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VisionCoders

The Intercultural Development Research Association (IDRA) proposes the development and evaluation of VisionCoders, a five-year Early-Phase EIR grant (**Absolute Priority 1: Demonstrates a Rationale, Absolute Priority 2: Field-Initiated Innovation- Promoting STEM Education, and Competitive Preference Priority 1: CS)**. VisionCoders is a collaboration of IDRA with Texas A&M University – San Antonio (TAMUSA) and seven school districts in the south side of San Antonio (East Central, Edgewood, Harlandale, Somerset, South San Antonio, South Side, and Southwest school districts). As required by EIR statutes, the majority of students served by this grant will be high need as defined by the State of Texas as at-risk of dropping out or economically disadvantaged. The proposed VisionCoders is a field-initiated, research-based computer science (CS) course that engages middle school students who are in at-risk situations as software designers who create educational games for pre-kindergarten through first grade (PreK-1) students. While the project targets high-need students with limited CS opportunities, it is inspired by the needs of PreK-1 students identified amidst the COVID-19 crisis. As young students struggle to navigate and adapt to online learning, the pandemic has forced schools and communities to rethink early childhood online educational resources and remote learning pedagogical practices. VisionCoders gives students the opportunity to contribute solutions – a vision in the face of unprecedented challenges – while learning valuable CS skills and identities.

Competitive Preference Priority 1: Computer Science: This project builds on research where students, underrepresented in CS fields, develop computational thinking skills and computing identity because they are tasked to design games, using visual coding platforms, that are meaningful to community needs (Ryoo, 2019). *Computational thinking* is defined as a problem-solving process that uses computational steps that are usually carried out by a computer (Shanahan, et al., 2010). The VisionCoders project also will provide students with the opportunity to develop computing identity by fostering their computing interest and ability to perform computing tasks and be recognized for their efforts (Mahadeo, et al., 2020). VisionCoders makes full use of two coding platforms, *Scratch*™ and *Code.org*™, shown to increase computational thinking skills. Additionally, the project expects to see gains in mathematical skills as evidenced by current studies that correlate the use of *Scratch*™ and *Code.org*™ to increases in math scores as students build computational thinking.

A. Quality of the Project Design

1.Goals, Objectives, and Outcomes to be Achieved by the Proposed Project

Over the life of the project, the VisionCoders course will serve 1,400 eighth grade students in at-risk situations, as defined by the Texas Education Agency, from seven school districts where less than 1% of students take a CS class before graduating. The VisionCoders project has three major goals: (1) Develop a VisionCoders course for students; (2) Develop a master's level class for VisionCoders teachers; and (3) Implement the VisionCoders course to increase the computational skills, computing identity and math skills of "at-risk" students. We discuss critical project components and, in Exhibit 2 and Appendix I.b: Management Table, delineate the objectives and details of development, piloting and refinement for both courses.

<VisionCoders Student Course: Developing Computational Thinking. The VisionCoders course design will teach students to create educational games through a curriculum that makes explicit computational thinking skills used in *Scratch*™ and *Code.org*™. Both share similar features: both use "block programming" where students create programs by dragging and dropping graphical "blocks" of puzzle-like code related to traditional code syntax. *Scratch*™ and *Code.org*™ facilitate the teaching of the following computation skills, which are foundational to success in CS and all STEM fields (Wu, 2018): **Decomposition,** the process of breaking down

larger problems into smaller pieces; **Pattern Recognition,** how students connect similar problems and plans; **Abstraction**, identifying the core of a problem or solution instead of focusing on extraneous details; and **Design Algorithm**, how students find simple steps to solve a problem.

Scratch™ and *Code.org*™ features enable students to: play with the games in *Scratch*™ and *Code.org*™ project galleries; learn computing concepts by modifying existing projects features, events, attributes and actions; plan out their own original characters, scenes, scenarios and games; and create, test and refine their original creations. More specifically, these features align with computational thinking, because they challenge students to plan through computer programing problems through: **Decomposing** problems and steps behind a game idea by breaking it down into chunks, such as understanding how to animate letters when users click on certain areas or how characters move through keyboard actions. *Scratch*™ and *Code.org*™ facilitate decomposing this and other gaming problems by providing graphics called Sprites that students can manipulate through actions, events, controls, logical operators and appearance controls so they discover to how to plan a game with multiple components without the need for prescriptive training; **Pattern Recognition** as students analyze how others have solved similar problems by reviewing and playing with programs created by thousands of other students; **Abstraction,** *i.e.,* learning by taking ideas from those programs and identifying needed for their own games. A VisionCoder may look for a way to present letters and sounds in alphabetical order and discover the solutions in a game found in *Scratch*™ galleries where a character appears and disappears upon clicking on certain areas in the background. The VisionCoders course and the two platforms will facilitate this step by teaching students to ignore details from the code that are not useful to their game and instead use steps that pertain to their problem (Arfé, et al., 2020); and **Design Algorithm**, where students through explicit lessons can plan the steps to program their game, using all of the computational skills experienced in the course of “playing” to learn.

The VisionCoders curriculum will first take students through *Scratch*™ then to *Code.org*™ to teach more advanced programming skills and deepen computational thinking by scaffolding lessons appropriately. Ultimately, as described in Exhibit 2, VisionCoders students will learn CS skills and computational thinking by creating and refining products and creating a portfolio of *Scratch*™ and *Code.org*™ games. By scaffolding skills and creating games, the VisionCoders course will build confidence among students, who have little or no computing or programming skills, to plan out increasingly complex games and activities.

< **Meaningful and Purposeful CS Experiences.** CS researchers repeatedly insist that curriculum is not enough. Students underrepresented in CS fields succeed when projects are meaningful to them and their community. Researchers consistently find that students in at-risk situations succeed when presented with the opportunity to make a difference in their community with meaningful, purposeful computing tasks (Ryoo, 2019; Resnick & Maloney, 2019; and Angevine & Cator, 2017). A recent article in the Association for Computing Machinery, a trusted source of research on the CS profession, summed up an endemic problem in CS education: “Too often, K-12 computing education has been driven by an emphasis on kids learning the ‘fundamentals’ of programming… leaving real world applications for ‘later’” (Tissenbaum & Sheldon, 2019). The authors echo the seminal works of Ryoo & Resnick and make the case for practices that are “founded on the idea that, while learning about computing, young people should have the opportunity to do computing in ways that have direct impact on their lives and their communities.” VisionCoders’ educational game component incorporates these recommendations by tasking students to create games for PreK-1 students as (1) a response to the current COVID-19 crisis that has the potential of continuing to profoundly impact the U.S. education system; and (2) a

purposeful activity that is meaningful to students in at-risk situations.

Students' education must extend beyond prescriptive, rote curricula to meaningful educational opportunities. IDRA embeds that philosophy in many of its programs, most especially in the Valued Youth Partnership, our 36-yearstrong flagship youth leadership dropout prevention program. VYP informs VisionCoders' key educational game design activity. In VYP, sixth to eighth grade students in at-risk situations, the majority of whom are Black or Hispanic, take an elective class during which they tutor kindergarten and first grade (K-1) students. The VYP model is based on the concept that students in at-risk situations thrive in settings where expectations are set high and matching responsibilities are given.

VYP tutors develop a sense of responsibility when given this leadership role. As part of the process, VYP tutors create activities for their students and collaborate with K-1 teachers to design lesson plans. These students, formerly seen as at-risk, rise to the challenge and engage deeply in the tutoring process. Over 30 years of experience implementing, researching and evaluating the VYP in the United States, Brazil and England has proven that students in at-risk situations build deep connections to the community of students they tutor, and the tutors do significantly better in school themselves. Those types of meaningful and purposeful connections are exactly what the CS educational community recommends as the context for student's computing creations. In COVID-19, virtual classrooms, VYP tutors continue to help kindergarten and first grade students remotely. It was their observations that K-1 students have been struggling in the COVID-19 era that sparked the idea for VisionCoders. While VisionCoders is not a variation of the VYP, the power of VYP student responses to the pandemic deeply influenced this project.

< **PreK-1 Student Visits.** Each VisionCoders student will present their projects at minimum on a quarterly basis to three PreK-1 students in their district. This will provide feedback for their

projects but also create the deeper sense of purpose and connection VYP students experience. VisionCoders students will see that their projects are of consequence and purpose and will rise to the challenge of improving the games they create. This deeper connection to a community need provides VisionCoders students with a heightened sense of self-efficacy, motivation to improve their projects and find solutions to create better games for the students assigned to them, and a sense of urgency to deliver products to younger children they have built relationships with.

< **VisionCoders Learn Basic Literacy and Numeracy Pedagogy.** The VisionCoders course will provide younger students with basic literacy and numeracy pedagogy lessons to guide the content of their games. As part of the course, students will use guidance documents, developed during the project, based on What Works Clearinghouse's early childhood literacy and numeracy publications (Shanahan, et al., 2010; Frye, et al., 2013). For example, if students are creating a read-along story about a puppy, VisionCoders students can include questions and activities from the Reading Process found in WWC publications. These can include Activating Prior Knowledge ("Think about the dogs you have seen. How many legs do they have? Do they all have tails?") and Setting a Purpose activities ("What do you want to know about puppies?"). IDRA's curricular and professional development staff have extensive experience in training VYP teachers and students.

< **Computing Identity.** The VisionCoders design is aligned with nascent definitions of computing identity (Mahadeo, et al., 2020). Researchers at Florida International University proposed a framework that defines students' computing identity by correlating increases in interest, performance and recognition in computing to eventual engagement in CS fields. As discussed, the proposed project provides opportunities for all three. This is further described in Section A.3, Exhibit 5: Computing Identity Framework (CIF).

< **Professional Development and Technical Assistance.** Ultimately, iterative development

efforts on curriculum development, the master's level professional development course and the VisionCoders class lead up to the piloting and implementation phases of the project. These phases must include further assistance to observe project implementation across 12 campuses, assist teachers and students, and gather further refinement data. The professional development and technical cycle consists of: (1) Participating teachers' enrollment and successful completion of the TAMUSA master's-level course; (2) IDRA/TAMUSA's ongoing technical assistance to teachers and VisionCoders students during the pilot and implementation/testing period of the eighth grade class; (3) professional development modules for course and independent use; and (4) teacher participation in CS for All Teachers (https://www.csforallteachers.org), an online community of practice. Participation use and efforts in these supports will be documented for use in VisionCoders' formative processes and fidelity of implementation tool for evaluation purposes.

IDRA/TAMUSA's ongoing technical assistance to teachers during the pilot and implementation cycle will consist of a minimum of two visits to eighth grade classes where VisionCoders staff will observe using a project-created tool, provide feedback, model lessons as needed or suggested, identify student needs and create further support as necessary. Monthly VisionCoders staff meetings will serve to identify common issues that need to be addressed and provide further training and technical assistance. IDRA has provided thousands of teachers with successful professional opportunities and will leverage our experience to refine processes and ensure project, teacher and student success. Furthermore, all VisionCoders teachers will belong to CS for All Teachers, an online community of practice for CS teachers that is funded by the National Science

Exhibit 1: CS for All Teachers

- Connect novice computer science teachers with the resources and people they need to learn rudimentary CS knowledge and skills.
- Cultivate a deeper sense of learning for intermediate computer science teachers to improve their teaching practice.
- Challenge veteran computer science teachers to enhance their leadership skills to support their colleagues and advocate for CS education.
- Contribute research to the field about how best to support computer science teachers virtually.

https://www.csforallteachers.org/about

Foundation and managed by the American Institutes for Research (AIR). Exhibit 1 outlines what the platform provides.

< **Entrepreneurial Opportunities: Yearly Software Exhibition.** IDRA is a leader in the Bexar County STEM industry's efforts to increase effective pedagogies and practices across all districts in the area. Celina Moreno, J.D., IDRA President & CEO; Dr. Stephanie Garcia, proposed VisionCoders director; and Michelle Vega, IDRA's chief technology strategist, are an integral part of the Alamo STEM Ecosystem (ASE). The ASE is a community of practice committed to providing STEM experiences for students traditionally underrepresented in STEM/STEAM. IDRA will work with business leaders, involved with ASE, to provide entrepreneurial opportunities for VisionCoders students. IDRA and the ASE will organize a yearly exhibition of projects where students present their games to local IT business leaders to foment entrepreneurial opportunities. These opportunities will include sessions on creating business proposals and pitching ideas to potential clients. This showcase also presents crucial opportunities for student recognition, a key component in developing a computing identity.

Exhibit 2: VisionCoders Program Goals, Objectives and Outcomes

Goals	**Objectives**	**Outcomes**
Goal 1 The project will develop and establish eighth grade computer science VisionCoders course, professional development and materials to increase student computational thinking, computing identity and math skills.	**Objective 1.1** VisionCoders' instructional design team will create structures, alignment processes, development protocols, computational thinking process documents, observation tools and research-based pedagogical documents for use as guiding documents in development and pilot period of VisionCoders materials and course.	**Outcome 1.1** CS advisory team will report that the curriculum is appropriate and likely to increase students' computational thinking, computing identity and math skills.
	Objective 1.2 VisionCoders' instructional design team will create 10 to 12 curriculum units consisting of five to six *Scratch*™ fundamentals and five to six intermediate/advanced modules from *Code.org*™ materials.	**Outcome 1.2** CS advisory team will report that *all* curriculum and materials creation followed iterative development processes.

Exhibit 2: VisionCoders Program Goals, Objectives and Outcomes

Goals	Objectives	Outcomes
Goal 2 During pilot and subsequent implementation years (2022-2024), VisionCoders teachers will increase their computer science knowledge and pedagogical expertise through completion of a VisionCoders professional development summer course.	**Objective 2.1** VisionCoders instructional design team will develop a summer long credit-bearing master's level course at Texas A&M University of San Antonio to prepare teachers to deliver the VisionCoders course.	**Outcome 2.1** Teachers participating in the summer course will report a 50% increase in teaching computational thinking skills.
		Outcome 2.2 A year of teaching the VisionCoders course will result in 40% confidence in teaching computational thinking through the use of visual coding platforms like *Scratch*™ and *Code.org*™.
Goal 3 During pilot and subsequent years (2022-2025), VisionCoders students will increase their computational thinking, computing identity and math skills through completion of the VisionCoders program.	**Objective 3.1:** During pilot year (2022-23) and implementation years (2023-24, 2024-25), VisionCoders students in at-risk situations from 12 participating ASPIRE middle school campuses will improve their computational thinking skills, computing identity and math skills.	**Outcome 3.1** A year of participation in VisionCoders will result in a 10% improvement on a test of student knowledge of computational thinking as measured by the Computational Thinking Abilities Middle Grades Assessment.
		Outcome 3.2 A year of participation in VisionCoders will result in a 15% increase in students scoring at a "strongly agree" level on the computing confidence, interest/motivation, and sense of recognition.
		Outcome 3.3 A year of participation in VisionCoders will result in a 15% increase in students' state math assessment scores.

2. Design of the Project Addresses the Needs of the Target Population and Other Needs

< **IDRA and TAMUSA Respond to the Districts' Needs.** In the spring of 2019, Dr. Cynthia Teniente-Matson, President of TAMUSA, commissioned IDRA to provide a comprehensive profile on the socioeconomic, demographic and educational attainment of seven feeder school districts TAMUSA serves. These districts are East Central, Edgewood, Harlandale, Somerset, South San Antonio, South Side, and Southwest ISDs. The key findings of the report show that these seven districts: (1) are predominantly Hispanic; (2) have the highest levels of economically disadvantaged students in Bexar County, ranging from 82% to 95% of free or reduced-price lunch eligible students compared to 42% for the rest of the city's districts; and (3) represent some of the

starkest differences in adult educational attainment ranging from 28% to 42% having less than a high school diploma compared to an 8% average for the rest of the city's areas. The report's findings were the impetus to creating ASPIRE, a regional partnership between TAMUSA and the seven school districts. In a press event, Dr. Matsen stated, "ASPIRE will double down on common regional needs with joint initiatives that can escalate collective impact across the nearly 70,000 K-12 students in the ISDs." IDRA has provided districts in San Antonio youth leadership programs, family leadership models, equity-based research and training, administrator training and STEM professional development. VisionCoders builds on this work to target the CS and academic needs of San Antonio's largest underrepresented and economically disadvantaged student population.

< **Participating Campuses Demographic Profiles and Math Needs.** Across the seven ASPIRE districts, there are 15 middle school campuses, of which 12 will participate in VisionCoders. Appendix I.c lists all campuses, their demographic profiles and their performance on the mathematics state-mandated State of Texas Assessments of Academic Readiness (STAAR) standardized test. All but one campus are overwhelmingly Latino (85% to 99% with only one campus at 68%). The state average Latino student population is 53% per district. The average percentage of economically disadvantaged students for ASPIRE campuses is 85% (with only one campus falling below 73%), compared to the state average of 61%. The table also shows that all but two of the campuses have more than 60% of students in at-risk situations compared to the 50% state average. Appendix I.c also demonstrates that the state passing rate for mathematics on the STAAR test is 57%. Only one of the 15 ASPIRE middle school campuses surpasses the state average. All others fall between 12% to 49% passing rates, with most falling under 40% passing. These performance rates are important to note as the VisionCoders project will not only address CS and computational thinking needs but measure improvement in math skills as a likely outcome

supported by research.

< **VisionCoders addresses ASPIRE'S CS Needs.** The following section describes the specific educational needs pertinent to **EIR's Absolute Priority 2 (STEM) and Competitive Priority 1 (CS)** that VisionCoders addresses. The Pew Research Center (Funk & Parker, 2018) reports the majority of STEM workers in the United States are white (69%) and Asian (13%), with Blacks at 9% and Latinos at 7%. The report finds that within the STEM job clusters, the majority of workers in computer-related jobs are also white (65%) and Asian (19%), while Blacks (7%) and Latinos (7%) remain underrepresented (Funk & Parker, 2018).

IDRA's profile of the VisionCoders' target districts shows that adult employment trends in computer-related fields fall well below the national average of 7%. According to our findings, in the largely Latino ASPIRE geographic area, less than 1% of adults work in computer-related fields. These findings require action across the education sector. Advancing the U.S. economy requires the development of a well-educated diverse CS workforce. Communities that invest in recruitment from a diverse STEM talent pool will experience a cycle of economic development (Perry, 2018). Overlooking any segment of the population will adversely impact our country's economic growth (Perry, 2018). The pandemic has shown us that workers in brick and mortar enterprises have been impacted due to their specific skillsets. Yet workers in information and CS fields have been less affected by the downturn. According to the Financial Times, "Tech companies are still hiring feverishly as they move to take advantage of a world shifting increasingly to digital as a result of the coronavirus, despite mass lay-offs elsewhere and growing concerns over plummeting global markets" (McGee, 2020). Unfortunately, the data show students in the seven target districts are unprepared for CS fields that are more resilient in tumultuous and chaotic economic cycles like the one we are currently experiencing.

Students in the target area are currently not being engaged to follow CS or STEM pathways in general, as evidenced by two indicators: (1) the percentage of students taking CS classes; and (2) the percentage of students graduating with a STEM endorsement (discussed further below).

Exhibit 3: CS Enrollment in ASPIRE Target School Districts

District	Enrollment in CS Classes in Middle and High School*	STEM Endorsement Graduates
East Central ISD	4%	11%
Edgewood ISD	2%	0%
Harlandale ISD	3%	3%
Somerset ISD	28%*	0%
South San Antonio ISD	29%*	0%
South Side ISD	0%	0%
Southwest ISD	4%	0%

**The majority of these classes are general computer use and productivity suite classes.*

Exhibit 3 shows that the ASPIRE target districts struggle to enroll students in CS courses that lead to interest in CS as a career. The majority of CS courses available to students in the ASPIRE middle school and high school campuses fall into two broad subject CS categories recognized by the Texas Education Agency; (1) **Computer Science** courses predominantly include general computer use, productivity tools and internet use. While the state standards for these technology application courses can include programming and CS, few technology applications classes in the ASPIRE districts include CS components; (2) **Information Technology** courses, depending on the district, can include computer programming. The two districts with higher rates of CS enrollment (28% and 29%) have campus-wide recommended IT principles classes. But these classes are not programming or Advanced Placement CS.

< **Texas STEM Endorsements.** Since 2014, under the state's main high school graduation plan, Texas students must choose an endorsement in eighth grade, which is akin to high school "majors" where students can prepare for future college and career choices. Endorsement choices are: Art and Humanities, Business and Industry, Public Service, Multidisciplinary Studies, and STEM. The Texas Education Agency data concerning the percentage of students graduating with a STEM

endorsement is telling. Two ASPIRE districts, Harlandale and East Central ISDs, have embarked on IT initiatives, offering cybersecurity career tracks for students. As a result, these districts have higher STEM endorsement declarations and graduations than other ASPIRE districts. On the whole, the data show that in most of the districts fewer than 1% of students are graduating high school with STEM endorsements and few are taking CS/programming classes in middle or high school. Although all ASPIRE campuses offer middle school technology classes and three of the larger districts strongly recommend that students take these offerings, only the two districts that offer cybersecurity classes have an uptick in solid STEM endorsement graduations. This leads to two conclusions about how VisionCoders must address the needs of these districts: (1) Middle school classes that concentrate on solid CS principles are likely to affect students' computation thinking and computing identity; (2) This increase in CT and computing identity will likely correlate to an increase in middle school students taking more CS classes and graduating with STEM endorsements. It is at this juncture that VisionCoders' design and goals are poised to increase the number of students, currently underrepresented in STEM/CS fields, who engage the field of study.

3. Proposed Project Reflects Up-to-Date Knowledge from Research/Effective practice

This section describes how the project reflects up-to-date knowledge and responds to **Absolute Priority 2: Demonstrating a Rationale supported by current evidence**. The narrative discusses how key project components of VisionCoders' logic model (found in Appendix I.a) are informed by the latest research with positive findings that suggest the project will likely improve relevant outcomes.

< **Logic Model Key Components** (See Appendix I.a). The VisionCoders project will align and adapt *Scratch™* and *Code.org™* units to a curriculum that will be used in an eighth grade middle

school class where students in at-risk situations will create games appropriate for PreK-1 students **(Logic Model Input-1 & 2).** The rationale for this basic task is backed by recent research concerning (1) the efficacy of *Scratch*™ and *Code.org*™ in increasing computational thinking **(Logic Model: Long Term Outcome)** and computing identity **(Logic Model: Short Term Outcome);** (2) that at-risk situations are more likely to be engaged with projects that answer a community need; and (3) the impact of *Scratch*™ and *Code.org*™ on mathematical skills **(Logic Model: Long Term Outcome).**

< Impact of *Scratch*™ and *Code.org*™ on Computational Thinking: (Input-1 & 2) (Long Term Outcome). The MIT Media Lab led by Dr. Mitchel Resnick launched *Scratch*™ in 2007 as a service free for all users. Since then, it has amassed over 25 million users worldwide. The visual approach engages students at many levels to experiment in computer programming through remixing existing programs, "tinkering" and creating games that are meaningful and serve a purpose in students' communities (Resnick, et al., 2009). Dr. Resnick cites personal anecdotes where students consistently take ownership of the process when their creations are used by students in their communities. Appendix I.d provides screenshots of the environment.

Recent studies conducted across the country and internationally have shown statistically significant increases in computational thinking (Decomposing, Pattern Recognition, Abstraction and Algorithmic design) when students use *Scratch*™ (Rodríguez-Martínez, et al., 2020). It is a topic that has garnered much attention among researchers who have demonstrated the positive effects of *Scratch*™ and *Code.org*™ on computational thinking in different contexts, *e.g.*, middle school coding competitions (Pultoo, et al., 2020) and on secondary and college students (Armoni, et al., 2015). Researchers posit that the graphical nature of these platforms facilitates the computational thinking process. Still, almost all of the research points to a need for curricula that

(1) explicitly teaches the computational thinking process as described in Section A.3, and (2) takes advantage of these platforms' ease of use to provide opportunities for students to create projects meaningful to them and their community (Ryoo, 2019).

Code.org™ was launched in 2014 by Hadi and Ali Partovi. Its curriculum and features can be more complex and include explicit lessons on the computational thinking steps. It has features for students at all grade levels from early childhood to high school. Research on students as young as six years old using the platform to learn computing basics have shown that *Code.org*™ improves planning skills (Arfé et al., 2020). The platform offers units across grade levels and has features that enable students to create increasingly difficult software, such as mobile apps. One study concluded that the *Code.org*™ features increase computational thinking skills not only because of the graphical nature of the platform but also because it enables students to view others' work, share versions of their own work and participate in online communities (Brown, 2018).

< **Computing for a Purpose** A deep review of the literature concerning CS pedagogy and curricular practices consistently return the following recommendations: (1) Computational thinking is difficult to teach through isolated teaching of programming skills and concepts; it is best taught through the creation of artifacts; and (2) Computational thinking is best developed when projects are meaningful to students. These recommendations are not simply theoretical propositions; they yield results. A study published by Dr. Jean Ryoo at UCLA in 2019 revealed how students observed over one year who were tasked to create projects meaningful to them and to their community provided "evidence that pedagogical efforts to demystify CS by making it relevant to students' everyday lives and social issues in the community, while also welcoming student ideas and perspectives, positively impacted student engagement in CS learning." All students in this study came from populations underrepresented in STEM and CS fields. The

qualitative evidence provided in this study showed that students' interests and ability to perform in CS work were deeply affected by creating meaningful opportunities to participate in computing tasks. VisionCoders is poised to provide students with the necessary experiences responsive to researchers' recommendations.

< Impact of *Scratch*™ and *Code.org*™ on Math Skills: (Input-1 & 2) (Long Term Outcome). In the past five years, several studies have been published concerning the impact of visual coding platforms on students' mathematical skills. In 2015, Design for Teaching in a Networked World published a peer-reviewed article concerning the results of a quantitative quasi-experimental study that followed the mathematical achievement of middle school students using *Scratch*™. After training and three months of using *Scratch*™, the experimental group showed a statistically significant gain in mathematical skills and knowledge (Calao & Moreno-León, 2015). This led researchers to the conclusion that the gains made in computational thinking using a highly motivating visual coding environment led to increased mathematical reasoning. Another study of interest concerning visual coding environments and math skills is a research project where students with no CS background were asked to model solutions to a mathematical skill (least common multiple and greatest common denominator) by creating a game using *Scratch*™ to teach these skills (Rodríguez-Martínez, et al., 2020). Teachers taught computational thinking skills explicitly as part of the training and task. The results showed a statistically significant increase in computational thinking and in mathematical reasoning using pre-test and posttest measures.

To summarize **Section A.3 (Up to date Research and Effective Practices & Absolute Priority One- Providing a Rationale)** the studies cited provide evidence that visual computing environments like *Scratch*™ and *Code.org*™ align to our logic model (Appendix I.a) and are likely to positively impact computational thinking and math skills. Furthermore, the positive results of each study are aligned to our logic model with *Scratch™* and *Code.org™* as key components of our inputs.

4. Contribution to Understanding of Educational Problems, Issues or Strategies

This section will describe the following two potential contributions to the CS field: (1) Data on middle classes that may increase CS participation of underrepresented youth while increasing mathematical skills; and (2) Data concerning a recently proposed computing identity framework that can support further creation of curriculum and pedagogical practices to increase CS participation.

< **Mathematics Skills.** One of the measures that VisionCoders will likely improve are mathematics skills. Quasi-experimental studies as recent as 2015 describe statistically significant increases in math skills for students learning computational skills and programming using *Scratch™* (Calao, et al., 2015), (Rodríguez-Martínez, et al., 2020). The project is poised to contribute additional data to the field concerning this dimension of CT as: (1) the population the project will serve is representative of students in at-risk situations across the country in need of interventions that increase mathematical skills; and (2) the sample sizes in our study will be larger than those in most current research.

< **Computing Identity.** Researchers (Mahadeo, et al., 2020) have recently proposed that a computing identity framework is necessary to design programs that propel underrepresented populations (*e.g.,* Black, Latino and female) into CS fields. Researchers created the framework in hopes of correlating increased **Interest, Performance** and **Recognition** to future pursuit of CS studies and careers. The results of research around the framework have shown positive correlations between interest, performance and recognition in college students. VisionCoders' design is directly aligned to this framework. Through this project we hope to contribute to findings in this

burgeoning area of research. Exhibit 5 outlines the framework and its relationship to VisionCoders' components.

Exhibit 5: Computing Identity Framework (CIF)	
CIF Indicators	**VisionCoders**
Interest: Desire to learn about computing	• Students motivation to learn about computing stems from a need experienced by the community
Performance: Belief in ability to learn about computing	• Students use a curriculum and platforms that facilitate CS learning and foster computational thinking.
Recognition: Perceived recognition in computing:	• Students receive feedback and recognition from PreK-1 students who use their products. • Students participate in a programming showcase with CS professionals.

B. Adequacy of Resources and Quality of the Management Plan

1.Adequacy of the Management Plan to Achieve the Objectives of the Proposal

The VisionCoders Management Plan (Appendix I.b) describes goals, activities, timelines and personnel for achieving our three main goals: (1) Develop eighth grade CS VisionCoders course, professional development and materials; (2) Develop and establish a summer master's level course for CS teachers; and (3) Pilot and implement the VisionCoders program. Exhibit 6 describes that project phases and who will be served followed by a high-level description of the Management Plan.

Exhibit 6: Phases Overview

Appendix I.b: Management Plan describes activities, timelines and personnel in detail.

Year	Phase	Campuses	Classes	Students
January 2021-Fall 2022	Development (Goal 1 & 2)	0	0	0
Fall 2022- Spring 2023	Pilot (Goal 1 & 2)	4	8	200
Fall 2023- Spring 2024	Implementation & Testing (Goal 3)	12	24	600
Fall 2024-Spring 2025	Implementation & Testing (Goal 3)	12	24	600
Spring 2025 to December 2025	Analysis	0	0	0
		28	**56**	**1400**

For the rest of this section, please refer to Appendix I.b: Management Plan for details. The management plan follows the format recommended by the U.S. Department of Education.

< **Development Phase – Goal 1.** Each of VisionCoders' goals, objectives and activities fall into

distinct development, pilot and implementation phases. As described in Appendix I: Management Plan, during the curriculum development phase (spring to fall 2021), the instructional development team will complete Goal 1 activities. Goal 1 activities are designed to develop and establish the eighth grade CS VisionCoders course, professional development modules and materials to increase students' computational thinking, identity and math skills. These activities fall into two categories: (1) Preparing all team members to be fully knowledgeable in all foundational aspects of the project, *i.e., Scratch*™ and *Code.org*™ training, creation of computational thinking guidance documents, modification of WWC literacy and numeracy practice documents, iterative development protocols and pedagogical foundations for VisionCoders documents; and (2) Developing the VisionCoders course consisting of five to six curriculum units aligned with the *Scratch*™ online platform, five to six curriculum units aligned with the *Code.org*™ CS materials, and similarly-aligned professional development modules for independent study and use in the Master's level course.

< Development and Pilot Phases – Goal 2: Creation and Testing the TAMUSA Course. During the VisionCoders teacher course development phase (fall 2021 to spring 2022), the TAMUSA team leads and instructional design team will complete Goal 2 objectives and activities. These activities include: (1) creation of a summer course (onsite and online versions), refined professional development modules aligned with curriculum modules for course use and independent study, based on products from Objective 1; (2) piloting of the course in the summer of 2022 with the first set of teachers; and (3) completion of the course, during full implementation years of 2023-24 and 2024-25, by teachers from the 12 campuses.

< Pilot and Implementation Phases – Goal 3: VisionCoders Create Educational Games. Goal 3 consists of pilot year (2022-23) activities and full implementation activities (2023-24 and 2024-25), to be completed by the professional development/implementation team. Goal 3 pilot year activities implement campus coordination with counselors on student selection processes, technical assistance to CS teachers, selection of PreK-1 partner classrooms and assignment of PreK-1 students to VisionCoders. Two implementation years (2023-24 and 2024-25) are key for evaluation of program, as a total of 1,200 students will take the course over that time. This time will enable the implementation team to collect data across different contexts, test any modifications, provide technical assistance to teachers and produce end-of-year reports about refinements. This work is labor-intensive and requires that our professional development and implementation specialists at IDRA and TAMUSA collect data across the classes in the seven districts. IDRA staff has extensive experience in this kind of assistance and reporting. Two implementation years, following a pilot year, will allow us to document challenges across the districts in order to refine final products. We expect this level of work as necessary to produce a curriculum that is replicable and scalable across Texas and the nation.

2. Extent to Which the Costs are Reasonable

The costs associated with implementing the program during the development and implementation years are approximately $[redacted] per student, which includes the multiple professional development, technical assistance and observation time needed for final refinements throughout the life of the grant. Per IDRA's previous experience with federal research program grants, we exclude from the per-student calculation costs associated with evaluation, development management, consultant fees and personnel fringe benefits. However, VisionCoders' implementation and professional development after completion of the grant will be based on two factors: (1) The master's professional development course; and (2) costs to access professional development modules and curriculum materials. Once developed, piloted and tested, the master's level course will cost $[redacted] with fees ($[redacted] for a class of 25 students). Based on past experience, curriculum materials will cost approximately $[redacted] ($[redacted] per student for a class of 25 students). Given the costs of many professional development programs that charge upward of $[redacted] per day, full implementation costs for VisionCoders' products are quite reasonable.

3. Qualifications of Key Project Personnel

Exhibit 7 presents the key project personnel and their qualifications. This section also describes who is responsible for the two major types of activities: (1) Development activities are led by VisionCoders' instructional design team consisting of a VisionCoders director, curriculum specialist, professional development specialists, TAMUSA CS specialist, TAMUSA College of Education director and school district CS and curriculum personnel (Almost all activities are achieved as a collaborative, but certain activities will be led by members of the instructional design team and are designated as leads in the management plan); and (2) Implementation activities are carried out by the professional development/implementation team led by the director in collaboration by the professional development specialists, TAMUSA CS specialist, and district CS and curriculum personnel. While the teams are designated and have responsibilities, the teams are fluid. For example, the professional development and CS specialists will lend their expertise and feedback to development and implementation. As this project will serve seven districts, CS specialists and curriculum personnel from each district will serve on a rotating basis. However, all districts will serve as a part of the development and feedback processes.

Exhibit 7: Overview of Personnel Experience and Responsibilities	
IDRA VisionCoders Project Director	**Stephanie A. Garcia, Ph.D.**, has over 12 years of STEM experience. During her three-year doctoral fellowship, she served as a graduate researcher and collaborator on the TRESTLE project, working to incorporate evidence-based strategies such as formative assessments, peer-assisted learner models and STEM project-based learning to improve student engagement and learning outcomes at the University of Texas at San Antonio's College of Engineering. **Dr. Garcia** will oversee the project implementation, coordinate with partners and collaborate with internal and external staff to meet project objectives. She will oversee curriculum design activities, formalize relationships with TAMUSA, and manage monthly meetings with all partners and districts. She also will formalize the instructional design and professional development/technical assistance teams.
IDRA President & CEO	**Celina Moreno, J.D.,** is IDRA's President & CEO. She provides leadership to all IDRA programs and is currently leading efforts in broadening STEM for underrepresented students through national and

Exhibit 7: Overview of Personnel Experience and Responsibilities	
	international STEM Ecosystem efforts. She will (1) provide guidance in the day-to-day efforts of the project; (2) ensure that spending is relevant and within the project scope and in compliance with U.S. Department of Education guidelines; (3) avoid over-expenditure of award funds; and (4) comply with requirements for progress and final performance reports. **All of her efforts are in-kind.**
TAMUSA Computer Science Specialist(s)	**Smriti Bhatt, Ph.D.**, is an Assistant Professor of Computer Science in the Department of Computing and Cyber Security at Texas A&M University – San Antonio. Dr. Bhatt teaches cybersecurity and CS courses in the department. She received her Ph.D. in computer science from the University of Texas at San Antonio. **Dr. Bhatt** will provide her CS, computational thinking, education and curriculum expertise during the development, piloting and testing of project materials. She will serve as liaison with other CS specialists who will provide different perspectives and expertise on projects designed to increase participation of underrepresented students.
TAMUSA Director Dean of College of Education	**Carl J. Sheperis, Ph.D., NCC, ACS, CCMHC, MAC, LMHC, LPC**, over 20 years, has over 100 professional publications. He has authored seven textbooks, which are used at hundreds of universities throughout the world. Dr. Sheperis will ensure that all curriculum, products and technical assistance processes translate to high-quality professional development and post-graduate coursework of the highest caliber for a world-class university.
IDRA Curriculum Development Specialist	**Hector Bojorquez** 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 technology training to families. Mr. Bojorquez 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 VisionCoders program. Mr. Bojorquez will lead the development and implementation/technical assistance teams to create materials, manage timelines, and oversee continuous feedback processes.
IDRA Professional Development Specialists	**Dr. Linda Cantu and Michelle Vega** will ensure that all training, implementation and monitoring activities are executed for each objective. They will train teacher coordinators, provide technical assistance to teachers, and participate in instructional development and on the implementation/technical assistance teams. Over the past 20 years, they have trained thousands of teachers in asset-based pedagogies, youth leadership, technology, and IT/CS issues and pedagogies.
IDRA Project Evaluator Liaison	**Roy Johnson, M.S.,** will be the in-house VisionCoders project evaluation coordinator and liaison with the external evaluator. Mr. Johnson has had extensive experience with program evaluation and has a strong background in educational research, survey design, editing, program evaluation, and quantitative analysis. Mr. Johnson has conducted meta-evaluations for over 60 STEM-focused projects in 42 U.S. universities as part of a U.S. Department of Agriculture initiative.

4. Adequacy of Procedures for Ensuring Feedback and Continuous Improvement

The VisionCoders full management plan (Appendix I.b) includes detailed continuous feedback activities throughout the development and piloting cycle. The process follows these steps: (1) Preparation; (2) Design; (3) Testing/Pilot; and (4) Refinement.

Goal 1, Objective 1.1 describes activities (1.1.3-1.1.8) where the instructional team meets regularly to prepare guidance documents before the course curriculum is written. Also, the product of Activity 1.1.8 is a set of iterative development tools to guide the feedback and improvement of the project's products. Goal 1, Objective 1.2 describes a cycle of development, testing and refinement activities for each component. For example, the team creates modules in Activity 1.2.1. using the guidance documents from Objective 1.1. Activity 1.2.2 then states, “Instructional design team will test first draft of first five to six *Scratch*™ VisionCoders modules with two middle school classes in target campuses using Activity 1.1.8 process.” Results are integrated into model in activity 1.2.3. The feedback and improvement processes are built into all activities in this manner. The *Code.org*™ curriculum components are designed tested exactly the same way Activities 1.2.4-1.2.6. To create the masters level professional development course, online and onsite PD modules, Goal 2 activities take the products of Goal 1 and repeats a similar process with development, piloting and refinement of the masters level course within a reasonable amount of time. Activities 2.1.1 to 2.14 detail the creation, piloting with teachers and refinement activities using tools and processes created in development activities 1.1 and 1.2.

Goal 3 activities include the culminating VisionCoders class pilot year (2022-23) and full implementation/testing year (2023-24 and 2024-25) activities of the grant. As such, the pilot activities are critical to providing feedback to refine a curriculum and process that has been thoroughly refined by the instructional design team. During Goal 3 pilot year activities, the professional development/technical assistance team will document all processes for student selection, technical assistance, student product creation, teacher efficacy and all iterative processes. The documentation will be used for final recommendations on refinement.

< **Advisory Team (Activity 1.1.2** and **Measures 1.2.e, 2.1.f).** To provide external feedback to the project’s continuous improvement loop, an advisory team will convene to report on the project’s processes, products, evaluations and intermediate outcomes. The proposed advisory team will consist of two curriculum experts, two CS education researchers and local teachers. Appendix I.e lists experts who have committed to serving on the advisory team.

5. Dissemination of Project Results and Products

IDRA will disseminate project results and products in three ways: (1) a communication plan designed by IDRA's award-winning communications department that will include yearly articles, podcasts, webinars and infographics; (2) project presentations at AERA, CS conferences and international STEM Ecosystem conferences; and (3) submission of project results to peer-reviewed journals. We will leverage IDRA's highly successful communication strategies that apply multi-channel methods that currently reach thousands of stakeholders each month. Part of our matching costs will come from IDRA's communications efforts.

C. Evaluation Plan

Abt Associates, a highly qualified evaluator, will conduct an independent formative and summative evaluation of VisionCoders. The proposed project director for the evaluation component is a highly-skilled researcher who has experience as a technical lead on multiple evaluations of educational interventions. Abt's evaluation will follow the phases of the project, as shown in Exhibit 8 below.

Exhibit 8: Project Phases and Associated Evaluation Activities

Project Phase	Abt Evaluation Activities	Goal of Evaluation Activities
Phase 1 (Year 1): Intervention development	Develop study design plan, draft fidelity measure, data collection procedures	Prepare for evaluation
Phase 2 (Year 2): Pilot study in four schools	**Formative evaluation:** Conduct interviews/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	**Implementation and impact evaluation:** Conduct quasi-experimental study of VisionCoders effectiveness; conduct study of implementation fidelity	Understand VisionCoders' effects on math achievement, computational thinking 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

IDRA and Abt have developed research questions specific to each phase (Exhibit 9). The research questions during the Formative Evaluation are designed to provide rapid, actionable feedback that can inform the continued development of the VisionCoders model and support ongoing monitoring of teachers' and students' experience with the curriculum and, in turn, program improvement. To provide timely information on implementation strengths and challenges, Abt will prepare descriptive data analyses during and immediately after the pilot year so that IDRA can make improvements to the program model for the first year of the evaluation phase. The research questions during the Evaluation Study (Years 3 and 4) are designed to understand implementation fidelity and produce evidence that meets WWC standards with reservations about VisionCoders' effectiveness in improving students' computational thinking, computer identity and math achievement.

Exhibit 9: Research Questions for Formative Evaluation and Impact and Implementation Evaluation

Questions		Data Sources
	Formative Evaluation	
1.	How effective did teachers think the professional development was? Were there any topics on which teachers needed more or different professional development?	Teacher interviews
2.	Were teachers able to implement the VisionCoders as intended? Are there additional resources and supports that could aid successful implementation?	Teacher interviews, classroom observations
3.	To what extent did students find the VisionCoders curriculum clear, well-organized and enjoyable? What challenges did students experience?	Student focus groups
	Impact and Implementation Evaluation	
1.	Do students who participate in VisionCoders have higher average *math achievement* at the end of one year of VisionCoders compared to matched students who do not participate in VisionCoders?	Administrative data
2.	Do students who participate in VisionCoders have higher average *computational thinking scores* at the end of one year of VisionCoders compared to matched students who do not participate in VisionCoders?	Study-administered assessment data
3.	Do students who participate in VisionCoders have more positive attitudes toward CS at the end of one year of VisionCoders compared to matched students who do not participate in VisionCoders?	Survey data
4.	Is VisionCoders more effective for some student subgroups than others? For example: Is VisionCoders effective for "at-risk" students? For girls?	Outcome data above coupled with demographic data
5.	To what extent is VisionCoders implemented with fidelity?	Course records, attendance, teacher surveys, observations
6.	How does implementation fidelity vary across schools and cohorts (pilot year, first full impact year, second impact year)?	*Same as above*
7.	Do classrooms or schools in which VisionCoders is implemented with fidelity have greater improvement in student outcomes from baseline to posttest than classrooms or schools in which VisionCoders is not implemented with fidelity?	*Same as above*

The Evaluation Phase during school years 2023-24 and 2024-25 will include both an implementation study and an impact study.

1. Methods of Evaluation will Meet WWC Standards

The impact study, designed to meet WWC standards with reservations, will use a student-level Quasi-Experimental Design (QED) to compare outcomes for students in the VisionCoders course to outcomes for a matched group of comparison students in the same schools. The study will be conducted in 12 middle schools representing seven districts. In each middle school, 50 eighth grade students will be recruited for VisionCoders (two classes of 25 students each), and students not enrolled in VisionCoders will be selected for the comparison group. Each school will contribute two cohorts of students, one in the 2023-24 school year and the second in the 2024-25 year, for a total of 1,200 students in the intervention group (see Exhibit 10 and also mentioned in Exhibit 6). Abt will use propensity score matching to select an equivalent number of comparison students who are similar to those participating in VisionCoders on baseline characteristics, including demographics characteristics and math and reading achievement from the year prior to the intervention. Comparison students will receive business-as-usual instruction, which may include some basic computer instruction. Parents/guardians will be asked to give consent for their child's participation in the evaluation, including allowing them to complete annual surveys and for the evaluators to gain access to achievement and demographic data.

Exhibit 10: Number of Participating Schools and Students, by District and Overall

District	# middle schools	Cohort 1 (2023-24) - # of students		Cohort 2 (2024-25)- # of students	
		VisionCoders	Matched comparison	VisionCoders	Matched comparison
East Central ISD	1	50	50	50	50
Edgewood ISD	2	100	100	100	100
Harlandale ISD	2	100	100	100	100
Somerset ISD	1	50	50	50	50
South San Antonio ISD	2	100	100	100	100
Southside ISD	2	100	100	100	100
Southwest ISD	2	100	100	100	100

Exhibit 10: Number of Participating Schools and Students, by District and Overall					
Total	**12**	**600**	**600**	**600**	**600**

2.Evaluation will Provide Valid and Reliable Performance Data on Relevant outcomes

The evaluation will provide valid and reliable performance data on the key outcomes of interest using measures that meet WWC standards for reliability and validity (Exhibit 11). IDRA will request extant student-level administrative data on students' achievement and demographic characteristics from districts. To assess students' CS skills, the study will use the Computational Thinking Abilities Middle Grades Assessment, which is reliable, developed for middle school students, and provides a reasonable measure of computational thinking for both intervention students and those in the comparison condition who have not had access to a computer programming class. Appendix I.f – Exhibit 2 includes references to reliability/validity measures. IDRA will administer this assessment along with selected subscales of the Computer Science Attitude Survey to intervention and comparison group students via their existing online survey platform. Both measures will be collected twice, at the start and end of students' eighth grade year, with survey data transmitted directly to Abt to ensure independence. Small incentives for data collection participation will be offered to maximize response rates.

Exhibit 11: Outcome Measures for Impact Study

Domain	Outcome	Reliability/Validity	Baseline Measure(s)
Math achievement	STAAR eighth grade mathematics test	Standardized tests (WWC assumes that state tests meet outcome standards for validity and reliability)	STAAR seventh grade mathematics test
CS achievement	Computational Thinking Abilities Middle Grades Assessment	Cronbach's alpha of .834 (Appendix I.f – Exhibit 2)	Same measure administered at start of eighth grade
CS self-efficacy and computational thinking identity	Computer Science Attitude Survey	Cronbach's alpha of .83 to .91 depending on subscale (Appendix I.f – Exhibit 2)	Same measure administered at start of eighth grade

The analysis approach will compare changes in the outcome for students in the VisionCoders class to changes in the outcome for students in the comparison group. The models will adjust for clustering of students within middle school (at the start of the intervention), baseline measures, student demographics, and cohort (see Appendix I.f for the impact model). Separate models will be estimated for each outcome. Abt will ensure that all analyses for each outcome meet WWC standards for baseline equivalence (differences less than or equal to 0.25 standard deviations) by including the appropriate baseline measure in the analytic model and by using propensity score matching to select comparison students who are similar to those participating in VisionCoders. The study design plan developed during Phase 1 will specify the variables to be included in the propensity score model and the approach to balancing the groups (*e.g.*, nearest neighbor matching). The impact study will be powered to a minimum effect of 0.132 standard deviations (see Appendix I.f for more details on the power analysis).

3.Evaluation will Articulate Key Components with Thresholds for Acceptable Implementation

The VisionCoders intervention has four key components: the student curriculum, teacher supports, partner PreK-1 classrooms, and student showcases (see Appendix I.a: Logic Model). The implementation study will assess the fidelity of implementation of each of these components, providing necessary context for interpreting the impact findings during the Evaluation Phase. As shown in the final research question (Exhibit 9), implementation data will allow for exploration of the relationship between implementation and impacts to draw conclusions about effective strategies suitable for replication or testing in other settings.

As mentioned above, Abt will work closely with IDRA during the Development Phase to finalize appropriate and systematic measures of fidelity of implementation for each of the key components of the program logic model and to revise the logic model's components, mediators, or outcomes if needed. The implementation measures will include quantitative indicators of full implementation for each component (see Exhibit 12 for possible indicators) and will go beyond fidelity of the key components to understand implementation quality using data from teacher surveys and classroom observations. Exhibit 1 in Appendix I.f: Impact Analysis Model provides more details on each of the data sources, along with the timing and sample for each. Abt and IDRA will determine what constitutes adequate fidelity at the school level and at the sample level for each measure, and Abt will pilot test the measures with the four schools in the pilot year to provide preliminary data to IDRA for setting fidelity thresholds. During the Evaluation Phase, Abt will assess implementation of VisionCoders in each treatment classroom and school.

Exhibit 12: Key VisionCoders Components and Possible Indicators

Key Components	Indicators
Student curriculum	• Number of *Scratch*™ curriculum units developed • Number of *Code.org*™ curriculum units developed
Teacher supports	• Number of teachers who complete the master's level course • Number of teachers who participate in all *Scratch*™ and *Code.org*™ professional development modules • Number of teachers who participate in IDRA-provided professional development and technical assistance • Number of teachers who participate in the online community of practice
Partner PreK-1 classrooms	• Average number of educational games each student develops • Average number of times each student visits partner classroom
Student showcase	• Whether showcase occurs each year • Number of students who participate in showcase

COVID-19 Challenge

The uncertainty of the current climate calls for us to state that IDRA's has proven capacity to carry out all the work outlined in this proposal and has prepared remote classroom contingencies to assist teachers and students should the need arise in the implementation years of this proposal. During this time, IDRA has supported schools through our Online Learning – Free Webinar Series, a bilingual weekly electronic newsletter with resources for schools and families responding to coronavirus (COVID-19) and links to important research and resources families. Since March 2020, IDRA created over 30 free webinars and conducted all of our work with districts remotely. We stand ready to work with our partners through these uncertain times.