

What are the major goals of the project?

- Deliver WGG to over 6,600 youth at over 25 B&GCs.
- Develop nine 1-hour and two 6-hour informed engineering design challenges that engage youth in virtual and physical design challenges that require engineering thinking and STEM knowledge and are aligned to the Common Core Math Standards and Next Generation Science Standards.
- Develop and refine WGG training and workshop materials for B&GC staff.
- Adapt the training and workshop materials to create a virtual training delivery system so B&GC staff nationally can use and adapt the materials.
- Provide National Department of Energy Laboratories and informal STEM providers with WGG materials.
- Expand and enhance the *WISEngineering* platform to align with the goals for exemplary informal STEM materials and make it is more engaging and easier to use.
- Study WGG activities, examining evidence in relation to claims about youth outcomes.
- Create a sustainable presence for *WISEngineering* at Hofstra with continued maintenance and support on the Hofstra server even after the completion of the grant period.
- Publish and disseminate models, materials, products, and results.
- Coordinate and collaborate with The Center for Advancement of Informal Science Education (CAISE) for use and dissemination.

What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?

Major Activities:

- **Team meetings:** The WGG management team met in in mid-September and again in mid-December to plan for the final year of the project. During these meetings the team spent time addressing current administrative issues as well as engaged in efforts toward sustainability and expansion of our work. Planning, including creating of an agenda for the January 2019 Advisory Board meeting was undertaken. The team also collaboratively designed a poster display for the CAISE meeting and provided feedback about a display for the ASTC meeting that co-Pi Uzzi and Dr. Ellen Furuya attended. There will be a final team meeting in June 2019.
- **WGG Advisory Board:** The WGG Advisory Board met virtually in January. During this meeting the Board provided feedback and recommendations focused on sustainability and expansion of the work and STEMgineering Academy. The group also discussed how WGG can help expand the educational mission of BGCs. The successful efforts of Central Virginia BGC CEO, James Pierce was discussed and how these efforts might be used at other clubs

- **Supporting the Clubs:** As in prior years, the club Liaisons delivered materials during the early fall and again in January. Breaking the delivery of supplies into two phases provided Liaisons with opportunities to provide guidance if needed, collect anecdotal data about delivery, and reinforce with the clubs the importance of delivering activities in somewhat the order suggested. During the first time meeting the Liaisons discussed the year's overview and reviewed the reporting requirements. Once again this year the Liaisons did not provide on-going professional development before implementation of the activities. Instead, clubs relied on the video and text professional development materials that we had developed.
- **Facilitator professional development:** We studied the use of the Facilitator videos and written facilitator guides. We created new professional development videos for the new activities. We also shared the professional development videos on our website.
- **Delivery of WGG:** We started the year working with the 16 clubs that had participated in year four of the project. However, one club, Hicksville, dropped out for managerial and financial reasons as they could not hire a Facilitator. To date there has been a high rate of completion of the activities by the clubs.
- **Shark Tank:** We refined the revised the Shark Tank protocols based on the data collected last year to better align with the structure of the clubs. In particular, we found during the prior year that youth wanted to actually *build* not only create a design challenge. This year building is included as a recommendation. Nearly all the clubs indicated that wanted to include the Shark Tank activity by the end of the year (mid-June).
- **New WGG activities:** We completed the beta testing of seven new activities during summer 2018. These are now available for clubs to use after they complete the initial 15 activities.
- **Android app:** We finalized the *WISengineering* Android app and it is available in Google Play. We have continued the development of the iOS app. The programming challenges have been even more daunting than with the Android version, but we anticipate by summer's end to have a beta version for testing. Use of the apps will allow users to move in and out of wifi connectivity without loss of the work they have completed.
- **Analysis of data:** Analysis of the data collected from the multiple sources (e.g., facilitator reports, *Wisengineering* data, etc.) showed youth demonstrate an understanding of the engineering design process that increases as the number of activities they complete increases. Further, and perhaps more importantly, they demonstrate the application of STEM knowledge in making improvements to their designs.
- **Observation protocol:** The project created an observation protocol for use by a club's grant coordinator or another person familiar with the youth. The observation protocol was created after Club CEOs expressed a need to understand engagement and learning among participating youth. Our hypothesis is that by measuring engagement through the protocol we will be able to correlate this to youth performance measured in *WISengineering*. The observation protocol is currently being tested.

- **NSF 2026 Idea Machine:** We submitted a NSF Next Big Idea. Our idea focused on family engagement as a way to bridge the informal and formal educational worlds. The submission made the top 100 list of the NSF Great Ideas contest.
- **STEMgineering Academy:** Continuing our focus on broader impacts and sustainability, we created the STEMgineering Academy. Although all the WGG materials will remain open source and freely available, STEMgineering Academy will provide another option to organizations that do not want to run the project on their servers for a modest service fee. STEMgineering Academy will allow us to share the WGG activities and the *WISEngineering* online learning platform to other informal education and after school program. We are developing material ordering documents with links to the specific supplies to accompany each activity to help organizations ordering supplies. Developing the website and interfacing it with a payment system and other university requirements has been a more complex process than anticipated.
- **STEM video showcase:** We created a video related to our virtual professional development model for the NSF Video Showcase. This video highlighted the virtual professional development model we created based on use of the evaluation results.
- **American Society for Engineering Education (ASEE) workshop:** PI, Burghardt and STEM coordinator, Dr. Ellen Furuya, held a workshop on WGG at the 2018 summer annual meeting of the American Society for Engineering Education.
- **Association of Science and Technology Centers workshop:** Co-PI Bernadette Uzzi and STEM coordinator, Dr. Ellen Furuya, presented at the annual meeting of the Association of Science and Technology Centers in Fall 2018.
- **Hawaii Educational Conference Paper Presentation:** PI, Burghardt presented a paper on the WGG effective virtual professional development model at the 2019 Hawaii Educational Conference.
- **Dissemination through non-traditional approaches:** The project expanded its non-traditional dissemination program to include delivery of WGG at a senior center, local libraries, Parent University, and with military families. WGG team member Scott McMullen worked completed 12 activities with senior citizens, 11 couples. The response of the senior citizens was very positive and several brought the activities home to do with their grandchildren. Ms. Lois Miceli and Dr. Ellen Furuya delivered five WGG activities to children at three local libraries, again with great interest on the part of the children participating. As a follow-up, the Hempstead and Uniondale libraries had engineering undergraduates conduct more activities during the academic year. Dr. Erika Tate continued her collaboration with Parent University in Savannah Georgia, engaging 15 families in WGG STEM activities. The results continued to support last year's findings that parents and grandparents are able to deliver the activities at home with their families. Further, they often engage other organizations (churches, civic) in conducting the activities. Dr. Tate also worked with Military Families at Fort Stewart, Georgia in doing WGG activities. As part of this effort we provided activity 'care packages' that could be sent to deployed family members.

- **Participation in CAISE conference:** Drs. Burghardt and Hecht attended and participated in the 2019 CAISE conference in February 2019. A poster was presented and connections made with other AISL projects.
- **Attendance at National Association for Afterschool and the Best out of School Time:** Dr. Ellen Furuya participated in the National Association for Afterschool and the Best out of School Time conferences. She disseminated information about WGG and the STEMgineering Academy while also developing a contact list of informal educators interested in WGG.
- **Research Papers:** We have several research papers in progress dealing with
 - Designing Informal STEM activities (manuscript under review)
 - Analysis of Shark Tank and Youth Learning (conference paper accepted)
 - Preliminary Findings using the Observational Protocol (conference paper accepted)
 - Analysis of Youth Learning of Engineering Design and Design Revision (under development)
- **Share information about WGG with NYSED AmeriCorps program:** We shared information about WGG with the director of AmeriCorps in New York State. AmeriCorps programs sometimes work with informal STEM program and we wanted to alert the program to the availability of our resources

Specific Objectives: Specific Objective will refer to the Work Plan Activities and Milestones for WGG.

Work Plan Activities

- As planned, we are implementing all activities with 15 BGCs.
- All the professional development was delivered virtually
- All clubs are on track to will meet their target number of participants by June 2019.
- We created seven more WGG activities and refined the Shark Tank activity.
- The final version of all activities was completed.
- We held management team meetings and an Advisory Board meeting. The project continues to collaborate closely with the evaluation team.
- The dissemination of WGG occurred at CAISE, other national conferences, publications, the NSF STEM video showcase
- WGG activities were disseminated through non-traditional formats, such as libraries, senior centers and on military bases.
- Articles highlighting project successes and new knowledge are being written

Locations

- There are 15 BGCs actively engaged in WGG.
- Clubs are located in three states, New York, Connecticut and Virginia.

Professional Development

- The virtual professional development (video and text) was available and successfully used by all clubs.
- The professional development materials were accessible from smart devices. This allows facilitators to view them from their phones.

***WISEngineering* Technologies**

- The infrastructure of the system is a hybrid architecture of web applications and mobile applications.
- There has been ongoing updating of *WISEngineering*, enhancing performance.
- The mobile application stores a cached version of all learning materials so that contents can be accessed offline (without Internet), and youth responses will be collected and submitted when Internet is available.
- Considerable effort is being devoted to creating apps for smart devices, both Android and iOS so that in the future clubs and other organizations can access WGG from their personal devices. The Android app is available through the Google Play, the iOS app is under continuing development.

Evaluation and Research

- The project evaluator and her team have been collecting and analyzing data from youth work, assessing club involvement and participation, as well as analyzing the roles of project personnel. Data include:
 - Data collected within *WISEngineering*
- A youth survey was created and collected
- National STEM data collected by Boys and Girls clubs was reviewed as available for the project sites
- Observations were conducted at clubs during delivery of WGG
- The Shark Tank videos are being reviewed
- During summer 2019 the data will be analyzed

Dissemination

- Co-PI Bernadette Uzzi has incorporated project activities at Brookhaven National Laboratory.
- Co-PI Bernadette Uzzi and STEM coordinator, Dr. Ellen Furuya, presented at the annual meeting of the Association of Science and Technology Centers in Fall 2018.
- Conference and journal papers have been presented and will be noted under Key Outcomes.
- We received permission from Hofstra University to create the STEMgineering Academy, where we will be able to promote the WGG activities and the *WISEngineering* online learning platform to other organizations.
- We are continuing to support Dr. Erika Tate's work with Parent University and with military families.
- We implemented a strategy of non-traditional dissemination (in addition to traditional papers and presentations) that involves having the management team Liaisons select an

informal organization, such as public libraries, senior centers and offer to facilitate WGG activities.

- We participated in the 2019 CAISE conference and are providing information regarding WGG to the CAISE data base.

Significant Results: As noted elsewhere, we have been successful in meeting our goals the current year. Beyond what we promised, an overarching theme this year was to develop innovative plans for disseminating and sustaining WGG after NSF funding ends.

- Clubs are successfully using the WGG materials (including professional development tools) and that youth are learning from these experiences.
- Materials have been revised and enhanced with seven new activities created.
- Nine clubs completed Shark Tank at this time and are analyzing these data to gain insight into youth understanding of engineering design and STEM from this.
- We have much data from the *WISEngineering* database that the research team is analyzing.
- We have verified that the virtual professional development is effective; clubs have successfully implemented activities solely using it. We developed video and text virtual professional development support for the seven new activities based on the model we created for our model of professional development.
- We created a video for the NSF 2019 STEM for all Video Showcase related to inexpensively creating virtual professional development video and text support materials.
- PI Burghardt used selected WGG activities in his STEM and Children's Engineering classes.
- We are collaborating with James Pierce, Central Virginia Boys and Girls Clubs, in creating a framework for how WGG can expand and enhance the educational mission of clubs.
- We created and are testing a beta observational protocol for use by club administrators to ascertain the effectiveness of the WGG activities.
- We revised the Shark Tank assessment framework and will be utilizing this with the 14 clubs who indicated they will be submitting videos.

Key Outcomes/Other Achievements: The project has several publications promoting *WISEngineering* and WGG.

Hecht, Deborah et al. (2019). Virtual Professional Development: Low cost - High success. 2019 NSF STEM for all Video Showcase.

<https://stemforall2019.videohall.com/presentations/1419>

Burghardt, M.D. and Hecht, D. (2019). An Analysis of STEM Learning Facilitation in Informal Educational Environments. 2019 Hawaii International Conference on Education. Honolulu.

What opportunities for training and professional development has the project provided?

We are very pleased that the virtual professional development model that we created is successful. This means we have not needed to provide in-person training for the WGG activities. Instead, the Liaisons visited clubs twice to deliver supplies, once in early October and again in January. At these meetings, the Liaisons discussed WGG with the Facilitators so they knew where all the resources were located. The opportunity for professional development were continuously available on the WGG website and is accessible from smart devices. In fact, we found that Facilitators often accessed the material from their phones prior to, and sometimes during, an activity.

How have the results been disseminated to communities of interest?

In addition to keeping Boys & Girls Club of America informed as the progress of WGG, we have undertaken varied ways of disseminating the results and processes of WGG to other educational communities. Drs. Burghardt and Furuya held a workshop of WGG at the 2018 annual conference of the American Society for Engineering Education. Dr. Furuya and co-PI Uzzi participated in the annual conference of the Association of Science and Technology Centers and Drs. Burghardt and Hecht participated in 2019 CAISE conference. Many clubs are using their participation in WGG with their advisory boards, garnering support from them and their communities. The model of Parent University has been disseminated by Dr. Erika Tate's blog and within the Savannah educational community by Parent University. Further, Dr. Tate has engaged military families in using WGG at Fort Stewart in conjunction with the USO on the base. Further, we have conducted WGG workshops at a senior center, doing 12 activities; at three local libraries conducting five activities. In addition, Dr. Ellen Furuya participated in the National Association for Afterschool and the Best out of School Time conferences, disseminating information about WGG and the STEMgineering Academy.

What do you plan to do during the next reporting period to accomplish the goals?

The project has met its initial goals and has accomplished much more as has been detailed in the report. The next reporting period will be a no-cost extension where we will continue to focus on dissemination of the project and its resources and delve more deeply into the rich, complex data that we have gathered. We anticipate there will be several journal articles that result.