELA subject-area tests, increased computational identity, and increased likelihood of choosing the STEM endorsement graduation plan), as depicted in the logic model in Appendix G. As defined by EIR, the key components for TechXperts include (1) professional development for teachers – including a three-week summer professional development for TechXperts teachers that also includes early literacy and numeracy resources to guide students' development of games for buddy classrooms; (2) a 12-module curriculum, and (3) community of practice offerings for teachers. Direct components include students completing course modules, students making buddy visits to PreK-1 students in a neighboring elementary

school, and student exhibition that showcases what students learned throughout their TechXperts course. High fidelity implementation of the key components and the direct components (**mediators**) is theorized to lead to improved engagement in school (as measured by school attendance) and more positive attitudes toward computer science, which is turn will lead to improved student computational thinking skills. Ultimately, these may lead to higher rates of choosing STEM endorsement as the graduation plan. Our thresholds for implementation fidelity are informed by previous implementation of TechXperts and are shown in detail in the fidelity measure shown in Appendix J.