WGG 2018 Annual Report 1422436

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:

- The WGG management team met in mid-August to develop plans for year four. A major task involved reviewing and fine-tuning of the WGG activities, paying particular attention to the language and format of the embedded questions.

- In year four the team adjusted the ways the liaisons would work with the clubs. Involvement with the clubs included at least two face-to-face visits to bring materials (one in late September/early October and the other in January.) During this visit, liaisons discussed expectations for the year and to reviewed the reporting requirements. Unlike prior years, 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. During the initial club meeting (September or October), the Liaisons met with the Facilitator and often the grant coordinator for the club.

- During year four, we added four new clubs, bringing the total number of active clubs to

16. Unfortunately, several clubs were not able to continue after year three because of personnel reasons or, in the case of Hempstead, tragically because the club dissolved due to leadership issues.

- With four exceptions, the 2016-2017 clubs completed all required activities before summer 2017. This is impressive since we provided less one on one support this year and over 50% of the Facilitators were new. We believe this helps demonstrate the effectiveness of the WGG support materials. During debriefing with the club facilitators we also learned that some clubs shared the videos with youth.

- Further, we supported the five clubs that wanted to do WGG as part of their summer program (not required for the grant,) by providing access to *WISEngineering* and supplying the materials that they needed.

- We developed the Shark Tank activity and piloted it at three clubs. After piloting, the activity was refined. In spring 2018, youth at seven clubs were able to complete the revised activity. We are currently synthesizing the facilitator and student feedback. However, in general the Facilitators reported they liked the activity although they found that it took more time than anticipated and required more organizational skills than other activities. To help document this activity, and to provide an additional data collection approach, we provided clubs with cameras to videotape the youth presentations of their shark tank design solutions. As we received the videos, they were de-identified using software to bubble out faces.

- We have undertaken a programming initiative to make *WISEngineering* available on Android and iOS smart devices along with downloadable app. We anticipate the beta version of the Android app will be available in early Fall 2018 and the iOS version will be available in late Fall 2018 or early winter 2019. This activity was used to address an "challenges" using the project provided tablets. While it was initially unclear whether the problem was software or hardware related, further study suggested that allowing youth and facilitators to use different smart devices, ones they already have available at the clubs, might alleviate the problems.

- Several clubs expressed interest in having more activities available to select from, or to use during their summer programs. To that end we have created seven new activities, and have three more in the final stages of development. The new activities will be piloted this summer.

- The facilitator reports, submitted twice a year, were improved in content and number. Facilitators reported that the activities are very readable and understandable. They noted the hands-on parts of the WGG activities were critical to the project's success. They also described how participation in WGG creates a positive social dynamic of collaboration and empathy. In terms of learning, youth become familiar with the

engineering design process.

- Another key activity in the past year was work by the evaluation team and Co-PI Xiang Fu to develop procedures for automatically extracting information from the *WISEngineering* database. There had been issues related to translating database information into an Excel format that could be used to analyze individual respondent level data.

- In the past year, we engaged in a variety of dissemination activities. We will be providing a workshop on WGG at the 2018 ASEE annual conference in Salt Lake City and will be presenting at the Association of Science-Technology Centers annual meeting in September 2018. Additional papers and presentations will be noted later in the report. We have also developed a strategy of non-traditional dissemination, in addition to traditional papers and presentations of results. The non-traditional strategy involves having the management team Liaisons select an informal organization, such as public libraries, senior centers and offer to facilitate WGG activities. We expect to learn more about different organizational needs and how to respond to these needs while also disseminating our work.

- Co-PI Melissa Rhodes was instrumental in recruiting new clubs and has kept Boys & Girls Clubs of America informed as to our progress. In April 2018 she joined the Stamford Boys & Girls Clubs as Director of Development. The Stamford club is one of our active and productive BGCs.

- The project supported Dr. Erika Tate working with Parent's University in Savannah Georgia re using WGG STEM activities. She increased the number of families from eight to 15 this year. The results of this collaborative initiative have been very positive—parents engaged, learning activities, working at home with their families conducting the activities, and often engaging other organizations (churches, civic) and conducting the activities there, too.

- We are also very pleased that a research assistant to Dr. Hecht was selected to NSF iTEST mentoring programming and he worked with Dr. Erika Tate in developing an iTEST proposal that builds off of the work of *WISEngineering* and Dr. Tate's work with Parent University in Savannah, Georgia.

- We created a video on WGG, highlighting features of WGG and the research capabilities of *WISEngineering* and are participating in 2018 NSF video showcase. Continuing our focus on broader impacts and sustainability, we received permission from Hofstra University to create a STEMgineering Academy, where we will be able to promote the WGG activities and the *WISEngineering* online learning platform to other organizations for a modest service fee. The focus for the STEMgineering Academy will be informal education and after school programs. The business plan has been developed and

approved by Hofstra University and we anticipate a soft launch in early fall 2018. WE are developing a material ordering document to accompany activities with links to the specific supplies to facilitate ordering by organizations. All the WGG materials will remain open source and freely available. However, through the STEMgineering Academy organizations that do not want to run the project on their servers will have another option. Feedback from several organizations has indicted the idea of participating in a program hosted by a university and developed with National Science Foundation funding, as well as having youth receive a STEM Certificate is of great appeal.

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

Work Plan **Activities:**

- As planned, we have implemented all the activities with 16 BGCs.
- All clubs will meet their target numbers by June 2018;
- We are encouraging clubs to use WGG for summer activities. If they use the activities, we will provide the needed materials.
- We fine-tuned the 15 activities including a new one, Shark Tank, which was pilot tested in the fall of 2017 and implemented in spring 2018.
- There was further refinement of the Facilitators Guide. Shark Tank activity video and text supports were created.
- We implemented a badging and STEM certificate program.
- We created seven new activities with three more in the final stages of development.

Locations

- There are 16 BGCs actively engaged in WGG.
- Clubs are located in three states, New York, Connecticut and Virginia.
- We are adding four new clubs for years four and five.

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.
- Currently, WGG is accessible through a browser and on 7-inch Android tablets. The project provides clubs enough tablets for 15 youth to participate.

- 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.

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.

Dissemination

- Co-PI Melissa Rhodes was a regional officer of the Boys & Girls Club of America for much of the project year, and was able to communicate directly with headquarter staff regarding the project. She participated in the northeast regional BGC meeting, as well as national meetings.
- We have a BGC in Charlottesville, VA that is situated in the southeast regional network of BGCA. They have made regional presentations about WGG.
- Co-PI Bernadette Uzzi has incorporated project activities at Brookhaven National Laboratory.
- Conference and journal papers have been presented and will be noted under Key Outcomes.
- Mr. Ken White, Manager, Office of Educational Programs at BNL, is exploring the use of adapting *WISEngineering* and WGG in their expansion of the Science Center.
- 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 will support her efforts
- A colleague of Dr. Hecht's plans to submit an iTEST grant, expanding the use of WGG.
- We developed a strategy of non-traditional dissemination (in addition to traditional papers and presentations) that strategy involves having the management team Liaisons select an informal organization, such as public libraries, senior centers and offer to facilitate WGG activities.

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
- 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 have gained insight into

developing the new videos for the new activities, and have created a format for them. We anticipate creating professional development text and recording professional development videos in summer 2018.

- Our team meetings always include discussion of dissemination and sustainability/
- We are expanding the dissemination approach we took with Parent University (i.e., build upon current and work, expertise and partners of a project partner) to other organizations. We begin by identify the new organizations needs and resources. We then begin to facilitate their offering WGG activities to a new community. Currently we are exploring the introduction of WGG to libraries, senior centers and in other informal settings.
- Brookhaven National Laboratory (BNL) is relocating and expanding its Science Center with co-PI Bernadette Uzzi incorporating WGG in those efforts.
- PI Burghardt used selected WGG activities in his STEM and Children's Engineering classes.
- Dr. Jennifer Chiu used selected WGG activities in STEM methods courses and were used in the Young Women's Leadership Program at UVA.
- Hofstra University has given approval to our creating the STEMgineering Academy, a spin-off of WGG that will provide the online infrastructure and support to organizations that want to use our STEM activities. We are building on the model that BNL used on a prior NSF grant we collaborated on in establishing fee-based science center activities for school districts. Ken White, Manager, Office of Educational Programs at BNL was very helpful in guiding us with this model.

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

Burghardt, David. (May 2018). Wise Guys & Gals—Engineering Design using WISEngineering. 2018 STEM for all Video Showcase.
http://stemforall2018.videohall.com/presentations/1158?panel=mc#panel-jq

Ochs, L., Chiu, J. L., & Mumba, F. (2018, March). Developing Pre-service Science Teachers' Understanding of Engineering Design Strategies Through Teaching Scenarios. National Association for Research in Science Teaching Annual International Conference, Atlanta, GA.

Chiu, J. L., & McElhaney, K. (2018, April). Using Knowledge Integration Tools to Support Next Generation Science Standards–Aligned Science and Engineering Instruction. Annual Meeting of the American Educational Researcher Association, New York, NY.

Hecht, D., Chiu, J. Bridgelal, I. & Burghardt, D. (2018). Supporting Engineering Practices in Informal Learning Environments with a Tablet-Based Engineering Design Environment. 2018 IEEE Integrated STEM Conference.

McMullen, S. (2017). Hofstra Center for STEM Research—A Resource for NYSSLS. STANYS Fall Regional Conference.

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, so we have not needed to provide in-person training for the activities. 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?

We have expanded the communities beyond Boys & Girls Clubs, but starting with BGCs, co-PI Melissa Rhodes has kept the headquarter staff of Boys & Girls Club of America updated about the project. She has attended national and regional meeting of BGCs, informally disseminating the effectiveness of WGG. Further, many of the CEOs of the participating clubs attend these meetings, confirming WGG's value. 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. As part of our non-traditional dissemination strategy, and building the groundwork for sustainability, we have discussed implementing WGG with libraries, and will be piloting activities in summer 2018 and perhaps fall 2018; we will be implementing activities at a senior center late summer/early fall; co-PI Bernadette Uzzi anticipates using activities with Girl Scout troops she is involved with and we are reaching out to other organizations that wish to host STEM activities. Conference and journal papers are noted under Key Outcomes.

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

We will continue the model developed this year regarding quarterly management team meetings, bringing supplies to clubs at the start of the year and at the mid-point. We will continue to offer the 15 activities finalized this year to extend a consistent research model. We are presenting in September 2018 at the annual meeting of the Association of Science Technology Centers and are presenting a workshop at the ASEE annual meeting in summer 2018. We will seek to present at the February 2019 CAISE meeting. There will be a grant proposal submission to iTEST featuring the collaboration of Parent University, CUNY CASE, and Hofstra University. We will be testing the WGG model with other informal learning organizations, such as libraries and senior centers, as a means of disseminating the model and building interest in the STEMgineering Academy. We anticipate that the STEMgineering Academy will reach out to other communities, disseminating our findings and sustaining the WGG model. The additional 10 activities that will have been created by Fall 2018 will be piloted

and become part of the WGG activity portfolio. We will be working with BGCA STEM lead, Eliana Ouimet, to have WGG become one of the STEM projects that BGCA recommends. With the STEMgineering Academy online, we will have the means to work with additional clubs. We will finalize the materials list for all activities, so clubs and organizations can easily purchase materials. We anticipate presenting at several organizations, such as AERA, based on our research findings.