Librarians and Children as Design Team Partners: Creating a Digital Game for Young Innovators

1.0 PROJECT JUSTIFICATION

1.1 Introduction and Target Audience

Syracuse University's iSchool project team proposes to create and disseminate a fully functional, interactive web-based game, Best Practices guide and children's e-book to provide the context for teaching young children about creating an invention to solve a problem and the information skills needed to be successful and a video demonstration/tutorial for the game's use in school and public libraries that wish to offer programs in their communities that stimulate youth innovation while strengthening information literacy skills. The project team requests $249,838 for this two-year National Leadership Project Grant starting August 1, 2022. This project aligns with the following program goal and objective:

**NLG-L Program Goal 2 addressed in this two-year implementation grant**: Build the capacity of libraries to lead and contribute to efforts that improve community well-being and strengthen civic engagement.
The proposed project will provide opportunities for users to use and transfer what they learn from the digital game experience where they help solve problems in a fictional community to using their inventive thinking skills to solve authentic problems in their actual communities.

**Program Objective 2.1:** Develop or enhance replicable library programming, models, and tools that engage communities and individuals of diverse cultural and socioeconomic backgrounds.
The proposed project will develop a library program for all children, developed by diverse groups of designers, testers, and advisors, that includes a fully developed digital learning game, inclusive lesson plans that incorporate the digital game into existing or new library children's programming and other support materials. Partnering with a company for game programming and web integration and a digital artist, the core project team, including both instructional designers and a User Interface (UI) designer, will bring together diverse stakeholders including public and school librarians, STEM educators, library and gaming experts, a youth and Connected Learning scholar, a diversity and inclusion scholar, and children as design team partners. The shared goal will be to integrally involve children and librarians in the game design and iterative prototyping and develop and test a game that motivates STEM inquiry into environmental concerns, information literacy skills and inventive thinking in children in grades 2 – 4. Young children are the future stewards of the environment; fostering their affinity for nature and protecting their environment is an important goal of environmental education programs and may improve quality of life as well as STEM capacity (Sprague, Berrigan & Ekenga, 2020). While grade 2 – 4 children are the primary target group, librarians will also benefit from the results of the grant by having a game and program materials at their ready for in-person, usable or online delivery, that not only support the invention process but also assist in their pursuit of preparing information literate citizens. Ultimately, the community benefits when children realize that they have the power and skills to contribute to the well-being of their communities.

The game will be designed to be easily adoptable, sustainable, and implementable across libraries' existing innovation programming, thus increasing its chances of implementation. The proposed project represents the culmination of the previous 15 years of research and development by the PIs, under the umbrella project "Young Innovators Project" (YIP). YIP began in 2003 with the creation of Curiosity Creek, first as children's books and then a website, followed by a series of three Kauffman Foundation grants to explore the invention processes, motivations and information needs of adult and child inventors. These were succeeded by two sequential IMLS grants, creating _The Information Destination_ website and focusing on a variety of youth invention processes and activities, captured via video interviews with 50+ K-8 inventors, in which one finding was that young inventors often use inadequate information resources to answer their questions or make decisions at key points in the invention process. In summer 2020, the PIs created and tested a conceptual prototype for a digital game where young children learn and experience the invention process while helping solve a problem in the game's fictional community, which led to a 2021 grant from the Lemelson Foundation to create a digital resource evaluation tool for young inventors to use during the invention process. All of these experiences provided the catalyst and conceptual framework for the current proposed project.

1.2 Importance of Game-Based Education and Game Creation

The American Library Association (ALA) recognizes the social and educational value of games in its initiatives and suggests that game creation in libraries has benefits, including the pride of creation and its accompanying confidence, the practicality of new skills for digital work and awareness of audience (ALA, accessed 2020). The ALA Games and Gaming Round Table has sponsored events such as GAME (Gaming As Meaningful Education) starting in 2016, providing networking and mingling opportunities for game-interested librarians (Carlson, 2016). ALA continues to

sponsor its annual Game On! grants program in 2022 to enable libraries to develop gaming programs or collections for their public. A consultant to this IMLS proposed project served as a member of the ALA/Verizon gaming initiative panel of experts on games in libraries and brings his valuable perspective and library experience to the project. IMLS has ~~also~~ acknowledged the importance and challenges related to implementing game-based education in libraries through their funding of initiatives such as American University's National Forum on Libraries and Game-Based Education.

1.3 Librarians: Uniquely Equipped to Support Need for Melding Inquiry/Information Skills with Innovation

Empirical studies support a significant positive relationship between business leaders with strong information literacy skills and exploratory innovation (e.g., Ahmad, Widen, and Huvila, 2020). Equipped with information literacy expertise, librarians are in a strong position to help prepare such future leaders from an early age.

Librarians have been using their unique set of skills to afford interactive learning opportunities for their communities via a welcoming safe space for gathering and sharing games. Some have enhanced their maker and innovation spaces by facilitating coding events in which children and teens hone critical thinking skills through creating their own games. With the increased interest and opportunities for gaming in libraries over the past decade, many librarians have become experts at facilitating game-based learning and socialization; thus, it makes sense that they are equipped to take on a consultative role in the proposed project. Participating librarians will provide critical input to the development and pilot-testing of a game that blends inventive thinking skills with fortifying inquiry and information skills and is specifically designed as a tool to strengthen their school or public libraries' existing STEM and innovation programs for young children. Librarians will guide children as they learn and practice inquiry, just one example of where their input will be key. Research by the PIs in interviews with 50+ recognized child inventors (gr. K-8) has demonstrated that while children enjoy the process of invention, they often lack the inquiry process skills necessary for accurate information seeking and preciseness in question-framing, critical to success during the invention process (Small, 2014, Arnone & Small, 2019). This reveals that librarians have an important role in increasing these skills and abilities in our nation's youngest innovators.

1.4 Lack of Diversity in Game Development

Even with the recent interest in games, there is a shocking lack of representation of diverse characters in gameplay. This diversity issue and underrepresentation is not only evident within the games themselves but within the national cohort of game developers, with one study noting that over 80% of developers are white males (Williams, Martins, Consalvo & Ivory, 2009). That statistic has not improved much over the more than 10 years since the article was published. According to a 2019 survey conducted by The International Game Developers Association (n = 1116), 71% of respondents identified as male, with only 24% as female, 3% as non-binary, and 2% responded "prefer to self-describe" and 4% identified as transgender. The statistics for "Race/Ethnicity/Ancestry" painted a bleak picture of game developers in underrepresented categories. Those who identified as Black/African-American/African/ Afro-Caribbean and West Asian each were only 2% of the total respondents (2019); Black and Latinx characters are underrepresented in games themselves (Peckham, 2020).

Games can be illuminating in their potential to teach strategy and skills (Manesis, 2020), but they often also reinforce entrenched stereotypes and bias (Richard, 2017). The diversity issue is so prevalent in gaming that noted game researcher and designer, Lindsay Grace, held several convenings to address this issue by directing the American University Game Studio Summits, intended to bring about discussions to support the game industry in furthering diversity initiatives. In *Doing Things With Games: Social Impact Through Play*, Grace supports the notion that games, unlike passively watching tv, require such full attention for participation, an intense engagement that makes it ideal for reaching an audience for social impact (2020). The proposed project intends to make diversity and inclusion a priority in its design and execution, accomplished through the composition of the project team, project advisory committee, participating librarians and children, and by building the values of equity, diversity and inclusion into the gameplay and overall game design.

1.5 Bringing Children into the Game Design Process

Children from the target age group (6-9) will serve as design team partners to our central development team, a practice Druin (e.g., 2002) has shown to be effective when developing media for children. When children create games, they learn valuable skills for future innovation and for working effectively in teams, while also providing the project team with useful ideas on how to use gamification with serious (learning) games (Kostenius, Hallberg & Lindqvist, 2018). Children are now a huge target group for gaming companies and, as such, they are frequently involved in playtesting but *infrequently* involved in the actual design process. Child-centered game development (CCGD) requires that children are embedded in the total process of game development (Moser, 2013) and this is the intention of the proposed project.

The importance of co-designing with children from the target audience cannot be underestimated; adult designers often think they understand children's needs/preferences better than they actually do. In one study in which children worked

with adults to co-design a friend robot, adults assumed that children would want a large-sized friend robot. However, in reality, some children preferred their robot be smaller and portable (Arnold, Lee & Yip, 2016). That co-designing is essential to developing products for children was also corroborated during summer 2020 when the PIs and UI designer conducted two children's game design focus group sessions to explore low fidelity mock-ups. The children's conception of a new character, Agent Abigail, was quite different than the adult designers had imagined. Children as design partners (as opposed to just being testers, for example) must be considered as equal stakeholders throughout the process (Hanson, 2017), with their unique insights and competence acknowledged.

2.0 PROJECT WORK PLAN
In this section of the proposal, we first provide a brief overview of the game and describe the theoretical foundations for the work we propose. We then define our project goals, beginning with the planned project outcomes and moving to the technical goals in service of those outcomes. The project activities and their relationship to innovation and inquiry/information skills will be described, followed by a brief description of the timeline and approach to project management (with a more detailed schedule of completion as a separate document). Our core project team and all other contributors are introduced. A theory of change is then presented graphically through a logic model that succinctly depicts the national need/situation we will address, how we envision change occurring through project inputs, activities and outputs, and outcomes, and our evaluation goals are shared.

2.1 Overview of Game Concept and Gameplay
Using a Connected Learning Framework, guiding principles from Self-Determination Theory, and the Lemelson Invention Education curriculum as the foundation of this effort, the project team, with librarians and child design team partners, game programmer, User-Interface (UI) designer, digital artist, web integration expert, and guided by the project advisory committee (with expertise in STEM innovation, youth, libraries), will co-create a 12-part game for ages 6 -9. The game is
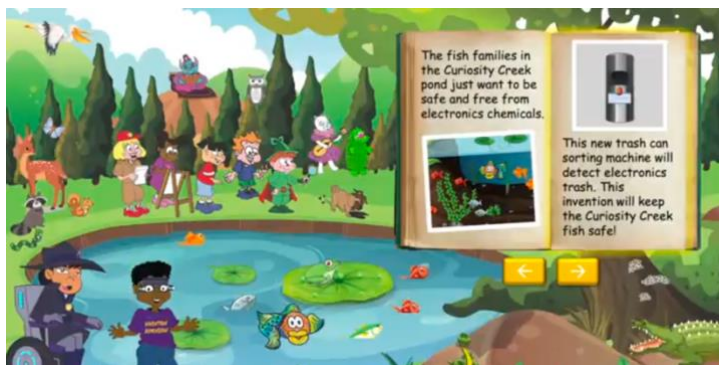

situated in Curiosity Creek, a fictional rural town created by the PI and used in children's books and online. It requires its children and critter inhabitants to use inventive thinking, specific inquiry skills, and decision-making, involving equity, diversity and inclusion, for gameplay success. Librarians will use the game as a tool which they can integrate into their existing innovation or invention programs, enhancing those programs and sparking learner engagement. The game can be played either independently by children to stimulate their creativity and reinforce inquiry skills or, more often, librarians will play the game with a group of children. In this way, they can choose one or two game sections in each session and incorporate the suggested teaching and mentoring ideas to further support specific inquiry and inventive thinking skills necessary to proceed to the next "Challenge" in the game. In a parallel activity from the Best Practices Guide, students, working independently or with STEM teachers, can apply the same skills modeled in the game in a real-life application in their community. In a separate but related app (already developed through a Lemelson Foundation grant) called *Get SET!* (Source Evaluation Tool), kids will evaluate the credibility of the information sources they use as they invent. The game and code will carry a Creative Commons open license, making it free to educators and developers. The game concept was designed and piloted in 2020 with input from two children's focus groups who shared their design ideas, resulting in insightful feedback that contributed to this proposal.

2.2 Theoretical Underpinnings
As STEM invention skills are practiced in each game challenge, principles of the Connected Learning Framework and Self-Determination Theory (SDT) will underly them. They will help inform the development of the invention game and support materials. SDT, one of the most empirically tested motivation theories, holds that individuals must have their psychological needs for competence, autonomy, and relatedness met to motivate self-determined behavior (e.g., task persistence) and a sense of well-being (Ryan & Deci, 2020). Autonomy support, in the form of meaningful choices that increase a player's uncertainty and active engagement, and impact the player's experiences and the game's outcomes, is particularly important in game design. Noted game designer Sam Kabo Ashwell described a variety of choice-making patterns for games. In early consultation with project consultant and game expert Chris Harris, the PIs have elected to apply a "branch and bottleneck approach" to the design of the proposed game, where players are given meaningful choices to determine solutions to a problem, receive essential informational feedback on their choices and are rewarded

for choice quality (see graphic below). Regardless of the path taken, players arrive back at the next bottleneck point in the game (Ashwell, 2015). This approach is both motivating for the player (e.g., replaying for higher score) and efficient for game design and programming.
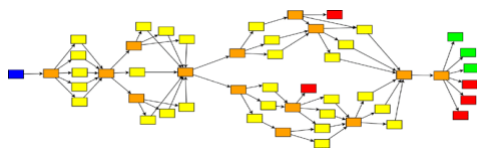
Graphic Representation of Branch and Bottleneck Approach

Basic need support is especially important given the diversity of learners and the authors argue that autonomy support plays a key role in fostering inclusive learning environments. SDT works well in tandem with the Connected Learning Framework in which personal interests, meaningful relationships (e.g., librarians as mentors, peers, other adults), and real-life opportunities combine to create engaging and "connected" learning experiences. Design principles of Connected Learning also place a high value on approaches that give advantage to less resourced youth (Ito et al, 2020).

2.3 Project Goals

The proposed project represents a natural progression from the PIs' past successful projects in the areas of youth innovation and information literacy and contributes to the current growing national invention education movement. The proposed project's over-arching goals will serve three main audiences: 1) librarians nationwide as represented by the 15 librarians participating in the Librarians Council and project implementation, 2) children as designers represented by the 10 children's design team partners, and 3) children served in the communities of the participating libraries and librarians.

Project goals are listed below; specific indicators and targets for our Outcome Based Evaluation (OBE) Plan are listed in the Appendix.

1. Participating librarians will find the game and support materials are easily integrated into existing STEM and invention education programs, adding a new dimension to those programs, and increasing (librarians' observation of) learner engagement, inquiry skills, and STEM-related inventive thinking; with added support from our previously developed, IMLS-funded mentor training on our project website, The Innovation Destination (https://theinnovationdestination.net), librarians also will feel empowered to serve as invention mentors to participating children without having to be STEM experts.
2. Children participating as game design team partners will derive benefits from serving as integral members of a design effort; publishing the results of the design team experience will inform library professionals of benefits and best practices for engaging children in game design.
3. Children playing the game in the participating libraries' diverse communities in tandem with the parallel community problem-solving activity will report or demonstrate increases in the following:
   a) Curiosity and interest in STEM related invention for social good
   b) Knowledge and use of inquiry skills that support invention activities
   c) Positive feelings about the values of equity, diversity and inclusion represented in the game design by, in part, character role modeling and incorporating scenarios in the game which place characters in situations where value decisions must be made that will impact others.
4. As a result of the project's dissemination effort and expansion of *The Innovation Destination* web resource, there will be an increase in use of and satisfaction with the resource, attributable to the addition of the game and support materials resulting from IMLS grant funding.

   In service of the project outcomes, the technical goals of the project are:
1. Design, develop, iterate, test and deploy a fully functional web-based game as described;
2. Produce a Best Practices guide with teaching ideas supplied by librarian participants;
3. Design and conduct cognitive testing of a pre-post instrument to measure project goal 3;
4. Produce an informational video to serve as a project orientation and implementation guide for participating librarians;
5. Design and produce an e-book that sets the context for the game to be used by participating librarians;
6. Create Dissemination Plan to alert librarians nationwide of results of project and information about accessing the freely available products of the grant; and
7. Expand the project web site to include game and support materials.

2.4 Project Activities

Project activities will be informed by the project goals described in 2.3, theoretical underpinnings described in 2.2,

participation and guidance by project participants described in section 2.6, and the results of the conceptual work and children's focus groups conducted in the summer of 2020.

The game will be developed for 2D play using React Native, open access software for 2D game development and the project management approach described in Section 2.5. Once the game has been developed and enters the implementation stage, collaborative teams of librarians and STEM education classroom teachers will serve as mentors, inspiring children to identify and select a local problem (in their community or school) that they can solve by employing inventive thinking, STEM inquiry skills, and empathy modeled in the game. This combines the playing of the game (which solves a problem situated in Curiosity Creek) while simultaneously addressing an authentic problem within their local community or school. Through these documented parallel activities, children will recognize that they can apply the same skills to real-life problems, and, by the end of the process, they will have a prototype or proposed solution they can potentially share with community or school decision-makers.

Game Concept and Preliminary Work. Three members of the core team spent the summer of 2020 creating and piloting the general concept for the game. The proposed game design and development project incorporates the story

elements of Curiosity Creek, a site created by the PI that connects literacy, inquiry, and invention to motivate an affinity for nature, and also integrates brief video clips of recognized child inventors from the target age group from the PIs' prior IMLS-funded project, The Innovation Destination. In preparing for this proposal, the team held two focus groups with children (experienced inventors and non-inventors) who provided input on the game's preliminary design and mechanics and on the depiction of a major game character. The team used this input to create a concept prototype with

"It looks like we just received your 1st challenge from Agent Abigail!" Click the smartphone to open the message.

sample game mechanics, set in the fictional rural community. A trailer (1 minute, 25 seconds) can be viewed at Game Trailer. The complete visual prototype resulting from the summer 2020 work, including children's focus groups, illustrates the game mechanics and the iterative process of innovating (38 minutes) and can be viewed at Game Concept and Mechanics. The learning goals and game mechanics for each challenge are depicted. These preliminary activities, in preparation for this grant application, demonstrated the engaging overall concept (as observed in focus groups). They also showed areas where the new co-created game in the proposed project requires iterative design and development that not only will incorporate inventive thinking skills but also offer more opportunities to hone STEM inquiry skills and support values of equity, diversity and inclusion in the game-based scenarios. One area for improvement suggested by our consultant and library game expert, Chris Harris, is to include more open-ended decision-making opportunities, which we can do by adding elements such as a journal app to record ideas as the player moves through.

The completed new game will be the first in a planned, future 5-game series with the same user interface and characters but with a different "mission" posed in each game. The deliverables of this grant will be used to secure external funding for the subsequent games in the series to continue making the games freely accessible.

2.5 Timeline and Project Management Approach
A detailed timeline for this 2-year project is included in the Schedule of Completion as a supporting document noting all the project tasks and milestones. We will utilize an Agile development approach reflected in the Schedule of Completion. This approach is often used in game development because it allows the team to see demonstrable iterations of small parts or vertical slices of a game, often called game "mechanics," to quickly identify what is working and what is not. This approach is particularly useful since our child co-designers as well as our librarians can provide "just-in-time," critical feedback and ideas throughout the process as opposed to waiting long durations for an entire phase of development before providing input (referred to as "Waterfall" project management). *Agile methodology* allows early attainment of functionality, resulting in greatly reducing the chances for dependencies on game mechanics that we later determine need to be eliminated and allows scope to be adjusted based on input. Features that are well-accepted by child co-designers can be expanded or built upon with more content utilizing that specific functionality.

2.6 Personnel, Advisors, Librarians and Other Contributors
Demonstrated Expertise of Core Team. The PIs have a strong track record in developing demonstration projects fostering inquiry, curiosity, and innovation, and that help librarians provide increased inclusion and accessibility to persons with disabilities. They have published articles on learning in technology-pervasive learning environments, are well-established researchers in information literacy, motivational design and innovation, accessibility issues in libraries, and experienced in using outcome-based measures for project results. **Dr. Marilyn Arnone** (PI), Professor of Practice (Emerita) and Research Professor, Syracuse University, focuses her research on children's curiosity and inquiry-based

learning and is an expert at video storytelling and web design. She will direct the administrative responsibilities of the proposed project including the execution of the project performance measures, lead the evaluation effort, contribute to overall game design, plan and produce the video training, direct eBook development, produce the character animation for the game, co-direct the dissemination effort, and serve as ex-officio chair of the project's advisory committee. **Dr. Ruth Small** (co-PI), Laura J. & L. Douglas Meredith Professor of Information Studies (Emerita) and Research Professor has expertise in information literacy, motivation, innovation, and libraries and disabilities, with two national research awards (ALA, AASL). In collaboration with our advisory committee, she will work with external organizations and libraries on recruitment and participation of diverse children's design team members, lead the conceptual development of the game with input from the child co-designers, game consultant, and librarians as she manages the iterative software development, work with participating librarians to implement the game and support materials, and co-direct the dissemination components of the project. Together, the PIs have collaborated on over two dozen successful grant-funded projects from foundations, government agencies and universities, including many IMLS funded projects. They realize the critical importance of bringing in diverse perspectives into project planning and execution and the opportunity for this project to build on two successful previous national, IMLS-funded youth innovation projects. They have been working together in youth innovation for more than 15 years and both possess a PhD in Instructional Design, Development and Evaluation from Syracuse University giving them a thorough understanding of theory and practice related to learning.

An integral member of the Syracuse team, **Jennifer Han**, graduate student research assistant, has experience in user interface (UI) design through her employment at Microsoft Corporation and effective facilitation of child focus groups during the game prototype testing with the PIs in summer 2020. Ms. Han will work on UI design, facilitate the Children's Design Team meetings, and work closely with the PIs and game programmer.

We also partner with technical director, **Thomas Hardy**, a software engineer and founder of Data Momentum Co, who will direct technical development of the web components and supervise the day-to-day work of the game programmer with regular participation from the project team. He has worked with the PIs on numerous major funded projects over the past 20 years, including *S.O.S. for Information Literacy*, *Project ENABLE*, and *The Young Innovators Project*. **Marguerite Chadwick-Juner**, recognized artist and character cartoonist for Curiosity Creek, will serve as digital artist. A graduate student project assistant (TBD) will assist with development of the Best Practices Guide, recruitment, and evaluation tasks. All have designated personnel, financial and other necessary resources, including adequate, dedicated time, to fulfill the scope and scale of this project (see Bios for further information). The Syracuse iSchool's research administrator and clerical staff will provide internal support to the project team.

Several other strategic collaborations will strengthen the project, ensure the inclusion of diverse perspectives and amplify the critical role of librarians in project outcomes. They include the following:

The Project Advisory Committee (PAC) represents multidiversity in geography (five states), places of employment (libraries, universities and businesses), gender and race/ethnicity. The PAC will convene with the project team as a group three times during the two-year grant period and PAC members will meet individually with the project team for three additional one-on-one meetings to provide advice in their specific areas of expertise. Our PAC members were thoughtfully selected, based on their wide variety of relevant backgrounds and expertise that will allow them to meaningfully contribute to this project. They also will assist in promoting and disseminating the outcomes of this project to their various organizations and constituents. For their efforts, they will receive a modest stipend.

The PAC includes: (1) *Amanda Baskett*, Director at Rockdale Magnet School for Science and Technology in Georgia. She serves as co-director of the Rockdale Regional Science and Engineering Fair, serves on the board of the National Consortium of Secondary STEM Schools, and was one of two founding teachers of the Georgia K-12 InVenture Prize a statewide youth invention competition. She will advise on STEM-based youth invention education programs and provides the parent perspective, as the parent of a 2nd grade inventor; (2) *Brian Mayer*, Coordinator of the School Library System and Media Services and former Gaming and Technology Specialist at Erie 2 BOCES, an educational services agency that supports the libraries of 27 mostly rural districts in Western New York State. He was named a 2015 *Library Journal* Mover and Shaker, is a freelance game designer and co-author of *Libraries Got Game* (ALA, 2009) and several books in the "Teaching through Games" series (Rosen, 2015) and is the designer of the award-winning board game "Freedom: The Underground Railroad" (Academy Games, 2013). He will advise the project team on game design for libraries; (3) *Dr. Shandell Maxwell*, artist, coach, and activist. Her expertise is in leadership and change management exploring the impact of racial socialization practices on diversity and inclusion efforts by organizations. She will help guide the project team as they aim to include the values of diversity, equity, and inclusion into all aspects of the game design; (4) *Katherine McGinnis*, elementary school librarian and artist in upstate New York. She brings experience in both designing and implementing innovation projects and has worked previously with the PIs on grant projects, including creating much of the artwork for the PIs' previous IMLS grant, "Inspiring Invention Through Stories." She will advise the project team on

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game character and setting design and game integration into primary grade STEM curricula; (5) **Stephanie C. Prato**, Head of Children's Services at Simsbury Public Library in Hartford, CT and incoming co-chair of the School-Age Programs and Services Committee of the Association for Library Service to Children (ALSC) Division of ALA. She previously served as a lesson plan creator for the PIs' "Inspiring Invention Through Stories" grant. She will advise the project team on integrating project deliverables into existing children's information literacy programming in public libraries; (6) **Dr. Mega Subramaniam**, Professor & Co-Director of the Youth Experience Lab, at the College of Information Studies, University of Maryland. She is nationally known for her work with youth and the Connected Learning framework. Dr. Subramaniam's research focuses on enhancing the role of libraries in fostering the mastery of emerging digital literacies that are essential to STEM learning among underserved young people. She will advise the project team on the application of connected learning principles in digital game design; and (7) **Dr. Carol L. Tilley**, associate professor at the School of Information Sciences and associate professor at the Department of Gender Studies, College of Liberal Arts & Sciences, University of Illinois. Her research is in areas such as children's print culture (e.g., comics research), information inquiry and instruction, and information seeking and use. She has served as co-editor of *School Library Research* and Director of External Relations for the Association for Library and Information Science Education (ALISE). Carol will contribute to our game design through her knowledge of graphic stories and her research in information inquiry and seeking. In addition to sharing their knowledge and expertise, advisors will assist with recruitment of librarians and child designers and will use their extensive connections with national and state professional library organizations (e.g., ALA, ALISE, AASL, PLA, ALA- GameRT, NYLA) to help disseminate project deliverables and promote their use.

The project team also will consult with **Dr. Christopher Harris**, Director of the School Library System for the Genesee Valley (NY) BOCES, a consortium supporting 22 small, rural districts in Western NY State. He was an ALA Emerging Leader (2007), an ALA Fellow for Youth and Technology Policy, a *Library Journal* "Mover and Shaker" (2008),served as a member of the ALA/Verizon gaming initiative panel of experts on games in libraries and started *Play Play Learn*, a site providing educational resources and consulting services to connect games and learning in libraries, schools, and homes for students of all ages. Chris published several books in the "Teaching Through Games" and "The Playful Classroom" series (Rosen Publishing, 2015) and the "Unplugged Activities for Future Coders" series (Enslow, 2019). Chris' latest adventure is as developer of a totally virtual secondary school, for which he will serve as Principal. Chris has advised the project team on this proposal and has committed to continuing throughout the two-year grant period, for which he will receive a stipend.

The Librarian Council and Implementation Team. Fifteen librarians, representing diversity (racial/ethnic, gender, years as librarians, location), will be recruited using snowball sampling (a recruitment technique in which librarian participants are asked to recruit other librarians and children until the target number is reached) to serve as virtual design team partners, providing input during formative evaluation, pilot testing the game, and providing examples of their best practices for implementation. Eight of the librarians on this team will implement the game in their libraries and an additional seven librarians will contribute their input and ideas to the development of the best practices guide, informational video, and e-book, as well as support their colleagues during implementation of the game. One activity that we plan to use in this grant, based on its success in a previous IMLS-funded grants, is to establish a virtual Facebook group (closed), *community of practice* of librarians, led by the librarian participants with input and feedback from the project team and initiated during the implementation phase so that lessons learned can be shared with each other as they rollout the game and materials in their libraries. Librarians will also provide formative feedback during implementation and help children fill out a brief questionnaire at the end of the project. They will receive a stipend for their participation.

The Children's Design Team Partners. Ten children (TBD), in the target age group (6-9) and representing diversity (race/ethnicity, gender, age, location, invention experience), will serve in a co-design capacity. The Children's Design Team Partners will play a critical role in game design, development, and iteration. Each participant will receive a stipend for their participation.

All of these stakeholder groups bring their knowledge and experience to support the project team's efforts and positively impact this project's success for meeting its goals.

2.7 Logic Model. The logic model graphically represents our theory of change, depicting the situation the project addresses and how the project components will lead to project outcomes. Both short and medium-term outcomes will be measured.

LOGIC MODEL: Librarians and Children as Design Team Partners: Creating a Digital Game for Young Innovators

SITUATION / NATIONAL NEED:
1) Children often lack the inquiry skills needed to research their invention ideas, 2) There is a lack of diversity among adult game developers and in children involved in invention related activities, 3) Children need to be able to co-design products developed for them.

INPUTS	OUTPUTS		OUTCOMES		
	Activities	Participants	Short-term	Medium-term	Long-term
- Project team expertise - Data Momentum's game developer and staff -Expertise from the 7-person Project Advisory Committee -Game design consultant -Fifteen librarians -Ten child co-designers -University staff support -Student support -Funding from IMLS -Existing infrastructure of innovation website -Existing infrastructure of Curiosity Creek site	-Planning meetings -Participant Recruitment -Design of performance measures -Planning & Design of instruments for outcome-based evaluation -Game design, development, testing, iteration, using Agile development methods with input from children co-designers -Support materials development -Implementation and feedback -Evaluation -Reporting -Dissemination	*(Those who benefit from inputs and program activities)* 15 Participating librarians who deliver game and/or provide input 10 Children participating as Design Partners Children participating in library program with game and materials Librarian users of the expanded Innovation Destination web-based resource	Librarians: 1) perceive game is easy to integrate into existing programs 2) indicate confidence in deploying game and 3) observe learner engagement Children co-designers 1) report increased confidence in design abilities 2) show improvement in teamwork, 3) report increased feelings of autonomy 4) Child participants in gameplay in libraries are more aware of the values of diversity and inclusion and more competent in inquiry skills	Participating librarians indicate intention to use game & activities again in the next year Publications and dissemination of program results in more librarians offering the game accessing the model program through website registration. Increase use of virtual resource, *The Innovation Destination* to access game and other resources	*(Measurement of desired long-term impact is beyond the scope of this grant period but outcomes are listed below)* More children become involved as design team partners to co-design technology projects with adults. More librarians become involved as game co-designers working with children. Project contributes to increased diversity in game developers and in more diverse representation of game characters.

EVALUATION: On-going throughout the project and will include both formative and summative components as detailed in Evaluation Plan.

2.8 Evaluation Plan Overview (see supporting documents for complete, detailed Evaluation Plan).
Both PIs are experts in evaluation and share the philosophy that evaluation is critical to the ongoing development and improvement of high-quality library programs and services by providing evidence of success and understanding how to turn any failures into learning opportunities and ultimately successes. Dr. Small will lead the project evaluation effort, collecting data throughout the 2-year grant period (and beyond). With assistance from the participating librarians, iterative, formative data will be collected from all participating librarians, design team children, and playtesters. These types of iterative data collection allow the project team to make changes and improvements *while the game development is still in-progress*. The following projected top level outcomes will guide the proposed project's evaluation effort:

   Outcome #1: Participating librarians will find the game and support materials beneficial to their existing innovation programs.

   Outcome #2: Participants in the Children's Design Team (CDT) will derive valuable benefits from serving as integral partners in game design. and publishing the results of the design team experience will inform library professionals of benefits and best practices for engaging children in game design.

   Outcome #3: Children engaged in gameplay and related activity in the participating libraries experience gains in knowledge, skills, and positive attitudes toward diversity and inclusion.

   Outcome #4: There will be an increase in the use of and satisfaction with *The Innovation Destination* resource by site visitors over the full grant period.

   Summative evaluation data will be collected using pilot-tested instruments (e.g., questionnaires, journals, observations, interviews) to determine if project goals have been achieved. The summative evaluation will include a measure to assess how well the project goals have been met, including whether and how game experience and associated parallel community activities (that required research) have helped to improve participants' inquiry skills and their attitudes about equity, diversity, and inclusion. One potential method of collecting such data might involve building in some scenario-based questions (similar to the ones in the game but related to different content), included in the summative evaluation questionnaire for children. This may also help to indicate whether children can transfer their learning to new situations.

2.9 Performance Measurement Plan
The project directors will monitor and assess the overall management and performance of the grant in terms of meeting its goals based on the four criteria of effectiveness, efficiency, quality, and timeliness (See supporting document).

3.0 DIVERSITY PLAN

The proposed project's team has a long history of national projects in which diversity is the focus (e.g., "Project ENABLE," "Targeting Autism") and of working successfully with partner youth innovation organizations (e.g., Georgia Inventure Prize, By Kids For Kids, Connecticut Invention Convention) and libraries (public, school, academic) to achieve a broad diversity of participation across all project components, from the project team to our PAC and librarian and child participants, encompassing a variety of cultures, races, ethnicities, genders, socioeconomic backgrounds, and abilities. PAC member Maxwell, an expert in diversity, equity, and inclusion, will be an important contributor to designing a game that fosters these values.

The team will seek a level of broad diversity through its selection of participating librarians and children's design team members. The PIs, with help from members of our PAC, will broaden our initial set of criteria for recruitment of librarians and children as design team partners. These criteria include library program participants representing both public and school libraries and an emphasis on libraries situated in economically underserved communities that typically have lower than average employment and economic diversity, as well as a high incidence of at-risk children including those with disabilities. Children for the design team may be recruited through participating librarians working directly with underserved populations. Child co-designers who represent a diverse group themselves should also project diversity into the game design and development. Diversity, equity and inclusion also will be an important theme in the proposed game's storylines and characters.

4.0 PROJECT RESULTS

4.1 Addressing Agency Level Goals

This project addresses the IMLS agency-level goal of building libraries' capacity to contribute to community well-being and strengthen civic engagement by helping children to think innovatively and use information skills to solve problems in their local communities while promoting interest in STEM learning, and the values of equity, inclusion and diversity. The International Literacy Association (2018) engaged in a three-phase study that concluded that equity in literacy education ranked #2 in importance by respondents and access to books and content ranked #5 in importance. Equity was defined in the study as "ensuring all children get what they need not only in situations of poverty and limited resources but also regardless of academic proficiency, geographic remoteness, and any other barrier to school success" (p. 11). An important project goal is to attract interest and participation by children from underrepresented and marginalized groups and instill in them an interest in STEM innovation and inquiry. Few games are designed to stimulate both inquiry and STEM invention in the school or public library context or that attract diverse participation, making the proposed project unique, while contributing to the invention education movement in this country. The proposed game and associated materials will positively impact librarians' ability to facilitate children's learning through games, as well as impact children's attitudes toward embracing equity, diversity and inclusion in games and in the real-life application of design projects.

Scalability. The active dissemination effort to distribute the project findings and the existence of theinnovationdestination.net platform from which the game and support materials will be distributed nationally, strengthens the potential for the project deliverables to be implemented on a large scale across the U.S. The dissemination plan is detailed in Section 4.2 below.

Adaptability and Adoptability. While the project specifically targets public and school libraries to help cultivate young innovators, the game and other deliverables can easily be used in invention education programs in children's museums and independently by children (or with their parents) as an outreach activity. The innovation process and inquiry skills are the same regardless of where they take place. The game and support materials will be designed to integrate into existing invention education programs, increasing their potential to be easily adoptable, sustainable, and widely implementable across school and public libraries.

A Plan for Measuring Success. The project's outcome-based evaluation method that was detailed in Section 2.8 will contribute to the success of the project. Methods used by evaluators and librarians will include interviews, questionnaires, and electronic journals (kept by the participating librarians).

4.2 Product Dissemination and Communication Plan

An active dissemination effort, during and even *beyond* the funding period, is critical for national impact and to assure that project information continues to be available to our intended audiences. As the PIs have strong publication records and have presented often at professional library and education conferences, they have an established track record of successful dissemination efforts for their funded projects. For example, as a result of its communication efforts over the

past five years, more than 5,000 librarians, pre-service librarians, and teachers worldwide have registered for the *Project ENABLE* comprehensive training on library services to people with disabilities. Librarians selected for participation on the PAC were selected partially on their active participation in local, state and/or national professional organizations; one of their responsibilities will be to use those connections to assist the PIs with project dissemination efforts (e.g., presenting at conferences, submitting papers to journals). The PIs also have frequently included project participants as co-presenters at professional conferences and co-authors of professional publications. For example, the project leaders' AASL co-presentation of the launch of *The Innovation Destination* included five librarians who participated in the project as mentor-librarians, resulting in more than 5,000 visitors to the site in its first month. The PIs have also invited advisors and librarian participants as guest bloggers on the project blogs and plan to continue to do the same for this project.

Our marketing plan within our dissemination effort will include not only public and school libraries that have innovation programs and schools that incorporate invention education, but also youth invention competitions, invention education organizations, and invention programs in museums and online. We will not wait until the game is completed to kick off a dissemination effort to these groups. We plan a "Follow Our Game Design Journey" active dissemination effort throughout the project, pushing out information to librarians and other stakeholders, through our project's monthly blog and posts to various other regular digital announcement vehicles. Information will include what is being developed, beta-tested, co-designed with children, and even provide revealing glimpses into our "agile process" of development so that anticipation is being built before the actual launch of the game. Sharing images of game design unfolding, snippets of game mechanics, input from children and librarians, and even working within a budget, will comprise posts (and increase interest in the project). An app such as POST PLANNER will be used to help in scheduling releases of new information.

Dissemination of information about the proposed project and its outcomes includes the use of a wide variety of communication channels, such as (1) articles in professional journals for library practitioners and teachers [e.g., *Children and Libraries, Knowledge Quest, Public Libraries*], (2) presentations at professional library association conferences (e.g., PLA, AASL, ARSL), (3) blog posts, including selected project participants and partners as guest bloggers on the project website's quarterly blog; (4) reports, announcements, white papers via the Syracuse University web sites, social media (Twitter, Facebook), local and state librarian e-newsletters, and e-newsletters of innovator organizations; and (5) announcements to library organization e-newsletters, listservs and bulletin boards and shared with PAC members so they can share them with their professional library associations' divisions, special interest groups, roundtables and committees. *The Innovation Destination* and *Curiosity Creek* sites will promote the products of the grant. Digital deliverables will be freely accessible through the project site at https://theinnovationdestination.net. These deliverables include the web-based game, a set of best practices from participating librarians' experiences, an orientation/training video for librarians, and an e-book for children and librarians that sets the context for the game.

4.3 Sustainability Strategy

Strategic Positioning. Strategically situating this project within *The Innovation Destination* website, with reciprocal links to the *Curiosity Creek* site and allowing the project team to house this project with other highly successful and popular IMLS-funded-developed web resources, such as *Project ENABLE* and *S.O.S. for Information Literacy*, ensures sustainability for all projects. The proposed extended version of *The Innovation Destination* website, with its unique, innovative, searchable video and resources databases and other relevant materials, adds to the variety of resources available to librarians and others to support youth innovation activities in libraries, schools, recreational facilities, and homes. The collection of STEM and literacy-related, standards-based teaching/learning resources enhances this project's potential usage base. The PIs have enjoyed 20 years of successful collaboration with Mr. Hardy, who maintains the technical quality of *Project ENABLE*, *S.O.S.* and other project websites and will oversee the web integration of the game on the project site to ensure that the website is properly updated and maintained into the future. The project team has had a successful record of preserving and maintaining the digital content created for each of the projects undertaken.

Game Sustainability. Game sustainability will be achieved through selection of an open-source software development tool that will not require annual licensing to maintain the game. We have selected React Native, a robust programming language used for app development. that is not limited to only one platform. It has been used in the development of widely popular apps like Uber and Airbnb. React Native is an appropriate choice for our 2-D game which will be a hybrid app.

Sustainability in Emergency Situations. This project could be a deliverable in event of a shutdown. If a library should face a situation in which it must pivot to virtual delivery, the game project and its inherently virtual support materials will be an ideal mechanism for librarians to help them continue their invention education programming on a remote platform. [See supporting documents for full list of proposal's cited references.]

Schedule of Completion using Agile approach for software development (1 = 1st 6 months, 2 = 2nd 6 months, etc.)
KEY for Leadership Team (LT): Marilyn Arnone (MA); Ruth Small (RS); Thomas Hardy (TH); Jennifer Han (JH), Programmers (P)

Task/Activity/Milestone* (Lead Person)	1	2	3	4
1. Convene project team meetings (Leadership, Student Assistants, Programmer, Web dev., Artist (MA)	x	x	x	x
2. Identify/Recruit diverse librarians and children for design teams and for game implementation (RS)	x			
3. Conduct annual meetings w/project advisory board plus solicit input electronically, as needed (MA)	x	x	x	x
4. Lead game design; initialize decisions RE: scope & capacity including animation needs (RS)	x	x		
5. Bring in librarians for initial design sessions / focus group; address diversity, equity & inclusion (RS)	x	x		
6. Run regular feature-focused sprints w/ core team (3-week sprints), game programmer, digital artist (TH)	x	x	x	
7. Planning and Design: Internal Performance Measures & instruments for Outcome Based Evaluation (MA)	x	x		
8. Run bi-monthly sessions w/children's design partners for input on UI features, storyline, playtesting (JH)	x	x	x	
9. Produce character animation for introducing each challenge and giving gameplay instructions (MA)	x	x	x	
10. Iterations based on feedback followed by meeting w/ full team for playtesting (P, LT)	x	x	x	
11. MILESTONE 1: Complete gameplay mechanics for Challenges 1- 3		x		
12. Run playtesting session w/children's design partners; garner feedback, ideas (JH)		x		
13. Run focus grp of librarian participants: report on children's input & garner ideas (RS)		x		
14. Finetune storyline; continue storyline development and finetuning throughout (LT)		x	x	
15. MILESTONE 2: Gameplay mechanics documentation/report (RS, MA)		x		
16. Create digital art for Challenges 4 - 7, passing to programmer as completed (MA)		x	x	
17. Begin sprints for Challenges 4 – 7 (TH)		x		
18. Write and submit Year 1 Interim Performance Report to IMLS (MA)			x	
19. Expand young innovators project site with infrastructure to support game/materials (TH)			x	x
20. Continue run feature-focused sprints with full team for ongoing development (TH)			x	
21. Record narration as required; check accessibility, collect digital assets; fine-tune UI (MA, JH, RS)			x	x
22. Develop surveys for formative evaluation of gameplay features & accessibility to date (RS)			x	
23. Gather formative feedback from librarians & children's design partners on new features (RS, JT)			x	
24. Write formative evaluation report w/recommendations for sharing with team (MA)			x	
25. Integrate additional animations into the build (these are small character animations) MA)			x	
26. Initiate work on video documentation for librarians although it can't be completed yet (MA)			x	
27. Integrate admin features (e.g. usage reporting, ability to stop, then pick-up game) (P)				x
28. MILESTONE 4: Alpha game version complete by end o 3rd 6-month cycle (LT)			x	
29. Alpha/Beta Test: Librarians/children's design team playtest. Release to selected others. (RS, JH)				x
30. Alpha/Beta Testing/QA: Find/fix bugs; polish gameplay, check accessibility, Quality Assurance (JH)				x
31. Launch game & Best Practices on theinnovationdestination.net (MA)				x
32. Add patches to game, version control (JH)				x
33. MILESTONE 5: Game Launch (Target date: midway through final 6 months of project) (LT)				x
34. Gather final OBE data from librarians & children, include projects; analyze data (MA, RS)				x
35. Create Best Practices from librarians' lessons learned (RS)				x
36. Create librarian training video, and e-book (MA)				x
37. Write/submit articles for practitioner journals based on data (MA, RS)				x
38. Deploy dissemination plan outlined in proposal (RS, MA)				x
39. Create plan to approach corporate foundations for new game in series (RS)				x
40. Post data on project site for public access (MA,RS)				x
41. Write detailed final project report (MA with input from LT)				x
42. MILESTONE 6: Submit final project report to IMLS (MA)				x

Digital Products Plan

This Digital Products Plan for the proposed project aims to describe the creation and management of digital products designed and produced as project deliverables.

Type
Digital content to be created include the following:
- 1 Digital game created using React Native as programming language with original digital art assets created in Adobe Photoshop, Adobe Illustrator, and Adobe Character Animate, plus licensed graphical elements. The choices of software are based on the team's knowledge and experience of successfully using these software applications in the creation of digital assets for other projects.
- 1 Source code and documentation for above game.
- 1 Librarians' Implementation Guide consisting of support materials such as sample lesson plans designed to demonstrate use of the game to enhance information literacy skills in the context of the invention process while promoting diversity, equity and inclusion.
- At least six marketing materials targeting librarians to promote the game and its support materials. These include poster, video promos, digital ads promoting game in online librarian-oriented publications, and blog posts by members of our project advisory committee.
- 1 *Results of Outcome-Based Evaluation* Report
- 3 articles suitable for library trade journals on a) Lessons learned in game creation melding information literacy, invention process, and DEI, b) Working with children as game co-designers, and c) Technical report on software used and its efficacy for project goals as well as the technical project management
- 1 Project Website (theinnovationdestination.net) expansion based on products of grant made available on the site

Availability
The digital content and work products described under *Type* will be made widely available to the public through incorporating a delivery strategy which has proven effective in previous grants related to innovation awarded to the project's PIs.

The completed digital game will be freely available and playable through the homepage of the project's website which is theinnovationdestination.net. This site includes products from other IMLS supported grants that support innovation such as interviews with recognized child inventors, mentor training, and program materials, making this a rich resource which is easily utilized by anyone with internet connectivity and a standard web browser. No special software will be required to play the completed web-based game.

Other project assets such as documentation (i.e., white papers, technical reports, Librarians' Implementation Guide) will reside within the same resource under the menu tab labeled "Supporting Innovation" with the format of each asset appropriately tagged for

efficient searches. Published articles can be abstracted through this system with links to the publications. White papers and technical reports can be uploaded to this area of the site.

Access

A. The following products of the grant will be distributed free of cost to users and will be accessible and downloadable from the project site using a <u>Creative Commons Attribution 4.0 license</u> enabling broad and diverse use of such materials with attribution to Syracuse University School of Information Studies as the creator and author of same:

- White papers
- Technical Reports
- Librarians' Best Practices Guide
- Informational Video for Project Orientation and Implementation
- Marketing materials (e.g., poster, video promos)
- Software code (residing on GitHub and linked to from project site will also include DataMomentum in its attribution)

B. The web-based game itself will be distributed free of cost to all users and accessed/playable from the project site. The game will use a <u>Creative Commons Attribution-NonCommercial NoDerivatives 4.0 International license</u> with attribution to the School of Information Studies and DataMomentum. The existing Curious Kids' characters and Curiosity Creek concept/setting/artwork to be used in the game are copyrighted and will remain the intellectual property of the creator, Dr. Marilyn Arnone (c. 2003 – 2022). The eBook featuring the characters of Curiosity Creek will be used to set the context for the game and will carry the same Creative Commons license as the game.

The products of the grant will not implicate privacy concerns or cultural sensitivities.

Sustainability of Digital Products

All documentation described in Part A. under Access will be dated and maintained on the project web site (theinnovationdestination.net) which has a history of successfully sustaining products of previous IMLS supported grants. The completed game with its associated digital assets will be sustainable by virtue of choosing open-source software for game design and creation. This will eliminate the annual licensing fees associated with some game platforms and will make necessary technical updates easier. Finally, the Project PIs have a solid history of maintaining their IMLS funded projects over many years. As an example, Project ENABLE has been successfully maintained for over a decade even in years in which no funding was requested.

Organizational Profile

Officially chartered in 1870 as a private, coeducational institution of higher education, Syracuse University aspires to be a pre-eminent and inclusive student-focused research university, preparing engaged citizens, scholars, and leaders for participation in a changing global society. Syracuse's thirteen schools and colleges share a common mission to support student success by:

- Encouraging global study, experiential learning, interdisciplinary scholarship, creativity, and entrepreneurial endeavors
- Balancing professional studies with an intensive liberal arts education
- Fostering a richly diverse and inclusive community of learning and opportunity
- Promoting a culture of innovation and discovery
- Supporting faculty, staff, and student collaboration in creative activity and research that address emerging opportunities and societal needs
- Maintaining pride in our location and history as a place of access, engagement, innovation, and impact

The 680-acre campus is home to more than 20,000 full- and part-time undergraduate and graduate students from all 50 states and 90 countries.

The School of Information Studies (the iSchool) is an international leader in library and information science. The School not only enjoys an established national ranking, but also boasts a tremendous demand for its education, its research, and the skills of its graduates from eight degree programs. The School of Information Studies, established in 1896 and renamed as the first Information School in 1974, has a long tradition of leading innovation and change. The IST distance education program began in 1993. In 2004, the School of Information Studies along with the Graduate School of Library and Information Science at the University of Illinois founded the Web-based Information Science Education (WISE) consortium, which now includes 13 university members and 18 library association partners.

Our ideals and values are the foundation of our success.

Our vision: *Exploring the intersection of technology and humanity.*

We work, learn and liver in a digital information age. It drives our economy, our politics, and our education systems. The future will be shaped by those who understand and innovate in this environment. Who advocate for the underserved, design for the end user, and solve for the unsolvable. They're diverse, imaginative, and driven to make change. They're iSchoolers.

The iSchool's research spans diverse interests in information and technology, and their impact on orgaizations and society. We pursue independent and collaborative work in a range of fields with colleagues across campus and around the work. The iSchool's faculty and its student body are actively involved in research and creative activities through several research centers that are part of the school. These centers are:

- Center for Computational and Data Sciences
- Center for Digital Literacy
- Center for Emerging Network Technologies
- Center for the Future of Work, Information and Technology
- Smart Grid Research Center

The iSchool is home to approximately 730 undergraduate students and 650 graduate students.

Organizational Placement: The School of Information Studies is a unit of Academic Affairs, which is under the leadership of Dean Raj Dewan. Academic Affairs is one of the University's five administrative offices.
The Syracuse University Office of Sponsored Programs (OSP) is responsible for assuring that submitted proposals conform to University policies and sponsor guidelines, and if funded, that projects are compliant with sponsor requirements.