

Superhero School: Harnessing the Power of Science, Literacy, and Media

Twin Cities Public Television's proposed Ready to Learn project, *Superhero School: Harnessing the Power of Science, Literacy, and Media*, focuses on building the science and literacy skills of children ages 5 to 8. The project will deliver, in English and Spanish, 40 half-hour animated television shows; a suite of interactive games with embedded assessments and analytics, built on an innovative platform that serves as the project hub; an array of digital media including apps, ebooks, blogging and sketching tools, and a children's website; and outreach activities and materials that equip educators and parents to support the academic success of children at risk for academic failure.

Superhero School addresses Invitational Priorities 1 and 2. The project design integrates the development of all components and is built on a solid foundation of research about best practices for science and literacy education as well as using media most effectively for learning. It features new approaches to developing educational media, with an emphasis on reaching Latino communities and supporting the needs of children with disabilities. Formative and summative research, conducted by an independent evaluator, will inform the development of all project components and assess their effectiveness in improving children's academic achievement.

A. SIGNIFICANCE

In recent decades, science learning in U.S. early elementary schools has been marginalized as schools have turned their focus to reading and math. In 2012, a Noyce Foundation report noted:

- 1) Instructional time for science in the elementary grades (grades 1–4) has dropped to an average of 2.3 hours per week, the lowest since 1988; and
- 2) Aggregated national and state data indicate that less time for science is correlated with lower scores, accounting for approximately 12 points of the National Assessment of

Educational Progress (NAEP) Science Scale at grade 4 (Blank, 2012, p. 3).

To put this in perspective, the 2.3 hours spent on science compares to 11.7 hours on English language and reading and 5.6 hours on mathematics each week (Blank, 2012, p.7).

While eighth graders nationally scored higher in science in 2011 than 2009, 35% of students performed below basic proficiency, with substantial differences by race and income (NAEP, 2013). For example, 20% of white students performed below basic proficiency, while 63% of black students and 52% of Hispanic students performed below proficiency. Among students who were eligible for free/reduced price school lunch, 52% performed below basic proficiency. Students with disabilities and English Language Learners also struggle in science, with 66% and 83% respectively testing below proficiency (U.S. Department of Education, 2013).

This data is even more alarming given that students with strong academic achievement in STEM are more likely to find jobs and earn higher wages. Career opportunities related to STEM have grown three times as fast over the past 10 years compared with jobs in other fields (U.S. Department of Commerce, 2011). Between 2008 and 2018, STEM occupations are projected to grow by 17% compared to 9.8% percent growth for non-STEM occupations, and STEM workers earn 26% more than their non-STEM counterparts (U.S. Department of Commerce, 2011). America cannot remain competitive in STEM fields without developing young people who are academically prepared to excel in these professions.

Studies have shown that individual interests in science often emerge before high school (Crowley, Barron, Knutson & Martin, in press; Tai, Liu, Maltese & Fan, 2006), underscoring the importance of increasing the science knowledge and skills of elementary school children. As the authors of one large study suggest, “Much effort has been focused on raising test scores and promoting advanced courses at later ages; however, we should not overlook the likelihood that

life experiences before eighth grade and in elementary school may have an important impact on future career plans.... We should pay close attention to children's early exposure to science at the middle and even younger grades" (Tai et al, 2006, p. 1144).

Improving the literacy skills of young children remains a critical need, as noted in *Early Warning: Why Reading by the End of Third Grade Matters*. This report points out that children from low-income families are more likely to graduate from high school and less likely to face poverty as adults if they are reading on grade level by the end of third grade (The Annie E. Casey Foundation, 2010). Yet a recent NAEP fourth-grade reading assessment highlights significant achievement gaps. The percentage of students scoring at or above proficient was 46% for white students, 20% for black students, 18% for Hispanic students, 9% for students with disabilities, and just 6% for English Language Learners (U.S. Department of Education, 2013).

A 2013 update of The Annie E. Casey Foundation report noted that more recent research suggests additional priorities: 1) address gaps in reading achievement for children with learning disabilities and those who are English language and dual language learners; 2) align science, technology, engineering, and mathematics (STEM) with literacy instruction; and 3) accelerate the use of technology for children to acquire reading proficiency (The Annie E. Casey Foundation, 2013, p. 2).

Drawing on these findings, Twin Cities Public Television (TPT) has developed *Superhero School* to address these areas of need by focusing on children facing achievement gaps, integrating science and literacy content, and using television and new media technologies to advance children's learning.

Focus on Children Facing Achievement Gaps

Through a widely broadcast public television series, *Superhero School* will reach a large

audience, including a high percentage of children from low-income homes, who watch kids shows on public TV more often than their middle-class peers (Corporation for Public Broadcasting, 2011, p. 5). The project's outreach initiatives and community partnerships will also be aimed squarely at this audience.

The TV series, interactive media, and educational resources will be provided in Spanish to reach the Latino population. While the U.S. population of children experienced just a 3% rate of growth in the past decade, the number of Hispanic children grew by 39% (O'Hare, 2011). It is essential to reach this growing audience to address the achievement gap between white and Hispanic children in both science and literacy.

TPT is committed to serving all children. While public television was a pioneer in providing television content that is accessible for audiences with disabilities, there has been less focus on accessibility for digital media. *Superhero School* has engaged a leading expert to consult on how to create digital media that serves children with disabilities, to inform the development of all interactive media produced for the project.

Integrating Science and Literacy

Superhero School will integrate science and literacy learning goals by aligning the content with K–2 Next Generation Science Standards (including Earth and Space Science, Life Science, Physical Science, and Engineering Design) and Common Core State Standards for English Language Arts & Literacy (reading for informational text, writing, and speaking and listening). Key academic vocabulary related to science content and inquiry will be highlighted across all components of the project, exposing children to new words in multiple contexts. In addition, we know from past experience that science topics and process often naturally integrate mathematics (especially measurement and data) and technology standards.

A substantial body of research supports *Superhero School's* integrated approach (Yore, Bisanz, & Hand, 2003; Cuevas, Lee, Hart & Deaktor, 2005). To guide our work, TPT has enlisted Dr. Youli Mantzicopoulos, Director of Purdue University's Scientific Literacy Project and author of several studies demonstrating that integrated science inquiry and reading activities are yielding gains for young children.

Using Media to Advance Children's Learning

Superhero School will provide educational content through engaging television, interactive experiences delivered on popular and emerging platforms and devices, and resources available in print and online, supported by blended training for educators and resources for parents. This approach builds on the successful outcomes of prior Ready to Learn projects. During the 2005–2010 grant years, “Two major studies found that when Ready to Learn video, online, and print materials were combined with teacher training, lesson planning, and classroom instruction, kids from low-income backgrounds were able to make such rapid and significant growth in reading that they narrowed or closed the achievement gap with middle-class kids” (Corporation for Public Broadcasting, 2011).

B. PROJECT DESIGN

TPT has designed *Superhero School* specifically to improve academic achievement in science and literacy among children (ages 5 to 8) most at risk for school failure. The project uses the power of narrative storytelling and interactive media, across multiple platforms, to engage the target audience in building key science content and thinking skills, learning related academic vocabulary, improving their reading and writing abilities, and gaining experience using new technology. Television, interactive, and print materials will be provided in English and Spanish, to support children who face even greater obstacles to academic success. *Superhero School* will

reach deeply into low-income communities through TPT’s extensive, well-established partnerships with schools as well as organizations focused on informal learning, including libraries, science museums, out of school time programs, and PBS member stations.

All elements of *Superhero School* will be shaped by:

- 1) established curriculum frameworks, including Next Generation Science Standards and Common Core State Standards for English Language Arts;
- 2) an integrated team that includes experienced media producers, independent researchers, and experts in early childhood, science education, best practices in game design and assessment for young children, ELL, and disabilities;
- 3) evidence-based research on the most effective uses of television and interactive media to significantly improve educational outcomes and narrow achievement gaps;
- 4) a process for continuous review and improvement through formative research as well as embedded analytics and assessments; and
- 5) new technology developments and innovations that maximize engagement and learning.

The *Superhero School* television series will feature a team of superheroes whose classroom adventures and challenges take them around the globe—and even to outer space. (Why not? *They’re superheroes!*) The series will reflect young children’s natural curiosity about the world around them and innate predisposition for asking questions—the very basis for scientific pursuits. The series will model both scientific inquiry and engineering design processes.

Specific project deliverables are described below. TPT has incorporated into the project design several strategies for ensuring that all components are of the highest quality and have maximum impact. We will develop all deliverables with extensive input from the project’s team of consultants and advisors. Embedded analytics and assessments, within an innovative platform

for delivering project content, will provide real-time data, enabling the *Superhero School* team to continuously improve the materials. A series of formative evaluations and implementation studies conducted by an independent evaluator throughout the project will play a significant role in shaping the most effective approaches and content for serving the target audience.

Deliverable 1: Develop and nationally distribute 40 half-hour episodes of *Superhero School* in English and Spanish.

TPT and Toronto-based Portfolio Entertainment, a leading producer and distributor of television programs for children, will produce 40 half-hour episodes of a new television series, *Superhero School*, based on *The New York Times* bestselling children's book *Superhero School* by Aaron Reynolds. His many successful books are well loved by children and admired by parents and teachers for their imaginative takes on everyday life. His picture book *Chicks and Salsa*, adapted for television by the PBS KIDS Ready to Learn series *Between the Lions*, earned that show two Emmy awards. His most recent work, *Creepy Carrots*, was a 2013 Caldecott Honor Book, a *New York Times* bestseller, and an ALA Notable Children's Book.

The TV series will be set in Superville, once a booming metropolis and home to many of the world's greatest superheroes but now just a shadow of its former self. The Incredible Blue Tornado is determined to restore the city to its glorious heyday. All this superhero needs is an energetic team who believes anything is possible when you set your mind to it, and a school that will help kids hone their skills and master their amazing abilities. When Mr. Tornado opens Superville's first Superhero School, the possibilities for adventure—and learning—are endless.

The children can't wait to exercise their extraordinary powers, which often get them into scrapes that require a different kind of superpower to resolve—and that add humor along the way. For example, when Maxie accidentally demolishes a wall while testing out her super

strength, an understanding of forces and motion (pushes and pulls can have different strengths and directions), cause and effect (a cross-cutting concept), and scientific methods (inquiry, designing and testing solutions, data collection and analysis) are the real superpowers she needs.

The series will feature a diverse cast of characters that reflect the diversity of our nation's children, steering clear of stereotypes about gender, race/ethnicity, abilities *and* disabilities. Our viewers will see that being the best in something (say, seeing through walls) is great, but Harold, who can't see at all, is often the first to figure out how to solve a problem. Sure, Maxie has super-human strength, but it's her powers of observation and the questions she poses (*relentlessly*, sometimes!) that frequently lead other children to new ways of thinking and coming up with a solution. And what would a superhero school be without a lovable class pet? Meet Fluffy, a robotic guinea pig programmed with a wealth of useful information. Fluffy is also the perfect crash test dummy and frequent volunteer subject of scientific experiments.

Each episode of *Superhero School* will include two animated stories (roughly 11-minutes each) that address specific educational goals for science content, scientific thinking, and literacy. Story formats will be conceived for ease in excerpting content to other platforms. Additional segments that support the show's overarching story narrative, ranging from one to three minutes, are an opportunity for innovative transmedia approaches that reinforce important concepts and featured vocabulary. In addition to *Superhero School's* creative team, which has produced across all media, TPT will benefit from the experience of advisor Erin Reilly, Creative Director of USC's Annenberg Innovation Lab and a transmedia expert who, along with consultant Dr. Meryl Alper, authored *T is for Transmedia: Learning through Transmedia Play*.

The flexible design of the series enables children to watch full episodes or selected segments, which are especially conducive to viewing on mobile devices. This is becoming increasingly

important given Common Sense Media's findings that mobile media use time for young children tripled between 2011 and 2013 from an average of 5 minutes to 15 minutes a day (Rideout, 2013). In addition, the animated stories will be produced so that key portions can be excerpted and easily used, alongside the shorter segments, in formal and informal education settings.

The 40 episodes will focus on core content in life sciences, earth sciences, and physical sciences; science and engineering practices; and cross-cutting concepts such as patterns and cause and effect. Elements of engineering and literacy (especially academic vocabulary, reading informational text, and writing) will also be woven throughout the series. The project builds on current research in science and literacy education as well TPT's decades of experience producing science television series in English and Spanish for young children at risk for school failure.

Deliverable 2: Develop (or license) and distribute a range of educational media products, create an innovative media and gaming platform with built in assessments, and establish a companion series website.

To create digital products for a wide variety of continually evolving platforms and devices, TPT will build on its experience in the current digital landscape while keeping a close eye on opportunities to take advantage of innovative new technologies. TPT has identified a set of goals that will guide our work, distilled from a list presented to the software industry in the *Ed Tech Developer's Guide*. Specifically, we will focus on: 1) improving mastery of academic skills; 2) increasing family engagement; 3) designing effective assessments; 4) improving educator professional development (see Deliverable 3, below); 5) making learning accessible to all students; 6) closing opportunity gaps; and 7) closing achievement gaps (U.S. Department of Education, 2015, p 7).

Table 1. Pod Development

Grade Level	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
K		3	3	3	3	12
1	1	3	4	4	4	16
2		3	3	3	3	12
Total	1	9	10	10	10	40

TPT plans to develop and distribute an array of educational media products, including videos drawn from the television series along with a suite of digital games, apps, nonfiction ebooks, comic ebooks, digital tools for writing and drawing, and hands-on activities and non-digital games. These resources will all be accessible, organized by show topics into collections we call “learning pods” outlined in Table 1 and available on a unique online platform that builds on the groundbreaking work of GlassLab Games, a nonprofit organization in Silicon Valley.

GlassLab Games, with backing from the Bill & Melinda Gates Foundation and the MacArthur Foundation, has become a pioneer in bringing assessment analytics to the educational gaming space. GlassLab’s game portal is seminal because it brings to scale game analytics and assessment capacities that previously were not feasible for small educational game products. Their approach offers a clear pathway for creating a broad array of educational games that are classroom friendly and support teachers’ needs.

Educators enter the GlassLab Games portal to: 1) discover highly effective, fun games tied to essential learning standards; 2) sign up; 3) create a class; 4) invite their students; 5) offer play time; and 6) view learning results. The platform enables educators to create class groups and assign children to engage with specific content, giving the teacher and children real-time assessments of their progress. Classroom management tools and a dashboard provide progress and outcomes data to educators, who can share a child’s information with parents.

GlassLab will partner with *Superhero School* to customize its existing platform, including its game analytics (for browser based games and apps) and assessment visualizations, to incorporate

a variety of project assets, organized in 40 learning pods that correspond with the standards alignment of episode videos. Since resources will always be available online, children can continue to play and learn at home. The structure of the platform, with data secured in private classroom spaces, meets COPPA requirements for maintaining children’s online privacy and safety.

Digital Games TPT’s in-house, experienced game designer and producers will collaborate with national digital gaming companies to create 25 games that address the needs of students in grades K–2. Engaging and immersive game experiences will adapt to children’s skill levels and involve parents, teachers, and caregivers not just as guides but also as fellow players and explorers. *Superhero School* games will link directly to the story narrative, educational goals, and visual look of the television series, with a primary focus on earth science, physical science, and life science across three game categories:

1. Mini-Games: target one grade level, focus on a single learning objective, short playtime, built on known game mechanics, high replayability;
2. Giant Games: target two grade levels, focus on multiple learning objectives, playtime over single or multiple sessions, mix of known and inventive game mechanics, high replayability;
3. Epic Games: target three grade levels, focus on multiple learning objectives, extended playtime over multiple sessions, inventive and innovative game mechanics, high replayability.

Table 2. Game Development

Grade Level	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Grade K		Mini	Mini	Mini	Mini	4
		Giant A				1
		Giant B	Giant D	Giant F	Giant H	2
		Epic A		Epic B	Epic C	1
Grade 1		Mini	Mini	Mini	Mini	4
		Giant A				
		Giant B	Giant D	Giant F	Giant H	2
		Giant C	Giant E	Giant G	Giant I	2
		Epic A		Epic B	Epic C	1
Grade 2	Mini	Mini	Mini	Mini	Mini	5
		Giant C	Giant E	Giant G	Giant I	2
		Epic A		Epic B	Epic C	1
Total Per Year	1	6	6	6	6	25

The games will feature digital, non-digital, and alternate reality elements that tap into sources of intrinsic motivation like curiosity, cooperation, and challenge to create short, medium, and long term game reward structures. Games will be designed for individual play as well as for co-play between children and peers and children and grownups. In Mini games, players will encounter mechanics that involve direct consequence for their actions toward a short term reward (such as seeing a plant grow). In a Giant game, those same players can experience more meaningful, medium-term experiences in which their actions and immediate rewards begin to connect and build towards a greater structure. For example, plants and animals that players have learned to nurture might begin to interact with one another.

Epic games will include the addition of a long term reward exposure to game structure, during which children can reflect on their accomplishments and have the opportunity to demonstrate the knowledge and skill mastery they have obtained through nurturing plants and animals by growing impressive self-sustaining ecosystems.

Analytics and data about children’s activities and progress in games and their mastery of the embedded learning objectives are a powerful tool, but *Superhero School* games will go a step further and apply that data dynamically to children’s experiences within the game as they play

and learn. Opportunities to apply concepts that children have struggled with will emerge more frequently, and the mastery of a concept will start the introduction of new concepts that match the preferred pace and learning style of each child by employing the game mechanics with the most success at the most effective levels of difficulty.

Superhero School games will be broadly accessible, fun, and educational for children with different based on their learning styles. Players will start at the introductory level and will not be limited to content by grade level, but rather by their individual understanding and progress in games so that all learners, from struggling to excelling, have an equal opportunity to engage with and master topics. All games will apply the best user experience and interactive tutorial techniques for children so that gameplay is intuitive and needs little text-based explanation, overcoming language barriers and keeping children immersed in the experience.

Superhero School games will be accessible for players with disabilities. To help steer this work, we have enlisted Dr. Meryl Alper as a consultant. Dr. Alper is the author of *Digital Youth with Disabilities* for the MacArthur Foundation's reports on Digital Media and Learning. This work examines how school-aged children with disabilities use media for social and recreational purposes, their individual preferences and needs, and the limits of existing platforms.

During Year 1 of the project, as part of the planning phase, TPT will outline the scope and educational content of the games it intends to produce. These requirements will be described in an RFP distributed to educational gaming firms such as Filament Games, GlassLab Games, Schell Games, Curious Media, and EduWeb. The RFP process will enable TPT to assess each company's creative approach for meeting the educational goals as well as their capacity to innovate and collaborate within the project parameters—time, technical, and financial. Given the number of games TPT plans to produce over five years, we expect to work with multiple firms.

Educational Apps Approximately half of the games will be created as apps for iOS and Android devices. Apps provide ongoing opportunities for innovation, utilizing affordances of mobile smart phones and tablets. As kids migrate to mobile, we will have a suite of games, connected to our assessment platform, ready for play in classrooms and home environments.

Digital Tools TPT will develop standard blogging and drawing tools, simplified for K–2 student users. These tools offer educators flexible lesson options. They can be used for science journals and as opportunities for children to create remixed and user-generated content based on the *Superhero School* characters. The drawing tool will include digital graph paper for building bar graphs and stickers for building pictographs. Text and image artifacts can be saved and shared within the classroom (and with parents) and used by teachers for assessment purposes.

Nonfiction ebooks Through a license agreement with educational publisher Capstone Publishing (www.capstonepub.com), TPT will offer a collection of 40 nonfiction ebooks aligned to science and literacy standards and that match (or complement) episode themes. With text and natural voice audio, these books are accessible for children with disabilities and provide scaffolded support for English language learners. TPT will provide these ebooks at no cost in perpetuity for children served by the outreach initiatives described in the following pages.

Comic ebooks TPT will develop a collection of 6 original 24-page comic ebooks with Capstone Publishing. Comics are a natural addition to the transmedia mix, offering great storytelling opportunities and high engagement for kids. Capstone has considerable experience in the comic genre, including a license agreement with DC Comics. *Superhero School* comics will deliver high-interest content at low cost, allowing for greater distribution and reach. Excerpts will be printed on inexpensive newspaper grade paper for distribution at outreach events. Capstone will also market print versions of the titles to the school and library markets.

Hands-on Activities TPT will create 40 hands-on, inquiry-based science activities that build on content featured in the TV episodes and align with the research-based practices as well as current science and literacy standards. TPT has established a strong reputation for creating activities that effectively balance open-ended and guided investigations with opportunities for extension into the humanities. Our activities require low-cost materials since most schools and community organizations cannot afford to purchase costly supplies.

Non-digital (i.e., analog) Games The project team will develop a collection of *Superhero School* games with materials (game boards, cards, etc.), and directions that can be downloaded and printed by educators and parents. The games will foster co-play in classrooms, afterschool clubs, and homes. For example, a second-grade classroom might play Who Are You? a simplified version of 20 questions that encourages children to apply what they've learned about animals, plants, and other science-related content.

Many of the resources on this platform will also be available on a mobile-friendly series website for children. For children accessing *Superhero School* outside of educational settings, TPT will create a mobile-responsive children's website with *Superhero School* videos, games, and other popular elements that engage children on television series sites. Kids will create their own superhero avatars, assigning themselves their favorite superpowers. A link to content for educators, parents, and caregivers will provide information about *Superhero School*, educational goals, episode and character descriptions, and related resources.

Deliverable 3: Conduct a national outreach initiative that provides resources and professional development training for formal and informal educators, using an established and tested model that combines online and face-to-face training through an extensive network of partner organizations.

TPT will model the multi-year educational outreach initiative for *Superhero School* on its successful *SciGirls* CONNECT program, a five-year, NSF-funded scale-up effort. *SciGirls* CONNECT combines gender-equitable, inquiry-based teaching strategies and video-related outreach activities that have proven to increase middle school girls' interest in STEM and improve their attitudes toward these fields (Flagg, 2010, 2012; Knight-Williams, 2008).

The vibrant network established by TPT includes 112 formal and informal education partner organizations from schools, universities, community-based organizations, afterschool programs, science centers and Hispanic-serving organizations hosting *SciGirls* clubs, afterschool programs, and summer camps in 34 states. The flexible nature of the program is its strength. Educators implement based on their organizational capacities and what works best for their communities. In turn, the *SciGirls* CONNECT network benefits from the diversity of implementation models, which inevitably provide ideas for other sites. The model works. TPT has established a cadre of educators who are in their second or third year of implementation. In other words, these groups sustain programming after their initial encounter with *SciGirls*.

Superhero School will build on this successful model by also recruiting libraries as partner organizations. Libraries expand the reach and accessibility of outreach activities because they have the capacity to offer technology-enhanced programming; offer resources in low-income communities; and focus on reaching immigrant communities, which are more likely to live below the poverty threshold (Child Trends, 2014). In addition, *Superhero School* project objectives correspond with the American Library Association's guiding principles in five Key Action Areas: Diversity, Equity of Access, Education and Continuous Learning, Intellectual Freedom, and 21st Century Literacy (American Library Association, 1998). To facilitate this work, TPT has recruited advisory board member Dr. Paul Dusenbery, director of STAR Library

Education Network, an NSF-funded program that builds the capacity of libraries and library staff nationwide to deliver effective STEM learning experiences in low-income communities.

Ultimately, strategic, quality partnerships will sustain and grow *Superhero School* outreach programs. By the end of the five-year RTL grant period, we'll have trained 1,200 educators nationwide to use *Superhero School* resources. Based on each trained educator working with approximately 20 students, we estimate that 24,000 students will have meaningful involvement in the program. As part of the recruitment effort, TPT will specifically seek out and recruit programs serving children living in poverty (defined by eligibility for the National School Lunch program). We will use multiple strategies for reaching our target audience. Along with libraries, we will recruit partner organizations from: Hispanic-serving groups, formal education, science centers, and community-based organizations. Broad use of the program will demonstrate the impact of *Superhero Schools* across different settings.

Table 3. Outreach Partnerships

Superhero School Organizations	Year 1	Year 2	Year 3	Year 4	Total Types of Organizations
Libraries		4	4	4	12
Hispanic-serving			4	4	8
Formal Education			4	4	8
Science Centers		2	2	2	6
Community-based		2	2	2	6
Total Organizations Per Year		8	16	16	---
Running Total		8	24	40	40
Educators Trained*		240	480	480	1200
Kids Reached**		4800	14400	24000	24000

*Assume 30 educators per training

**Assume each educator reaches 20 kids every year

Best Practice Resources

To create resources for educators, staff will conduct literature reviews and develop best practice recommendations for educators on several topics: inquiry-based science instruction; teaching with technology (tech integration); broadening participation (equitable teaching

strategies, introducing science role models to young children, and engaging Latino families). This approach has been quite successful for *SciGirls* as it helps ground our educational philosophy and serves as a framework for professional development. *SciGirls Seven: Proven Strategies for Engaging Girls in STEM*, now in its second printing, also guides our efforts to successfully involve girls in STEM (TPT, 2013). (See Appendix F for a sample.)

Spanish-Language Resources

TPT will translate all *Superhero School* episodes, educational activities and interactive content into Spanish, providing Hispanic-serving communities and educators with resources for their programs. We will also provide them with an updated version of our best-practices guide *Engaging Latino Families: Key Ingredients for Successful STEM Programs*. We will work closely with Dr. Alicia Santiago, the project's cultural competency consultant, to adapt this guide for *Superhero School*. The current version provides useful, research-based strategies for developing culturally relevant approaches, including:

1. **Build relationships and establish trust.** Latino involvement is premised on establishing personal relationships with community members and developing trust (Hobbs, 2004).
2. **Offer programming that engages the entire family.** Latino families from a range of backgrounds have a preference for activities that build and maintain cohesion within the family (Garibay, 2009). If parents accompany their children to an event or activity, they will feel more comfortable (Bruyere & Salazar, 2010).
3. **Integrate experiences that are culturally relevant and personally meaningful.** To successfully engage Latino audiences, particularly first- and second-generation Latinos, programs must reflect the cultural traditions, beliefs, and values of the people (Koss-Chioino & Vargas, 1999).

4. **Emphasize the program’s educational merit.** Latino parents value education (Gasbarra & Johnson, 2008; Casas et al., 2005) and have high aspirations for their children, hoping they will achieve a better standard of living and quality of life than they themselves have.
5. **Include a focus on careers.** By linking STEM activities and hands-on approaches to careers in science and technology, families are exposed to an increased repertoire of career options and subsequent wealth potentials (Sanchez & Arce, 2009).

Parent and Caregiver Resources

We’ll also create resources for parents and caregivers, distributed through partner organizations to the parents of children participating in the program. As with our educator resources, we’ll do literature reviews and develop research-based best practices for: 1) How to encourage science learning at home; 2) Information on co-viewing (TV) and co-play (interactive); and 3) How reading nonfiction can support science learning.

Superhero School will partner with The Connector, a new national resource that is the most comprehensive portal for STEM offerings, making connections to STEM learning opportunities that inspire young people to explore, discover and create. The Connector’s 5,000+ programs represent a full range of topics in STEM—including coding for girls, robotics competitions, science summer camps, and nature-based programming for children. The goal of this free, go-to resource for families is to connect the children to STEM learning opportunities. The mobile resource is simple to use, suggests opportunities based on user location, and is searchable by STEM events, programs and activities by zip code, areas of interest, and time period.

The Superhero School project design is summarized in our project Logic Model (Table 4), on the following page.

Table 4. Logic Model

RESOURCES/ INPUTS	ACTIVITIES/ STRATEGIES	OUTPUTS/ DELIVERABLES	OUTCOMES/AIMS	IMPACTS
<p>Expertise of project team (partners and contractors):</p> <ul style="list-style-type: none"> • TPT’s 30-year science television and 5-year transmedia educational content development • Portfolio Entertainment’s television production and int’l distribution • GlassLab’s Game’s analytics/assessment engine • Ed gaming firms • Capstone Publishing ebooks & <i>Superhero School</i> comic books • WestEd’s competencies in educational media and program research and evaluation <p>Advisory Board: Support from national leaders with expertise in education, technology, media development, science, literacy, ELL, assessment, and ed programs</p> <p>Project consultants—expertise in disabilities, cultural competencies in programs, integration of science & literacy, and children’s media</p> <p>Educational Outreach: Successful outreach program model, based on TPT’s <i>SciGirls</i> CONNECT</p> <p><i>SciGirls en Español</i> and <i>SciGirls en la Familia</i>—research-based best practices for engaging Latino families</p> <p>The Connectory for engaging families in their communities</p>	<p>Design, produce, and distribute <i>Superhero School</i> (SHS) transmedia resources to engage learners ages 5-8 with narrative and science + literacy content delivered across a variety of digital platforms.</p> <p>Advisory Board: Implement an active Advisory Board</p> <ul style="list-style-type: none"> • Annual meetings Years 1-5 • Working virtual meetings as needed • Regular email and phone communication <p>Educational Outreach: Design and develop blended train-the-trainer outreach model for libraries, schools, community-based organizations, science centers, and Hispanic-serving organizations hosting SHS clubs, afterschool programs, and summer camps.</p> <p>Family Engagement: Build on TPT’s experience supporting Latino families to include other underrepresented youth, including African-American and immigrant communities.</p>	<p>40 animated television episodes; innovative interstitials; kid-facing website; 25 interactive games, 13 of which are educational apps; 6 comic books/graphic novels; 40 non-fiction e-books; 40 hands-on activities for home and educational settings; drawing/sketch pad; student blogs/writing tools; and game content assessment platform with embedded analytics for tracking and sharing learner progress with students, educators, and parents.</p> <p>Advisory Board:</p> <ul style="list-style-type: none"> • Provide expertise/recommendations for project planning and implementation • Promote SHS at conferences, meetings and professional networks <p>Educational Outreach: SHS outreach program will train 1,200 educators in 4 years and deliver 40 programs to 24,000 youth across the U.S. The blended train-the-trainer model allows for community-based customization.</p> <p>Family Engagement: Create and distribute family toolkits that encourage science participation among underrepresented youth including Latinos, African-Americans, and immigrant communities. We estimate that at least 24,000 family members (one per student) will be engaged with the programs.</p> <p>Introduce families to STEM opportunities in their communities via The Connectory</p>	<p>Children across the U.S. increase involvement with engaging transmedia content that aligns to Earth and Space Science, Life Science, Physical Science, Engineering Design, Reading for Informational Text, Writing, and Speaking and Listening standards.</p> <p>Children learn: 1) science is about asking questions to understand how the world works; 2) scientists answer these questions using the inquiry process; 3) scientists are everyday people in communities who make a difference with their work.</p> <p>Advisory Board: Obtain valuable insights on SHS project plans, activities and evaluation, resulting in an optimized program and implementation plan.</p> <p>Educational Outreach: Increased knowledge, awareness and engagement with science + literacy amongst 1200 educators and 24,000 underserved youth</p> <p>Family Engagement: 24,000 parents and caregivers with increased knowledge, awareness and value of science + literacy learning</p>	<p><i>Medium and Long-Term: More children participate in media-enhanced formal and informal science and literacy education opportunities</i></p> <p><i>More children demonstrate measurable increase in science and literacy fluency</i></p> <p><i>Increased number of parents/caregivers valuing and supporting science learning opportunities for their children</i></p> <p><i>Increased number of underserved children from minority and immigrant populations engaging in science and literacy</i></p> <p><i>Increased number of organizations offering science and literacy content across multiple platforms</i></p> <p><i>Increased number of educators trained in best practices around science, literacy and cultural competency</i></p>

C. STRATEGY TO SCALE

(i) Capacity to Develop and Bring the Project to Scale

TPT, based in St. Paul, Minnesota, is one of the highest-rated PBS stations in the nation, reaching more than 1.3 million people every month through multiple broadcast and online channels. TPT's mission is to enrich lives and strengthen our community through the power of media. TPT National Productions, a division of the station, is a primary provider of programming for the public television system. Notable projects include the recent four-part series *Constitution USA with Peter Sagal*; the Sundance Film Festival-nominated *Slavery by Another Name*, the Emmy Award-winning *The Forgetting: A Portrait of Alzheimer's*; and the Peabody Award-winning *Liberty! The American Revolution*. TPT National Productions has won over 300 awards, including 25 national and regional Emmys, three George Foster Peabody Awards, the duPont-Columbia Commendation, and an Academy Award nomination for *Hoop Dreams*, named "Best Documentary of the 1990s" by film critic Roger Ebert.

TPT has an extensive track record producing high-quality television programs focused on science for children, creating engaging interactive experiences, and extending the impact of our work through outreach materials and activities, especially for children in low-income communities. TPT's children's television productions include *Newton's Apple*, *Dragonfly TV*, and most recently *SciGirls*. Each of these series reflects TPT's longstanding commitment to engage children in the wonders of science, helping them to experience science as a way to ask questions about and understand the world around them. Further, these projects exemplify how TPT, with its management structure, experienced staff, and station resources, has the capacity to:

- manage large-scale, complex, federally-funded projects, delivering high-quality content on time and on budget;

- create educational, appealing, award-winning television for broadcast by PBS;
- establish an integrated team approach for the production of television and interactive elements (website, games, and apps);
- deliver video, interactive, and print content in English and Spanish, free or at low cost;
- establish partnerships that enable projects to reach their target audiences in formal and informal education settings;
- leverage federal funding to attract additional corporate and foundation grants that extend the reach and impact of projects nationwide; and
- sustain projects for many years beyond initial funding.

Newton's Apple, originally hosted by Ira Flatow (current host of NPR's *Science Friday*) and sponsored by 3M, had a 14-year run on public television, from 1983–1998. It's where children ages 8 to 11 and their parents could tune in to learn about a wide variety of science topics, see angular momentum demonstrated by Olympic Gold Medalist skater Scott Hamilton, and find out about probability from Monty Hall, host of *Let's Make a Deal*. In addition to winning a national Emmy Award for Outstanding Children's Series, *Newton's Apple* earned an AAAS Science Journalism Award, Television Parents' Choice Award, and National Education Association Award. More than 30 years after *Newton's Apple* first aired, 300 episode clips—on topics ranging from animals and plants, earth and space, health and medicine, chemistry and food, technology and invention, physics and sports—are available to watch online. *Newton's Apple* was an early adopter of interactive strategies for educational engagement. The series produced a large CD collection, organized by science themes and featuring videos, interactive lessons, and games.

TPT created *Dragonfly TV* based on the national magazine *Dragonfly*, the first children's

publication to feature the work of leading scientists as well as children's own investigations and discoveries. TPT produced seven seasons of this TV series for elementary and middle school children, showing real kids doing real science. It was broadcast on public television from 2002–2009, with the last three seasons produced in partnership with science museums. The series garnered nine awards, including two Emmys and multiple Parents' Choice awards. The show is streamed on pbskids.org and available for stations to broadcast. *DragonflyTV* materials remain available as part of several prominent science education sites including the National Science Digital Library, Science and Math Informal Learning Educators (SMILE), Pathway (a Lawrence Hall of Science project), and Science Buddies, a national resource for science fair participants. *DragonflyTV* video podcasts are available on iTunes and streamed on YouTube. *DragonflyTV* attracted funding from the National Science Foundation and Best Buy Children's Foundation.

DragonflyTV was the forerunner to spinoff series *SciGirls*, which aired its third season in 2015. In a change of format and focus, *SciGirls* episodes showcase bright, curious tweens putting science and engineering to work in their everyday lives, encouraging and empowering girls ages 8 to 13 to pursue careers in STEM. Live action *SciGirls* are joined by two animated characters—a plucky SciGirl named Izzie and her best friend Jake, who tie the series together with their ongoing adventures. In each episode they find themselves in jams only science and engineering can fix. To set things right, Izzie literally hops onto the *SciGirls* website, which she runs, and recruits smart, curious real-life SciGirls, who put STEM to work and save the day. Izzie also invites viewers to hang out on the website, a totally safe social networking environment where girls can connect, create personal profiles and avatars, share projects, and watch every episode.

SciGirls is broadcast on 86% of PBS stations nationwide. Since its premiere in 2010, the series has aired 28 episodes, been broadcast over 44,500 times, and garnered an estimated 25

million gross viewer impressions. Full episodes are streamed on pbskids.org; they can also be downloaded free from iTunes and viewed on YouTube. Videos chaptered for educational use are available for free online. Videos and resources on the *SciGirls* CONNECT outreach website (scigirlsconnect.org) are available in English and Spanish. The shows were recently sold internationally to South Korea, where the series currently airs.

SciGirls established its *SciGirls en Español* and *SciGirls en la Familia* initiatives to address the underrepresentation of Latinos in science and engineering occupations by providing high-quality, culturally appropriate Spanish-language STEM resources for educators and families. The need for this programming is profound. Latinos, including women, are underrepresented in STEM. In 2010, Hispanic women were the largest group of minority females, constituting 8% of the U.S. population. However, the participation of Hispanic women in science and engineering is significantly low: in 2010, just 2% of all of the scientists and engineers in the U.S. workforce were Hispanic women (National Science Foundation, 2013).

SciGirls en Español shows, which included dubbed episodes as well as segments shot in Spanish, aired on KLCS, the only PBS member television station in Los Angeles. The outreach effort engaged 1,200 girls, ages 8 to 13, and over 1,000 family members. Evaluation showed the programs positively influenced participants; raised families' awareness of opportunities available to their daughters; and increased awareness of Hispanic families' needs related to their daughters' science education and careers (Knight-Williams, 2012).

TPT's *Latina SciGirls* (currently pending at the NSF) builds even further on this work by developing half-hour television episodes of *Latina SciGirls* filmed entirely in Spanish, showing groups of girls and their Latina STEM mentors investigating culturally relevant science and engineering problems of interest to Hispanic communities across the U.S. TPT will also create a

series of family and girl-friendly online video profiles of Latina STEM professionals showing the daily life of a female scientist or engineer, and will provide opportunities to connect girls and their families with in-person Latina role models via community outreach in diverse Hispanic communities across the country.

Building on this work, the *SciGirls* CONNECT project, a five-year scale-up effort supported by the NSF, employed a blended (part online, part in-person) professional development model to equip nearly 1,800 formal and informal science education providers in 34 states with resources and strategies for gender equitable STEM education programs. From 2011–2014, through a network of 116 national and local partner organizations, such as Girl Scouts, Girls Inc., 4-H, science museums, schools, afterschool programs, YMCAs, libraries, and other PBS stations, *SciGirls* content reached 25,000 girls and boys in urban, rural, and suburban communities. Project participants were 32% Hispanic, 25% African American, 12% multiracial, and 46% white. Program leaders reported that the project encouraged girls to explore science concepts, generate their own solutions to problems, and apply the concepts they learned to their everyday world. *SciGirls* is poised to engage over 900 new educators by the end of 2015.

An independent evaluation conducted by Knight-Williams, Inc. documented the impact of *SciGirls*, finding that participants “were overwhelmingly positive about their experiences with the *SciGirls* program.” Local partner grantees reported that *SciGirls* helped them build new community partnerships, reach underserved and minority girls, and spark new inquiry-based activities. *SciGirls* training taught them how to incorporate research findings on how girls learn science into their activities. Participants concluded that *SciGirls* projects increased girls’ confidence to participate in science, deepened their understanding of the inquiry process, broadened their perception that science is bigger than previously thought, increased their

awareness of and interest in science careers, and showed them that science can be fun and exciting (Knight-Williams, 2012).

With initial funding for the *SciGirls* television series from the National Science Foundation's AISL program (Advancing Informal STEM Learning), TPT was able to raise additional support from other NSF programs. Grants from NSF's Program for Women and Girls and Research on Gender in Science and Engineering program have enabled TPT to expand *SciGirls* outreach to more communities and to provide educators with resources and training in best practices for engaging Hispanic girls and their families in STEM. TPT also leveraged federal funding for *SciGirls* to attract support from corporations and foundations such as Exxon, L'Oreal, Northrup Grumman Foundation, PPG Industries Foundation, Infor, and the Mosaic Company Foundation.

TPT will bring all of its experience in project management, television production, interactive media, outreach to low-income communities, and leveraging federal funding to the development of *Superhero School*. The success of the project will be further enriched by our collaboration with Portfolio Entertainment and GlassLab Games.

Portfolio is one of Canada's leading producers and distributors of innovative, award-winning television programs for children and families. It has built a reputation for creative excellence since it was founded 25 years ago. Portfolio owns the television and interactive media rights for the *Superhero School* book and has an in-house animation department. (See Memo of Understanding in Appendix E.) It has experience working closely with developers of convergent websites, games, apps, and other programming extensions. Portfolio has a long record of success in distributing television series internationally, generating funds that support production of new episodes.

Portfolio knows how to produce a successful series for public television. In partnership with

Random House, Portfolio produced 80 half-hour episodes of the highly popular PBS children's series *The Cat in the Hat Knows a Lot About That!* Portfolio sold this series for broadcast in more than 100 territories worldwide and is now creating three 60-minute specials.

Like TPT, Portfolio has produced television for Spanish-speaking audiences. Discovery Kids, the top-rated network in Latin America, selected Portfolio to produce and distribute *Doki*, an animated preschool series that celebrates the wonders of asking questions. Viewers follow team Doki as they travel the globe and beyond, to find answers to their questions about science, nature, and the world we live in. Portfolio developed the characters and a richly animated world from Discovery Kids' original base of popular interstitials. Portfolio also achieved wide international distribution for *Doki*—in the U.S., Canada, Germany, Korea, Thailand, and many other countries around the world. The series is now in its second season with 104 episodes (11 minutes each) and three 22-minute specials.

Founded in 2012, GlassLab is a non-profit start up whose mission is to empower youth to claim their path to 21st Century success through high-impact digital games. In a short few years, GlassLab Games has made real progress in solving the puzzle for how to bring assessment in educational games broadly to the field. Their open source software development kit allows game developers to embed analytics that can offer students and educators real-time feedback via a dashboard. Their game portal features original games developed by GlassLab and partner developers. TPT will join the list of GlassLab partners who are committed to improving learning outcomes for underserved, at-risk youth in classrooms and informal learning environments.

(ii) Utility of the Project in a Variety of Settings

The guiding strategy for Superhero School is to create a project that plays on the traditional strengths of the public media system while remaining nimble (and curious) enough to innovate

and create opportunities across the greater media landscape. Our plan to extend the project into new settings is designed for flexibility on a number of levels, always with the underlying goal of reaching target audiences: children at risk for school failure, their families, and the community groups (schools and others) that support them.

Television Series

Both TPT and Portfolio Entertainment have worked with PBS to create and deliver broadcast television and interactive media that meet their high standards for quality and educational content. We are committed to working with PBS as we develop *Superhero School* to create a television series that PBS will distribute to public TV stations nationwide. Children's television series on PBS attract millions of viewers, especially from low-income families, and pbskids.org is one of the most popular destinations for online games among our target audience. At this stage of the project, however, it is too soon to secure a commitment from PBS.

Nonetheless, as an alternative, TPT can commit to distributing *Superhero School* through American Public Television (APT), a leading distributor of groundbreaking, high-quality, top-rated programming to the nation's public television stations. APT Exchange distributes more than 3,500 hours of programming, including approximately half of the top 100 highest-rated public television titles. APT has already confirmed its interest and support of the series. (A Letter of Intent from APT to support distribution and promote carriage of *Superhero School* to all 350 public broadcasting stations nationwide is included in the Appendix E.)

TPT has many years of experience launching new children's series and excellent relationships with the nation's public television stations. TPT will mount an aggressive station relations campaign to assure the widest possible dissemination of the programs and related interactive and outreach initiatives. This campaign will begin six to eight months before the

series premieres, with regular e-mail and phone communications and introductory events at APT's program conferences. TPT will provide stations with promotional materials and build awareness of the station-based engagement opportunities around *Superhero School*. TPT's science series *Dragonfly TV* and *SciGirls* are distributed through PBS Plus, which, like APT Exchange, does not require common carriage among stations. However, TPT has typically achieved excellent coverage by stations, reaching 90% of US TV households.

With APT, the exclusive broadcast window on public television is limited to six months. This opens up distribution rights on other platforms, enabling faster and earlier strategies to scale and broader access to all viewers. To augment broadcast on public television, a traditional TV "by appointment" model, the project team has planned a broad, multi-platform distribution strategy for *Superhero School*. This includes other OTT (over-the-top), SVOD (streaming video-on-demand) services; digital and social media (YouTube, Facebook, Vine, Instagram, Twitter); embedding or release on web, mobile, apps and gaming platforms; and other technologies. TPT will place and promote the national distribution of *Superhero School* via the PBS Cove online video system. Cove provides local public television stations the framework to easily include—and feature—the programs in their rapidly evolving and expanding websites, apps, and OTT efforts, significantly complementing the reach of the project through local and national online distribution platforms. TPT already places many hours of content we've created into the Cove system to share with public television stations nationwide.

Portfolio will deploy its international sales staff to distribute the project in worldwide markets. Since the episodes will be available in Spanish, this increases its appeal in Spanish-speaking countries. Revenue generated by international sales will support the production of new episodes, extending the life of the project beyond the 40 episodes funded by Ready to Learn.

Interactive Media

As with the television series, TPT will aim to distribute interactive games and the project website through PBS, on pbskids.org. If distributed through APT, *Superhero School* would host its own site at superheroschool.com. Select *Superhero School* games would be available to PBS stations for embedding on their kids and family sites. Apps created for *Superhero School* will be distributed through both Apple and Android app stores.

The project platform, built with GlassLab Games, will be designed for scalability. GlassLab has established a graduated licensing fee for the *Superhero School* platform, based on the server costs associated with the number of users. TPT will support this scale-up cost by developing a “superhero” fundraising campaign for corporate and foundation donors. We know from experience that major grants from corporate donors are increasingly difficult to obtain. As a result, we will aim for smaller gifts of \$5,000-\$25,000, which often allow community program officers to move more quickly and commit funds without board approval. Our program structure will also allow corporations to scale up participation in their own communities by underwriting specific group’s participation. Corporations will receive recognition online for being part of the Superhero team and can make *Superhero School* challenges to encourage other corporations to participate.

Superhero School will also publish select games from its library on the original GlassLab Games portal. Sharing games with the established (and growing) GlassLab community contributes to the larger educational gaming community and serves as a promotional opportunity for our full complement of games on the *Superhero School* platform.

Educational Outreach

The flexible, scalable design of the *Superhero School* educational outreach initiative allows

for both organic and opportunistic growth and evolution. Building upon the existing five-year plan, TPT will take advantage of opportunities for adding additional cohorts in years after the RTL grant is finished. Given the program's built-in trainer network of people located across the country, regional and even local training can occur at low cost. TPT will continue to raise money for these efforts through public, foundation, and corporate sources. Within the *SciGirls* partner network, TPT found that many groups successfully raised funds for their own localized training.

Marketing and Promotions

TPT will engage a marketing and promotions firm to assist with planning and strategies for attracting broad audiences to the TV series and all other elements of the project. This firm will work with TPT staff in the years three, four, and five to devise and execute a plan that includes an emphasis on social media marketing. TPT has increasingly moved its marketing efforts to inexpensive/free channels such as YouTube, Facebook, Twitter, and Instagram. The speed of execution on these channels, and their ever-expanding role in the media world, makes them especially useful for reaching our target audience.

In addition, in years four and five, TPT will issue an RFP offering stipends to 10 PBS Stations interested in hosting *Superhero School* events with local library or science museum partners. Stipends up to \$5,000 will cover materials, marketing, and planning needs. Events might include family nights, STEM festivals, overnights, and screenings. TPT will provide recipients with an events toolkit with strategies for planning and implementation of successful events.

At the same time, *Superhero School* will encourage families to support their own budding superheroes with informal meet-ups, facilitated by local networks (social media and otherwise) at coffee shops, neighborhood parks, and other gathering places. In true transmedia fashion,

these events will encourage fans to expand on the *Superhero School* world. (And, of course, kids will be invited to come dressed as their favorite superhero, preferably in costumes of their own making!) Organizers will find *Superhero School* resources (games, printable signs, etc.) online for planning and execution of these grassroots events.

Professional Dissemination

TPT has identified professional conferences that will initially support the team's development efforts and then provide opportunities for sharing project resources and findings. In years one and two, team members will attend children's media conferences (such as Sandbox Summit, Dust or Magic, GDC, and Kidscreen Summit/iKids), to stay abreast of trends and opportunities in children's media. In year three, staff will share information about the project at education-focused conferences. In years four and five, when the project is more fully implemented, staff will conduct conference presentations at ELL, Latino education, disability education, library, afterschool association, science, and children's museum conferences. TPT will also collaborate with partners, advisors, and consultants to support broad dissemination of information about the project's resources.

TPT will also take advantage of low-cost, digital webinars. TPT will plan a series of webinars and collaborate with partner groups to present at their events, thus reaching new audiences. For example, TPT will reach out to Star Net librarians, public TV stations, and teachers via PBS LearningMedia network and professional organizations.

D. MANAGEMENT PLAN

(i) Achieving Objectives on Time and On Budget

TPT has over two decades of experience successfully managing large, federally-funded grant projects. We have received and managed grants from the Department of Education, National

Science Foundation, National Endowment for the Humanities and National Endowment for the Arts, and have undergone two federal audits with no significant findings. We have a mature, tested, financial management system and structure, and a staff compliance officer who receives regular training and updates to stay current with changing federal grant regulations and guidelines. We are familiar with the complexities of mingling federal and non-federal funding sources in the same project, and maintain an on-staff grants analyst who is responsible for financial reporting and draw-downs, as well as managing our grants database that tracks awards, deliverables, reporting and completion deadlines, and archives all grant-related documents. Our staff attorneys have drafted hundreds of grant-compliant agreements, including dozens for very large (\$1 million plus) subawards under federal grants. We have documented subaward management procedures, and train all relevant project staff in subaward management prior to project launch.

TPT project staff has extensive experience managing the large-scale production of television series, interactive media, and outreach initiatives, with a commitment to deliver all projects on time and on budget. The Project Director will be responsible for overseeing the management of all components to ensure they meet project goals and objectives. Throughout the course of the project, she will create and update schedules and monitor the flow of deliverables. The project director will work closely with TPT's financial management staff to track all project expenses and quickly address any necessary adjustments, pending approval from the Department of Education, to avoid any cost overruns.

TPT has established a detailed timeline, identified key deliverables for each year of the project, and assigned responsibilities to specific project staff, in Tables 5, 6, and 7.

Table 5. Project Timeline	Year 1				Year 2				Year 3				Year 4				Year 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
PLAN/DESIGN/DEVELOPMENT																				
Content/pod planning and design	■																			
Advisory board meeting	■																			
Hiring/Planning	■																			
Animation & Interstitial Pilot	■																			
Pod Pilot (game & activity)	■																			
GlassLab Design Work	■																			
FORMATIVE TESTING pilot	■																			
Planning Season 1	■																			
TV/DIGITAL/COMIC PRODUCTION																				
SEASON 1 Animation/Production					■				■				■				■			
Packaging					■				■				■				■			
Game Development					■				■				■				■			
GlassLab Platform Development					■				■				■				■			
Website Development					■				■				■				■			
OUTREACH & MARKETING																				
Ed guide development					■				■				■				■			
Partner Org Recruit & trainings					■				■				■				■			
Programs run					■				■				■				■			
Marketing Creation and Campaign					■				■				■				■			
Dissemination					■				■				■				■			
RESEARCH/EVALUATION																				
	■				■				■				■				■			

Table 6. Project Deliverables	Year 1	Year 2	Year 3	Year 4	Year 5
PLAN/DESIGN/DEVELOPMENT					
Annual advisory meetings complete	x	x	x	x	x
Staff Hired	x	x			
Animation & Interstitial pilot(s)	x				
One full content pod (game and activity)	x				
GlassLab platform design	x				
Formative testing of pilot content pod	x				
Season 1 Plan	x				
TV/DIGITAL/COMIC PRODUCTION					
Season 1 animations and interstitials		x	x	x	
Shows packaged			x	x	
Games developed		x	x	x	x
GlassLab platform	x	x			
Children's website		x			
OUTREACH & MARKETING					
Ed activities		x	x		
Partner organizations recruited		x	x	x	
Programs running nationwide		x	x	x	x
Marketing campaign executed			x	x	x
Broad dissemination of program			x	x	x
RESEARCH/EVALUATION					
Needs assessments/iterative test results/formative reviews	x	x	x		
Implementation studies			x	x	x
Summative Studies				x	x

Table 7. Core Team Member Roles and Responsibilities

Name	Role	Responsibilities
Terry O'Reilly	Executive in Charge	Oversee project across TPT and Public Media system
Joan Freese	Project Director and Co-Executive Producer	Manage project timeline and budget, lead digital/interactive work and educational and creative approach
Kathleen Shugrue	Co-Executive Producer	Manage television production and lead creative work
Alicia Santiago, PhD	Cultural Diversity Consultant	Design cultural competency best practices and review all Spanish content
Emily Stevens	Managing Producer	Manage television staff, production timeline, and budget
Sarah Carter	STEM Content and Outreach Manager	Create content framework, oversee science in shows, manage education content development and outreach efforts
Jenn Schmidt	Financial Director	Oversee financials for project
John Daenzer	Technical Director	Oversee technical approaches for digital products
Meryl Alper, PhD	Media and Disabilities Consultant	Guide digital strategies for making products accessible to all learners
Youli Mantzicopoulos, PhD	Scientific Literacy Consultant	Guide educational strategies for integrating science and literacy content and approach
Beth Kirsch	Children's Media Consultant	Guide key elements of project for quality, content, and GPRA compliance
Steven Schneider, PhD	Director of Research	Oversee all independent formative and summative evaluation

(ii) Qualifications of Key Personnel

TPT has assembled a stellar project team with a long history of collaboration in the production of media and outreach resources. Additional expertise will be provided by highly qualified professionals who will consult with the core team. The project’s Advisory Board will provide valuable, ongoing guidance. An independent company will conduct multiple formative evaluations and implementation studies to ensure the project is achieving its goals and objectives, as well as a rigorous summative evaluation to assess final outcomes. In addition, TPT has engaged several national partners that will play a major role in creating an innovative, successful project that builds the school readiness of young children.

Core Project Team

Terry O'Reilly, Executive in Charge, is Chief Content Officer for TPT, where he oversees local and national programming, online media, production and broadcast operations, and engineering. Mr. Reilly joined TPT in 2009 after an extensive career in network and local television. Previously, he served as Executive Vice President and General Manager for

ReelzChannel Television (a network seen in nearly 50-million homes across the USA) and as Chairman of the Board for Phoenix Television Ltd. (UK).

Joan Freese, M.Ed., Project Director and Co-Executive Producer, has served as the Project Director for several TPT initiatives and is the PI for *SciGirls Code: Connected Learning for Middle School Girls in Out-of-School Time* (pending, STEM + Computing Partnerships program, NSF). Under her leadership as the Senior Digital and Educational Content Producer, the *SciGirls* website earned a national Emmy Award for New Approaches in children's programming. Ms. Freese manages contracts with interactive and game development firms and collaborates with PBS Kids Interactive for *SciGirls* content on pbskids.org.

Kathleen Shugrue, Co-Executive Producer, played a primary role in the creation of the *SciGirls* series, as Co-Executive Producer in Season Two and Series Producer in Season One. She is an Emmy Award-winning television producer, most recently serving as Senior Producer for the Discovery/Science Channel's flagship engineering series, *Build it Bigger*. She was Series Producer for *DragonflyTV/Nano* and worked for 20 years at WGBH Boston, where she served as Senior Producer for *FETCH with Ruff Ruffman* and Series Producer for *ZOOM*.

Alicia Santiago, Ph.D., Spanish Content and Cultural Competency Consultant, is a bilingual research scientist and a Latino Engagement Specialist. Since 2007, Dr. Santiago has been involved in the development and implementation of innovative direct and mass-media science and health education national-level programs for the Latino community. Her expertise includes professional development on cultural competence to assist science educators in cross-cultural understanding and teaching effectiveness, and translation of scientific and technical language and concepts for professional and lay audiences, including Spanish-speaking Latino audiences. Dr. Santiago is a co-Investigator for *SciGirls* CONNECT and was Co-Principal

Investigator on *SciGirls en Español* and *SciGirls en la Familia*. She has a Ph.D. in cell and developmental biology from the University of California, Davis.

Emily Stevens, Managing Producer, has 20 years of experience in television, film, and multimedia. She supervised production of all *SciGirls* episodes and managed the interactive and outreach initiatives. Her TPT production credits include the Oscar-nominated *Hoop Dreams*, the PBS arts series *Alive From Off Center*, the Emmy Award-winning *Transplant: A Gift for Life*, and a series of video shorts on climate change for the Association of Science-Technology Centers. Ms. Stevens supervised more than 100 independent documentaries, narrative films, series, and specials for public television, with an emphasis on programming for multicultural audiences and children, as Director of Production for CPB's Independent Television Service.

Sarah Carter, STEM Content and Outreach Manager, works with TPT's production and outreach teams to create and disseminate episodes and educational resources for educators and parents. She collaborates with TPT staff on generating story ideas and developing science outlines with a focus on making sure the science content is clear, accurate, and age-appropriate. Prior to TPT, Sarah was a Professional Development Specialist and Librarian at Science House: A Resource Center for Educators located within the Science Museum of Minnesota, where she focused on closing the racial achievement gap in Minnesota.

TPT staff members **Jenn Schmidt, Senior Vice President of Finance and Business Administration** and **John Daenzer, Vice President, Digital**, will provide additional management oversight.

Project Consultants

Meryl Alper, Ph.D., an expert on the use of digital media by children with disabilities, is the author of *Digital Youth with Disabilities* for the MacArthur Foundation's reports on Digital

Media and Learning. Her work sits at the intersection of media and communication, science and technology, and disability studies. She has served as a children’s media strategist and researcher for Sesame Workshop, Nickelodeon, and Disney. She will guide the project team on how all components can best serve the needs of children with disabilities.

Youli Mantzicopoulos, Ph.D., is a Professor of Educational Psychology at Purdue University. She is a researcher in science literacy for early elementary students and has created curriculum as part of the Purdue Scientific Literacy Project. Dr. Mantzicopoulos will advise *Superhero School* on research-based approaches for integrating science and literacy, helping the team build its strategy. She will review education deliverables as needed to confirm their appropriateness for the intended audience.

Beth Kirsch has extensive experience producing children’s educational media, including public television series (such as the RTL-funded, Emmy Award-winning series *Between the Lions*), websites, games, apps, and outreach resources. She has overseen project development and implementation; alignment with curriculum goals, budgets, schedules; and independent research for several Ready to Learn initiatives. Ms. Kirsch will consult on all key elements of *Superhero School* to ensure that they are of the highest quality, deliver the educational content, and meet the GPRA performance measures.

National Advisory Board

The members of our advisory board include a diverse group of experts who have provided valuable advice throughout the development of *Superhero School*. They bring to the project their experience in elementary science education, literacy, innovative television and media production, educational gaming, English Language Learning, STEM programming in library settings, educational technology assessment and analytics, and science learning for families. (Curriculum

Vitae for all advisors are included in the Appendix D. of this proposal.) These experts will convene as a group each year to provide direction and review progress and results to date. TPT will also seek the input of advisory board members, individually and in small groups, throughout the course of the project. Members of the *Superhero School* board include:

- **Bodong Chen, Ph.D.**, Assistant Professor, Learning Technologies, University of Minnesota
- **Nancy Coddington**, Manager of STEM Content, Services & Programming, WSKG
- **Paul Dusenbery, Ph.D.**, Executive Director, STAR Library Education Network
- **Okhee Lee, Ph.D.**, Professor of Childhood Education, New York University
- **Dale McGreevy, Ph.D.**, Director of Gender and Family Learning Programs, The Franklin Institute
- **Erin Reilly**, Creative Director, Annenberg Innovation Lab and Research Director, Project New Media Literacies, University of Southern California
- **Patty Born Selly**, Executive Director, National Center for STEM Elementary Education, St. Catherine University
- **Jerome Shaw, Ph.D.**, Associate Professor of Science Education, University of California, Santa Cruz
- **Constance Steinkuehler, Ph.D.**, Associate Professor in Digital Media and Co-Director, Games + Learning + Society (GLS) Center, University of Wisconsin, Madison

Independent Evaluation

WestEd, a nonprofit research, development, and service agency based in California, works with education and other communities to promote excellence, achieve equity, and improve learning for children, youth, and adults. The depth, diversity, and history of its work, coupled

with on-the-ground experience and research-based knowledge, give WestEd staff unique expertise in the field. WestEd has designed and overseen numerous qualitative and quantitative studies for large-scale national projects—focusing on impact, efficacy, and quality—including RTL initiatives, other U.S. Department of Education programs, and the National Science Foundation.

Steven Schneider, Ph.D., Director of Research, WestEd, will oversee all independent formative and summative evaluation for *Superhero School*. Dr. Schneider founded WestEd’s Science, Technology, Engineering, and Mathematics (STEM) program and served as Principal Investigator (PI) for the science curriculum submissions to the What Works Clearinghouse. Dr. Schneider led WestEd’s work with the CPB and PBS Ready to Learn team over the last 5 years. He has been the PI on numerous initiatives including the Department of Education’s National Center for Cognition and Mathematics Instruction; NSF Center for Assessment and Evaluation of Student Learning; development of the NAEP Technology and Engineering Literacy and the NAEP Science Framework and Test Specifications projects; and multiple evaluations for PBS. Dr. Schneider received his Ph.D. from Stanford University in Design and Evaluation of Educational Programs with an emphasis in STEM.

(iii) Relevance and Demonstrated Commitment of Each Partner

Project Partners

Portfolio Entertainment, a Canadian television production and distribution company, was founded in 1991 with a focus on children's programming. Portfolio produces more than \$15 million of TV each year and, in partnership with Random House, created *The Cat in the Hat Knows a Lot About That!*, a PBS preschool series that introduces kids to science concepts. Portfolio’s distribution arm has sold television programming internationally to more than 95

countries/territories, generating revenue that funds production of additional seasons. **Portfolio has already committed \$2 million toward the development of the TV series for *Superhero School*.** It will work closely with TPT to develop the overall concept, structure, and production plan, produce all the animated segments, and pursue international distribution deals that can help finance production of additional episodes beyond the first 40 shows funded by Ready to Learn.

GlassLab Games, a nonprofit company based in Silicon Valley, focuses on empowering youth to achieve success through high-impact digital games. Founded in 2012, GlassLab aims to improve learning outcomes for young people through a unique gaming platform with embedded assessments that make learning accomplishments visible—and motivating—to children as they play. With a staff of 25 game and assessment designers along with a well-rounded support team, GlassLab also draws on top learning and assessment experts from academia, industry, and the nonprofit sector to produce new approaches to assessment design.

By integrating learning and assessment in a single engaging, data-rich experience, GlassLab aims to deliver students and teachers powerful, pioneering digital learning games, apps, and content to improve the process of learning and accelerate progress on the path toward college and career. Their development team will partner with *Superhero School* staff to create a version of the platform that expands upon games to collect learning data for all project educational media. They will license this work to *Superhero School* and house and serve the project.

The Connector, managed by the National Girls Collaborative Project, is the force behind theconnector.org. The effort has substantial support from partner organizations including: Time Warner Cable, Association of Science-Technology Centers (ASTC), Afterschool Alliance, Educational Development Center, Inc. (EDC), Maker Education Initiative (Maker Ed), National Afterschool Association (NAA), and Zozude.

Launched in 2015, the resource has more than 5,000 STEM programs in its online database for families. A parallel portal for STEM providers is a channel for promoting programs, finding partners for collaboration, and serving communities more effectively. Program providers such as *Superhero School* can register for free to showcase their work and connect to families and partners. In addition, *Superhero School* will use the site to network with STEM practitioners, educators, counselors, and researchers to share information, ideas, and resources.

Perhaps most importantly, The Connectory offers avenues for experiential science learning for *Superhero School* audiences. The hands-on nature of STEM programs is an excellent complement to the media-based nature of the project—just as the media assets of *Superhero School* are a great fit for hands-on programs. Our collaboration is win-win. As a partner organization, *Superhero School* will gain exposure nationwide through The Connectory’s conference participation and outreach staff. In addition, our project will be featured in The Connectory’s promotional content channels for families and program providers (email newsletters, Facebook and Twitter).

E. PROJECT EVALUATION

WestEd, as evaluation partner for the 2010-2015 RTL initiative with CPB and PBS, brings strong expertise to the role of project evaluator. WestEd conducted formative and summative evaluations throughout the five-year RTL project to ensure quality at each stage of product development. As Twin Cities Public Television (TPT’s) research and evaluation partner for the 2015-2020 RTL effort, WestEd will design and implement rigorous, scientifically-based research and evaluation strategies to support the successful design and use of RTL resources and to test their efficacy in addressing the needs of students at risk of educational failure. Sr. Program Director Steve Schneider, Ph.D in WestEd’s STEM Program will serve as the director of the

research and evaluation efforts. WestEd is a leader in research on public media and digital technologies, and in conducting random assignment studies in literacy and science. Descriptions of evaluators' experience are listed in Appendix A.

Overarching Research Questions Guiding the Evaluation

The following primary research questions will guide all research and evaluation activities:

- How do teachers and other educators serving children, especially in low-income communities, *perceive and use* transmedia products from *Superhero School* to support development of literacy skills and science/engineering development?
- How do new educational television and interactive media, and accompanying support materials, *impact literacy and science skills* in children ages 5-8 years old in low-income communities?
- What impact do TPT's outreach activities and professional development have on the "reach" of the *Superhero School* resources (e.g., number of people trained, number of students using resources), and on the ability of those trained through their outreach initiative (e.g., Partner Educator-Trainers) to effectively use the resources in different settings (e.g., schools, community-based organizations, summer camps)?

In addition, we will investigate the following exploratory questions:

- To what extent do *Superhero School* educational television and interactive media, and accompanying support materials, help children with disabilities (as identified through IEPs) and English Language Learners ages 5-8 years old from low-income communities learn literacy and science skills?
- What factors (e.g., use in school, use in afterschool programs, use at home; contextual supports and barriers) impact both *use* and *impact*?

Overview of Evaluation Plan

As a part of an integrated program of formative and summative research, the WestEd team will conduct: needs assessments; iterative testing and formative review of prototypes and early versions of television and interactive media and their related outreach materials; and a series of implementation studies to examine the effectiveness of: 1) TPT’s outreach model and blended train-the-trainer professional development in expanding the “reach” of *Superhero Schools* and the ability of educators, teachers, and parents to effectively use the resources; and 2) individual *Superhero School* media properties and the synergistic effect of these newly created television and interactive media on student learning.

In addition, two randomized controlled trials will take place—one in Year 4, set in afterschool programs, and one in Year 5, set in classrooms. These final summative studies will examine the impact of “learning pods” of resources (including resources such as television episodes, videos, games, e-books, apps, parent and educator outreach materials, and social and virtual networks) from *Superhero School* on literacy and science outcomes using multiple standardized and researcher-developed measures.

WestEd’s plan specifies that each major portfolio of learning resources developed under RTL will be evaluated at every stage of development, ensuring that each product meets the highest standards of educational quality. The plan, which is described in greater detail below, includes:

1. formative evaluation support during resource development to ensure the resources are educationally sound and align with the theoretical underpinnings described earlier in the narrative (e.g., constructivism);
2. implementation studies to:
 - detect the early promise of the resources;

- collect data on the effective use and implementation of the resources in different settings (including use of appropriate bundling of resources and support materials and determining appropriate environments to conduct impact studies of the learning resources);
 - investigate the development and use of TPT’s outreach and training efforts; and
3. rigorous experimental studies to test the impact of the resources.

Through each stage of the project, RTL stakeholders will receive a body of evidence addressing the quality of the resources, from their design to their completion, and from intervention to outreach. The plan will be based on five research and evaluation goals: 1) determine market needs and preferences for delivering and engaging children in *Superhero School* content; 2) examine the educational affordances (features and advantages) and potential of the learning resources; 3) study the implementation of the learning resources in order to evaluate their promise, facilitate replication, and examine fidelity; 4) assess the effectiveness of the learning resources; and 5) disseminate research and evaluation findings. Figure 1 illustrates how WestEd evaluation support will ensure the development of high-quality resources.

Figure 1. WestEd evaluation support at each stage of resource development.



1) Determine Market Needs and Preferences of the Target Population.

Researchers will conduct two comprehensive needs assessments to determine market needs and preferences for: 1) delivering and engaging children in RTL content, with particular focus on the target audience for *Superhero School* (including children with disabilities and Spanish-

speaking students); and 2) delivering and engaging teachers, educators, and parents (including those who serve disabled students and those in Hispanic communities) in blended professional development and outreach activities as they prepare to use *Superhero School* resources. The needs assessments will include in-depth nationwide surveys of various stakeholders, and reviews of literature to identify the particular market needs and preferences among a diverse constituency of educators, parents, caregivers, and communities. These results will inform national research and evaluation studies of RTL content and outreach resources.

2) Examine Educational Affordances and Potential of Learning Resources

WestEd research will focus on examining the educational affordances and potential of the *Superhero School* television and interactive media, outreach materials, and professional development materials and procedures while these resources are in their development phase. For example, a series of formative studies, including usability and feasibility studies of the newly developed *Superhero School* television and interactive media, will be conducted to understand the resources' academic content, appropriateness for their respective age groups, usability by target groups, and feasibility for use in different educational contexts. Formative research activities will also be conducted to examine TPT's professional development and outreach efforts and the *Superhero School* platform.

The goal of these formative tests is to provide developers with timely feedback during the product development process in order to maximize the educational effectiveness of the newly created resources. Evaluation activities will include (but are not limited to): 1) usability testing of paper prototypes and alpha builds of digital assets, as well as early user testing of storyboards and animatics for video episodes; 2) reviews of digital assets and video episodes by subject matter experts and teachers; 3) expert reviews of outreach materials, as well as professional

development materials and processes by experts in parent education, blended professional development, and train-the-trainer models; and 4) feasibility testing of digital assets in classrooms and informal educational settings (i.e., afterschool programs). Additional descriptions of evaluation activities focused on examining the educational affordances and potential of the *Superhero School* resources during the development phase are presented in Appendix A.

3) Study Implementation of Learning Resources

Implementation studies will provide findings that will help evaluate the promise of the resources to support learning in the target populations, facilitate replication, and examine fidelity. WestEd researchers will conduct implementation studies using *Superhero School* resources and “learning pods” targeted at specific populations and learning goals. These studies will yield important information about when, why, and how the learning resources work. The implementation studies will integrate research on the needs of specific populations and settings to provide targeted content and outreach resources. Implementation studies will take place in geographically, linguistically, and socio-economically diverse sites throughout the United States. Descriptions of the project’s implementation studies are presented in Appendix A.

4) Assess Effectiveness and Impact of *Superhero School* Resources

WestEd will conduct two scientifically rigorous studies (i.e., randomized controlled trials, or RCTs) to assess the effectiveness and impact of the *Superhero School* resources (one in Year 4 and one in Year 5). The primary research questions guiding these studies are:

1. Does the use of *Superhero School* resources improve students’ understanding of science and literacy?
2. What factors are associated with higher-quality and more effective use of *Superhero School* resources for supporting students’ learning?

Our secondary research question is:

- 1) Does the use of *Superhero School* resources improve students' understanding of mathematics?

The Year 4 RCT will be in the afterschool environment, while the Year 5 RCT will be in a regular classroom setting. For both RCTs, afterschool educators, teachers, and students will be recruited from populations determined to be at risk of educational failure. For the Year 4 RCT, afterschool programs will be selected from TPT's extensive partnerships with organizations focused on informal learning. Certain criteria will be used to select organizations that have a higher likelihood of using the resources with fidelity and that can provide students with a comparable dosage. For example, afterschool programs will need to have appropriate technology on hand, and will need to be designed for students to attend daily.

Study Design

To assess the impact of *Superhero School* resources, each impact study will use a cluster-randomized design. In Year 4, 60 afterschool teachers who teach K-3rd grade students will be randomly assigned to either use *Superhero School* resources or to conduct their afterschool programs in a business-as-usual fashion. In Year 5, 60 regular school teachers who teach 2nd grade students will be randomly assigned to either use *Superhero School* resources or to implement their science curriculums in a business-as-usual fashion.

Sample and Statistical Power Analysis

With 60 teachers (one teacher per afterschool program in Year 4 or per school in Year 5) and 20 students within each program/classroom, a power analysis for a two-level cluster randomized design with person-level outcomes was performed using the Optimal Design software (Raudenbush et al., 2011). The power analysis assumed: 1) an alpha threshold of 0.05; 2) an

intraclass correlation of .15; and 3) that 50% of the variance will be explained by a covariate (e.g., student pretest scores). Using these assumptions, the target sample size described above yields 80% power to detect an effect size of 0.25. This size effect is considered by the What Works Clearinghouse (WWC) as “substantively important” (p. 23, WWC v3). With as few as 15 children per site/class, the study is powered at 80% to detect an effect size of 0.27, suggesting that this design is robust enough to withstand minor violations in these assumptions.

Measures

Each impact study will employ multiple standardized and researcher-developed measures of science, English Language Arts, and mathematics outcomes appropriate for administration at the 2nd grade level. Table 8 below presents the measurement tools to be used in each RCT and the outcomes that will be measured.

Table 8. Student Outcome Measures for the *Superhero School* Impact Studies

<i>Measure</i>	<i>Domains Tested</i>	<i>Internal Consistency</i>
<i>Lens on Science</i>	<u>Content areas:</u> <i>Life Sciences, Earth/Space Science, and Physical/Energy Sciences</i> <u>Process skills:</u> <i>Observing, describing, comparing, questioning, predicting, experimenting, reflecting, and cooperating</i>	.87
<i>Iowa Basic Skills Test, Science Level 8</i>	Life Science, Earth, & Physical Science	.73
<i>Test of Early Mathematics Ability, Third Edition (TEMA-3)</i>	Number sense, counting, operations, geometry	.94 -.96
<i>Iowa Test of Basic Skills, Mathematics Level 8</i>	Math Concepts and Estimation, Math Problem Solving and Data Interpretation, Math Computation	.92
<i>Stanford English Language Proficiency Test</i>	Listening, Writing Conventions, Reading, Writing, Speaking	.91

Participating children will be assessed by trained researchers using pre- and post-tests.

Procedure

The study will test the intervention guided by educators working with students in the

afterschool program in Year 4, or by classroom teachers in Year 5. Students will be expected to use the intervention for 4 days per week, for 20 minutes per day, for 10 weeks. The intervention will include multiple *Superhero School* “learning pods” (i.e., units or lessons) that are aligned to specific science and literacy standards. Pathways for implementing each learning pod will be provided in an effort to maximize the likelihood of educators and teachers implementing the intervention in a standardized fashion. TPT *Superhero School* trainers will train educators and teachers in the treatment condition. The training will cover, but will not be limited to, weekly *Superhero School* curricula, hands-on science activities, best practices for inquiry-based science instruction, best practices for teaching with technology, best practices for broadening participation (i.e., equitable teaching strategies), best practices for introducing science role models, and best practices for engaging low-income and minority students.

Monitoring Fidelity of Implementation

To avoid contamination, treatment materials will be available only to the educators and teachers assigned to the treatment group, and they will be asked not to share any of the materials with colleagues until the end of the study. Researchers will also monitor fidelity of implementation through three major activities. First, researchers will conduct observations in treatment and control sites/classrooms, and will constantly monitor implementation, making sure there is no cross-contamination with control sites/classrooms. WestEd will use a rubric to organize data from the classroom observations. Second, a custom-designed research website will be configured to track activities and log when participants access *Superhero School*; which episodes, ebooks, and games from *Superhero School* they accessed and approximately how long participants used each episode, ebook, and game. This custom research website will use a login system that feeds data to Google Analytics. Each time participants log in to *Superhero School* via

the custom website, their username will be identified within Google Analytics. This will allow researchers to identify usage data from study participants. Embedded analytics for particular learning games will also be obtained from game producers. Third, educators and teachers will complete weekly fidelity surveys about: 1) which episodes/activities/games students watched/played; 2) how long students in their sites/classrooms watched/played the episodes/activities/games; 3) students' engagement with the episodes/activities/games; 4) whether students needed help during games/activities; and 5) whether they had anything else to share regarding the use of *Superhero School* assets.

Analysis

Standard data analysis procedures for cluster-randomized trials will be used. This will start with preliminary descriptive checks for outliers, univariate and cross-tabular analyses to check out-of-bounds and illogical values, and analyses of missing data patterns. Moderately- to highly-skewed variables will be transformed to closely approximate a normal distribution. We will conduct significance testing on the analytic sample to compare whether treatment and control groups differ in demographic or other characteristics at baseline. To understand sources of attrition and the generalizability of obtained results, the amount and patterns of missing data will be examined, as well as the characteristics of children who remain in the study compared to those who drop out.

The analysis of program impact will depend on the random assignment research design as its primary source of inference. A two-level hierarchical linear model will be used to analyze the program impact on students. For example, the following model estimates impacts for student achievement on *Lens on Science* assessment:

$$PostScience_{ij} = a_0 + b_1PreScience_{ij} + b_2Tx_j + \sum b_I I_{ij} + \sum b_T T_j + \tau_j + e_{ij}$$

where: subscripts i and j denote student and site, respectively; $PostScience$ represents student achievement on *Science*; $PreScience$ represents the baseline measure of science; Tx is a dichotomous variable indicating that a student in a site has been assigned to the treatment condition; and I and T are vectors of student-level covariates and site-level covariates, respectively, measured prior to exposure to the intervention. Student-level covariates will include free/reduced-price lunch status, English Language Learner status, and gender. Site-level covariates will include educator or teacher demographics, program/school size, and program/school demographics. Lastly, τ_j represents an error term for sites, and e_{ij} is an error term for students. In this model, the intervention effect is represented by b_2 , which captures treatment/control differences in changes in the outcome variable between pretest and posttest.

5) Dissemination and Knowledge Utilization

WestEd researchers will develop a dissemination plan focused on sharing research and evaluation findings with diverse audiences throughout the project. Methods include published white papers, research papers in scholarly journals, and accessible materials and resources that public media stations, educators, practitioners, parents, and other education stakeholders can use to support children and families in their communities.