Wise Guys and Gals
Boys & Girls as *WISEngineering* STEM Learners
Interim Annual Report
June 2017

Introduction

WISE Guys and Gals – Boys & Girls as *WISEngineering* STEM Learners (WGG) is a 5 year Advancing Informal Science Learning project funded by the National Science Foundation. WGG has three major project objectives: (1) Develop blended (both virtual and hands-on) WGG engineering design challenges and enhance of the computer host platform,*WISEngineering*, (2) Pilot and then revise the WGG design challenges based upon what is learned, and (3) Evaluate projects, materials, and the overarching model.

WGG introduces informal, blended STEM engineering design challenge activities to middle school aged youth who attend Boys & Girls Clubs (B&GCs). As B&GC youth work their design challenges they will practice engineering design thinking and learn about engineering careers. These youth, who are typically underrepresented in STEM areas, also enhance their STEM knowledge through WGG activity participation. The WGG project is developing both brief (75 minute) and longer (up to three hour) informal engineering challenge activities that will require youth to engage in both computer-based work and hands-on design experiences. Once developed, piloted, and revised these activities can be implemented at any B&GC or other informal STEM setting.

The WGG management or organization structure has participants working in teams on focused tasks and collaboratively to review work of different teams and for on strategic planning. The focus of teams is allowed to shift as the needs of the project change or when individual team members express an interest in exploring a particular topic in greater depth. Teams include curriculum development, club liaison, B&GC Facilitators, *WISEngineering* programmer, management and evaluation. Although each member of the WGG project is assigned to a particular team they also provide advice and support to other teams.

WGG Evaluation 2016-2017

The WGG evaluation is documenting and assessing WGG activities and whether they are being carried out as proposed and within the anticipated timeframe. During 2016-2017 the evaluation team:

- Documented and provided guidance for refinement and enhancement of the *WISEngineering* Platform, activities, PD facilitator guides and videos
- Studied recruitment and selection of clubs to identify which clubs are most likely to successfully implement (e.g., needed internet, structure of program, space, resources
- Examined how clubs recruit targeted youth, schedule activities, promote WGG

- Collected student and club data from in/out of *WISEngineering* about each activity implemented at each club
- Identified successes and challenges to implementation
- Provided feedback and recommendations
- Began to identify lessons learned

The project also began to explore ways to broaden and expand use of the materials based on stakeholder feedback. During this period the evaluation team attended all team and advisory board meetings, recommended revisions of WGG and continued reviewed all resources developed or revised, oversaw piloting and data collection and began data cleaning and analysis. This report describes the WGG pilot test and progress in key areas.

Preliminary Findings from the WGG 2016-2017 Pilot Testing

WGG pilot testing during 2016-2017 is on-going. Fifteen clubs are participating. The clubs include ten who participated in the prior pilot, two new clubs in Connecticut, two in New York City, and one club in Virginia. Clubs were selected based on their interest and willingness to participate. The two clubs in Virginia allowed the WGG team to study implementation in settings where they would have less direct involvement. Since the pilot test is still on-going and data continue to be collected, cleaned and analyzed only preliminary results are available. A data analytic plan is being developed and data analyses will continue throughout the spring and summer 2017.

Pilot Data

Data are and will be collected from multiple sources, including:

- **The Boys and Girls Club annual Wise Guys and Gals Director's reports** are collected by the Boys and Girls Club Director, Organizational Development at Boys & Girls Clubs of America and Co-Pi on this project and are shared with the evaluation team. During 2016-2017 the WGG Director Report form was revised to better address the needs of the evaluation. These reports we require Directors and Facilitators at each club to provide information about club operation, enrollment, mission and Implementation of the WGG activities (e.g. # students, materials used, demographics). The most recent bi-annual report which covered the period of 9/1/2016 to 2/28/2017 was examined for this report and are summarized below.

- **Club level participation data** are downloaded from the *WISEngineering platform*. *Wiseengineering* collects data about activity use. Among the available data are:
    - Completion data about each WGG Activity at the club level. Among the available data files are the number of youth who participate in an activity by club, the average number of seconds youth spend per page or screen and the average percentage of questions attempted on each page.

- Individual youth interactions with *WISEngineering*. The available data files include the number of youth at each club spend per page, the number of activities that were ever opened at a club and the total number of attempts per question.

- **Youth level response to *WISEngineering* embedded questions** that are used to scaffold learning or assess knowledge about the design challenge. Currently there are several types of questions included. Although not every question type is asked about each activity, several types of questions and scoring methods are included.
  - **Correct/incorrect questions** are often used to assess student understanding of a concept. Students can try multiple times to answer correctly. Scoring can include the number of attempts before a correct response is given, the number of correct responses across multiple questions (a summed score) or the number of youth at a club who answer an individual question correctly
  - **Multiple choice questions** typically ask the youth to select the best response from a list of several. The youth may be asked to reflect on "why" he or she selected a particular response. Although a best choice may be pre-determined by the development team, in most cases analysis involves consideration of why a choice was selected and an awareness of different possible "correct" answers**.**
  - **Rubric ratings** are used to have youth self-assess their designs. Scoring can involve examination of the self-rating by individual element or summed across elements. It can also be used to interpret a description about or photo of the design.
  - **Write-in's, narratives or reflections** are requested at multiple times, such as explain a rubric rating or answer other questions. Scoring may involve an analysis of the responses (i.e., assigning a rating of the narrative or systematically sorting narratives by how well they answer the prompt).

- **Pictures or videos uploaded by youth into *WISEngineering*** are downloaded. To date a decision about how to use pictures and videos has not been made, in part, because the number of uploaded files has been small. If more pictures and videos are obtained efforts will be taken to analyze the data.

- **Informal Feedback from liaisons, and project staff** is on-going. Data include notes from team meetings, phone calls, and other informal discussions.

- **Stakeholder surveys or interviews** will be collected at the end of the 2016-2017 year. Facilitators and liaisons will be asked to reflect on the past year, lessons learned, and youth reactions.

- **Facilitator feedback** is requested when each activity is completed. Facilitator response are currently being reviewed and the questions may be refined for 2017-2018 based on these analyses.

Implementation of WGG Activities – Pilot Study

Each club is required to complete all WGG activities during 2016-2017, and a majority of clubs completed most of the short activities at of the writing of this report. A proposed or recommended schedule of WGG Activity implementation was shared with club directors in the fall 2016. Clubs that had failed to complete all activities during 2015-2016 were allowed to implement missing activities during the fall before beginning the 2016-2017 WGG activity delivery. Additionally, clubs were encouraged to adapt the schedule to best align with their other activities. As a result, the proposed schedule was not followed at all clubs.

Table 1. Proposed schedule of WGG activities for clubs 2016-2017

Month of implementation	WGG Activity
October 2016	Avatar, High Five, Optimum Potato Chip, Design for Sound
November 2016	Slime, Prosthetic Challenge, Hover Above it All, Need Some Support,
December 2015	Design your Path, Kaleidoscope Challenge Dance Party
Extended actvities (to be scheduled as possible)	WuGGs, Rocket Design, Filtering Yucky Water
Summer	Solar Cooker, Splash Down

WGG Program Support – Facilitator Guides

As part of the 2016-2017 evaluation, the Club Director's report included a question about the helpfulness of the written and video Facilitator guides. The written Facilitator guide was used by 11 Facilitators. The video guide was used slightly less (n=9). The majority (82%) of Club Directors who reported using the written Facilitator guide reported it as *very helpful*. Similarly, the majority (60%) of Directors who reported using the video guide rated it as *very helpful*. Overall, the video guide was rated slightly less helpful than the written guide.

Table 2. Club Directors' feedback about the Facilitator guides

Type of Facilitator Guide	Response option			
	Not very helpful	Somewhat helpful	Very helpful	Was not used
Written Facilitator Guide (n=11)	0% (0)	18% (2)	82% (9)	3
Video Facilitator Guide (n=9)	11% (1)	22% (2)	60% (6)	6

After rating the usefulness of the guides, Club Directors were encouraged to describe any additional support they would recommend be made available. Their responses, presented below, were used to plan development or additional videos or support materials. These data also suggest the types of support needed for new activities. As noted later in this report, a new activity *WGG Shark Tank* is being developed which will require youth to design and then "pitch" their own activity. These responses reinforce the importance of creating a prototype or picture for communicating information about a new activity.

Figure 1. Club Directors' verbatim comments to "*do the Facilitator Guides provide sufficient information to prepare your staff to lead the WISE activities? Any suggestions for preparation support?*" (n=12)

- No
- I think the videos work well but mostly just takes running a module to get the swing of it.
- Provide actual video content in the videos instead of picture stills with audio over them.
- Perhaps the online modules can have more pictures or videos of the finished products to help give the students more direction. Some projects require more visual examples then others.
- I think the videos work well but mostly just takes running a module to get the swing of it.
- For projects where members will be working with a partner or in small groups (for example, Prosthetic Challenge, WuGGs to the Rescue, etc.), we create buckets, one prepared for each group, with the materials and supplies they will need for the project. This makes it easy for us to distribute materials (handing each group a bucket instead of handing each group each individual item at a time) and takes up much less of the session's time.
- N/A
- Buy supplies ahead of time and go over projects before you introduce it to the kids.
- For new facilitators it is very helpful for the Liaison to show or build a prototype together. It was very helpful to me when I first became a facilitator.
- It would be helpful if the video facilitator's guide gave an example of an instructor creating and testing the experiment.
- We are unsure if the video facilitator guide was provided.
- As an artist I find pairing a film or artists work to subject of stem lesson to be valuable. Many of these allow learners to envision themselves in careers.

In-Club Support

Club Directors were also to describe any ways that support staff helped them implement the activities. Although two clubs reported having no support staff, the remaining Club Directors described using support staff to help distribute supplies and lunch and prepare and lead activities. All responses are provided in below. These findings are being incorporated into the recommendations and best practices that will be shared about delivering WGG activities.

Figure 2. Directors' comments on the use of support staff during the program (n=14)

- Yes, there is support staff. They assist if I need assistance; if I need to step out of the room, deal w/ behavioral or technical issues, they help getting materials together, assist in gathering lunches together, and they help me check the students work if a student needs one-on-one assistance.
- I had one of the part-time teen staff support during the modules. He would help hand out supplies, keep members on track and writing module info on whiteboard.
- Support staff made sure the youth stayed in order and assisted with any extra supplies.
- Several staff members at the Club work together on a weekly basis to help ensure the success of our S.T.E.M. program year-round. Materials are maintained and stored by Club Education Director. Communication between program staff and parents is constant re: upcoming projects. Club Education Director updates promotional materials periodically and

is distributed by our Membership Services Director. Associate Director ensures snacks and incentives are ordered and accounted for on a reoccurring basis, and provides additional support and assistance wherever and whenever needed. Additional support is provided my Club Program Director to ensure a schedule that allows for optimal member attendance at S.T.E.M. sessions with minimal conflicts from our variety of other Club programs. Teen Program Director assists with maintaining a list of interested Teens for upcoming participation. In regard to supporting the implementation process: One group leader assists Education Director by ensuring that all materials and supplies are prepped and organized prior to each session. Additional responsibilities include offering assistance to struggling Club members as they work to complete each project, working one-on-one with members when issues arise with their tablets (freezing, malfunctioning, restarting, or trouble logging in), and helping distribute and clean up materials and supplies. Group leader provides support that encourages members to stay on track and on task, and shows an interest in member's progress as they move through the project by asking them questions and offering insight and compliments.

- Yes, they help distribute supplies and help students figure out any problems they might be having. Staff are required to guide and help all our members throughout the activity. They also make sure the kids are on task.
- Ms. Abby is my staff partner in 6th grade. She helps regulate behavior, hand out supplies, help members with questions.
  Volunteer/Interns – I usually have one intern and one junior staff in my room. They help bring children to the restroom and go around the room and help where they can.
- During WGG activities, there is a minimum of two staff facilitating the project. Typically, one staff member will run the project by reading/explaining, stimulating goal planning, and encouraging teamwork. The remaining staff will assist in helping the students follow along, make groups, construct materials, and aid in answering questions. All staff involved help to keep the students attentive, focused, and respectful to their fellow peers. All staff and students collaborate at the end of each project to reflect on what was learned and how the project could improve for next year.
- I had one of the part-time teen staff support during the modules. He would help hand out supplies, keep members on track and check for completion on tablets. I also had help from 3 volunteers from the university. They would help by giving certain kids one on one time and keeping them on task.
- I have full support of my staff. Before class starts, the staff gets the children ready for the class, i.e.: The staff would have the children who are in the class, already in the classroom prepared for the next lesson. They are also present during the entire activity to help myself as well as the students.
- Yes, the staff assists with all the preparations of activities.
- There is no supporting staff to assist with WGG activities.
- Yes, Club Instructors helped distribute supplies and assist students throughout the activities. In addition, the Social Recreation Coordinator, Child Care Director, and Assistant Executive Director, provided additional support in advertising the program, recruiting and registering the members, and assisting with grant requirements.
- The Program Director is the only one facilitating the program. No other part time staff members are involved in the planning or execution of the program.

- Yes. Support from staff enables the instructions to not get lost on learners. The groups attendance ranges from 15 to 25, so in the event I focus on one half of the room the others don't feel neglected and slow down the pace of the group activity

Challenges Encountered During Implementation
Club Directors were asked to identify challenges encountered during implementation. Issues with the WGG technology and tablets were noted, although most were troubleshot during implementation. Challenges with recruitment, especially when the program must compete with other B&GC programs, were also noted. All comments were reviewed and used to develop guidance and recommendations for new clubs

Recommendation's About Implementation for New Clubs
Finally, Club Directors were asked "*What advice would you give other clubs who will be joining the WI Engineering project next year*?" Directors stressed the importance of familiarizing themselves with the *WISEngineering* activities before introducing them. For example, they advised future clubs to, "understand that not all projects will be able to be completed in one sitting," "allow extra cleaning time for some of the modules," and "prepare a script and reading material." Club Directors also discussed the benefit of having incentives for students as a way to increase engagement and retention. These responses are also being used to develop recommendations and best practices for new clubs.

WGG Participating Youth in Pilot Study

The data reported here were obtained from a review of the Club Director's annual WGG reports (covering a period form 9/1/2017 through 2/28/2017) and from data downloaded from *WISEngineering.* In some instances, data are reported for the same period of time, in other instances the *WISEngineering* data include a longer time span. These preliminary data highlight ways the data are being used to inform program decisions.

Recruitment of Youth
During 2016-2017 WGG was interested in understanding how programs recruit youth for WGG activities and to identify successful strategies. As part of the 6-month Club Director's report, Club Directors were asked to describe their recruitment strategies, including both successful and unsuccessful strategies. Overall, Directors reported more successful strategies (n=10) than unsuccessful strategies (n=6). Successful recruitment efforts included providing incentives (i.e., snacks, prizes), having the program be grade-specific, and attracting students by emphasizing the program's STEM activities. These responses are being used to develop recommendations for recruitment that will be shared with all clubs.

Youth Participants (unique students who participated in one or more activities)
In 2016-2017 clubs were expected to engage at least 10 students in each activity, a goal that many clubs struggled to meet in 2015-2016. Accurately recording the number of youth participants was more challenging than expected and varied depending upon the data source. In particular, information about the number of club participants was obtained from: a) the 6-month Club Director's reports and b) the *WISEngineering* log-in reports. For illustrative purposes data were compared from both sources for the period September 2016 through December 2016 and these data can be found in Table

3. Only New Rochelle and Stamford reported the same numbers from both sources. For the majority of clubs higher numbers were reported in *WISEngineering.* Closer examination of the data revealed that in many instances youth created multiple logins. *WISEngineering* creates a unique log-in code for each youth and the expectation is that youth will use that same log-in every time he or she begins a session in *WISEngineering.* It was however found that some youth created new log ins every time they began a new session. When *WISEngineering* total participant counts were examined through April, the numbers were relatively stable. The most notable increases were 15 additional youth enrolled at Stamford (for a total of 28) and seven additional youth at New Rochelle. This suggests the problems with multiple log-ins was reduced as the clubs became more familiar with *WISEngineering.* Currently responses for youth who created multiple log-ins (which are recorded as separate individuals in the master data) are being merged manually into single case identifiers.

Table 3. Number of youth participants reported from Club Directors compared to *WISEngineering* (September 2016 through December 2017)

Boys and Girls Club	Number of Youth as Reported on Club Director's Report (9/2016-12/2016)	Number of Youth as Reported in *WISEngineering* (9/2016-12/2016)
Bellport	6	35
Central VA-Cherry Ave[1]	43	51
Central VA-Jack Jouett[1]	24	
Children's Aid	15	14
Glen Cove	33	61
Greenwich[2]	0	16
Grenville Baker	38	68
Hempstead	30	32
Hicksville	15	32
Metro Queens	19	21
Mt Vernon	21	20
New Rochelle	13	13
Oyster Bay	14	15
Stamford	13	13
Variety	25	42
Total	309	433[3]

[1] WISEEgineering combines data for VA [2] Club Director's report not submitted
[3] This total includes youth with multiple logins as well as some youth who were part of the 2015-2016 year but completed their activities during fall 2016.

Demographics of Youth Participants

The Club Director's report requested the number of WGG youth participants by race and gender. As is evident in Table 4, racially the majority of youth are traditionally underrepresented in STEM activities. Yet, the number of female participants is lower than males. The total number of youth in this table is somewhat over estimated because some youth were recorded in multiple race categories, but the format that the data were provided did not allow for the numbers to be broken out.

Table 4. Total youth served by race and gender as reported by Club Directors

Race	Total Number[1]	Percentage
African American	129	40%
Hispanic	122	38%
White	41	13%
Asian	9	3%
Multi-Racial	18	6%
Other	1	0%
Gender	**Total Number**	**Percentage**
Male	215	67%
Female	105	33%

[1]A total of 320 youth are reported in this table. Table 3, also generated from the same Club Director report totaled 309 youth participants. The discrepancy is due to the way the question was asked and youth being included in multiple race categories.)

Completion of WGG Activities

The completion of activities is being examined in several ways.

Number of Youth Participants by WGG activities

Table 5 displays the WGG activities completed at B&GCs between 9/1/2016 and 2/28/2017 as reported by the Club Directors. (Activities completed during March, April, and May are not reflected here) and the number of youth reported in *WISEngineering*. These numbers were reported by the clubs and reflect sign-in or locally maintained records. It should be noted that since these counts are the number of youth participants by activity if a youth participated in multiple activities he or she is included in both counts. A report was not received from Greenwich. As is evident in this table, the totals in the Club Director's report and in *WISEngineering* differ. However regardless of how the data are recorded, most clubs successful engaged at least 10 youth in each activity. Clubs that failed to meet the required number were asked to repeat the activity with additional youth before the end of the program year.

Table 5. Number of youth participating in each activity by club

Boys and Girls Club	Dates (reported on Club Directors report)	Activity[1]	# Youth (reported by Club Director)	# Youth with Data *WISEngineering*
Bellport	11/10/2016	Avatar/High Five	11	18
	11/16/2016	Optimum Potato Chip	12	12
	1/27/2017	Design for Sound	10	11
	2/2/2017	Is all Slime Created Equally?	10	12
	11/16/2017	Prosthetic Leg	16	14
	2/17/2017	Hover Above it All	10	11
	1/13/2017	Need Some Support	11	10
	1/6/2017	Design Your Path	14	14
	12/15/2017	Magical Mirrors/Kaleidoscope	11	11

Boys and Girls Club	Dates (reported on Club Directors report)	Activity[1]	# Youth (reported by Club Director)	# Youth with Data *WISEngineering*
	1/20/2017	Dance Party	12	12
	3/3/2017	WuGGs to the Rescue	11	0
	9/1/2016	Designing Rockets	11	11
		Filtering Yucky Water	0	0
		Splash Down! Water Game Design	0	0
		Solar Cooker	0	9
Virginia (Charlottesville and Jack Jouett)	Data for VA clubs were combined	Avatar/High Five	31	48
		Optimum Potato Chip	31	27
		Design for Sound	27	26
		Is all Slime Created Equally?	26	25
		Prosthetic Leg	26	29
		Hover Above it All	33	23
		Need Some Support	29	28
		Design Your Path	29	27
		Magical Mirrors/Kaleidoscope	34	27
		Dance Party	24	23
		WuGGs to the Rescue		0
		Designing Rockets		0
		Filtering Yucky Water		0
		Splash Down! Water Game Design		0
		Solar Cooker		0
Children's Aid	1/9/2016	Avatar/High Five	10	10
	10/14/2016	Optimum Potato Chip	14	13
	11/2/2016 & 11/4/2016	Design for Sound	15	3
	11/30/2016 & 12/5/2016	Is all Slime Created Equally?	10	8
	12/7/2016 & 12/10/2016	Prosthetic Leg	10	9
	11/9/2017	Hover Above it All	14	13
	02/10/2017 & 2/13/2017	Need Some Support	10	10
		Design Your Path		0
	1/30/2017	Magical Mirrors/Kaleidoscope	11	10
	2/27/2017	Dance Party	10	10
		WuGGs to the Rescue	0	0
		Designing Rockets	0	0
		Filtering Yucky Water	0	0
		Splash Down! Water Game Design	0	0
		Solar Cooker	0	0
Glen Cove	10/12/16, 10/19/16, 12/9/16	Avatar/High Five	32	48

Boys and Girls Club	Dates (reported on Club Directors report)	Activity[1]	# Youth (reported by Club Director)	# Youth with Data *WISEngineering*
	10/19/16, 11/8/16, 12/9/16	Optimum Potato Chip	14	19
	10/26/16, 2/15/17	Design for Sound	15	27
	11/2/16, 12/21/16	Is all Slime Created Equally?	10	17
	11/9/16, 11/16/16, 12/21/16	Prosthetic Leg	11	28
	11/30/16, 1/4/17	Hover Above it All	12	20
	12/7/2016	Need Some Support	10	10
	12/14/2016	Design Your Path	15	15
	1/11/2017	Magical Mirrors/Kaleidoscope	17	17
	1/18/2017	Dance Party	13	12
	1/25/17, 2/1/17	WuGGs to the Rescue	14	15
	1/16/17, 1/17/17	Designing Rockets	14	14
	2/8/2017	Filtering Yucky Water	13	24
		Splash Down! Water Game Design	0	0
		Solar Cooker	0	0
Greenwich	Report not received	Avatar/High Five	Report not received	16
		Optimum Potato Chip		7
		Design for Sound		5
		Is all Slime Created Equally?		4
		Prosthetic Leg		0
		Hover Above it All		0
		Need Some Support		0
		Design Your Path		0
		Magical Mirrors/Kaleidoscope		0
		Dance Party		0
		WuGGs to the Rescue		0
		Designing Rockets		0
		Filtering Yucky Water		0
		Splash Down! Water Game Design		0
		Solar Cooker		0
Grenville Baker	10/11/2016	Avatar/High Five	32	32
	10/11/2016	Optimum Potato Chip	14	14
	10/25/2016	Design for Sound	15	15
	11/1/2016	Is all Slime Created Equally?	14	7
	11/15/2016	Prosthetic Leg	13	12
	11/29/2016	Hover Above it All	14	14
	12/6/2016	Need Some Support	11	11
	12/12/2016	Design Your Path	35	22
	1/17/2017	Magical Mirrors/Kaleidoscope	31	10
	12/20/2016	Dance Party	11	11
		WuGGs to the Rescue	0	3
		Designing Rockets	0	8
	9/27/2016	Filtering Yucky Water	20	19

Boys and Girls Club	Dates (reported on Club Directors report)	Activity[1]	# Youth (reported by Club Director)	# Youth with Data *WISEngineering*
		Splash Down! Water Game Design	0	0
		Solar Cooker	0	0
Hempstead	10/7/16-2/17/17	Avatar/High Five	30	14
	11/4/2016	Optimum Potato Chip	16	16
	10/14/2016	Design for Sound	15	15
	12/7/2016	Is all Slime Created Equally?	15	14
	11/18/2016	Prosthetic Leg	17	17
	12/16/2016	Hover Above it All	15	14
	2/3/2017	Need Some Support	18	17
	1/13/2017	Design Your Path	21	20
	1/20/2017	Magical Mirrors/Kaleidoscope	14	14
	2/17/2017	Dance Party	18	8
		WuGGs to the Rescue	0	0
		Designing Rockets	0	3
		Filtering Yucky Water	0	0
		Splash Down! Water Game Design	0	3
		Solar Cooker	0	2
Hicksville	12/7/2016	Avatar/High Five	15	18
	11/18/2016	Optimum Potato Chip	13	12
	1/6/2017	Design for Sound	12	12
		Is all Slime Created Equally?		0
		Prosthetic Leg		6
		Hover Above it All		6
		Need Some Support		7
	2/22/2017	Design Your Path	11	8
	1/20/2017	Magical Mirrors/Kaleidoscope	11	10
		Dance Party		10
		WuGGs to the Rescue		9
		Designing Rockets		1
		Filtering Yucky Water		10
		Splash Down! Water Game Design		8
		Solar Cooker		0
Metro Queens	Not reported	Avatar/High Five	20	19
	Not reported	Optimum Potato Chip	18	9
	Not reported	Design for Sound	21	10
	Not reported	Is all Slime Created Equally?	15	2
	Not reported	Prosthetic Leg	17	10
	Not reported	Hover Above it All	15	2
	Not reported	Need Some Support	15	1
	Not reported	Design Your Path	15	1
	Not reported	Magical Mirrors/Kaleidoscope	15	8
	Not reported	Dance Party	15	0

Boys and Girls Club	Dates (reported on Club Directors report)	Activity[1]	# Youth (reported by Club Director)	# Youth with Data *WISEngineering*
		WuGGs to the Rescue	0	0
		Designing Rockets	0	0
		Filtering Yucky Water	0	0
		Splash Down! Water Game Design	0	0
		Solar Cooker	0	0
Mount Vernon	Not submitted	Avatar/High Five	19	19
	Not submitted	Optimum Potato Chip	13	13
		Design for Sound	0	0
	Not submitted	Is all Slime Created Equally?	12	12
	Not submitted	Prosthetic Leg	15	15
		Hover Above it All	0	0
		Need Some Support	0	0
	Not submitted	Design Your Path	16	11
	Not submitted	Magical Mirrors/Kaleidoscope	16	15
		Dance Party	0	0
		WuGGs to the Rescue	0	0
		Designing Rockets	0	0
		Filtering Yucky Water	0	0
		Splash Down! Water Game Design	0	0
		Solar Cooker	0	0
New Rochelle	11/3/2016	Avatar/High Five	15	13
	11/22/2016	Optimum Potato Chip	7	7
	11/29/2016	Design for Sound	7	4
	12/20/2016	Is all Slime Created Equally?	9	8
	1/10/2017	Prosthetic Leg	8	6
	2/7/2017	Hover Above it All	5	4
	1/24/2017	Need Some Support	6	5
	1/17/2017	Design Your Path	6	5
	1/3/2017 & 3/20/2017	Magical Mirrors/Kaleidoscope	12	6
	3/7/2017	Dance Party	6	0
	1/31/2017	WuGGs to the Rescue	6	5
	2/28/2017	Designing Rockets	11	0
	3/21/2017	Filtering Yucky Water	9	0
		Splash Down! Water Game Design	0	0
		Solar Cooker	0	0
Oyster Bay	10/21/2016	Avatar/High Five	11	15
	10/27/2016	Optimum Potato Chip	10	12
	11/3/2016	Design for Sound	11	13
	11/10/2016	Is all Slime Created Equally?	11	4
	12/1/2016	Prosthetic Leg	12	6

Boys and Girls Club	Dates (reported on Club Directors report)	Activity[1]	# Youth (reported by Club Director)	# Youth with Data *WISEngineering*
	11/18/2016	Hover Above it All	11	4
	1/5/2017	Need Some Support	9	4
	12/15/2016	Design Your Path	11	4
	12/22/2016	Magical Mirrors/Kaleidoscope	12	3
	12/8/2016	Dance Party	12	5
	11/19/2017	WuGGs to the Rescue	10	10
	1/27/2017	Designing Rockets	8	8
	2/2/2017	Filtering Yucky Water	8	8
		Splash Down! Water Game Design	0	0
		Solar Cooker	0	0
Stamford	Not reported	Avatar/High Five	13	13
	Not reported	Optimum Potato Chip	10	10
		Design for Sound	0	0
		Is all Slime Created Equally?	0	0
		Prosthetic Leg	0	1
		Hover Above it All	0	0
		Need Some Support	0	0
		Design Your Path	0	0
		Magical Mirrors/Kaleidoscope	0	0
		Dance Party	0	0
		WuGGs to the Rescue	0	0
		Designing Rockets	0	0
		Filtering Yucky Water	0	0
		Splash Down! Water Game Design	0	0
		Solar Cooker	0	0
Variety	10/20/2016	Avatar/High Five	32	41
	10/23/2016	Optimum Potato Chip	21	8
	11/9/2016	Design for Sound	18	5
	11/9/2016	Is all Slime Created Equally?	19	8
	11/2/2016	Prosthetic Leg	18	6
	12/14/2016	Hover Above it All	41	9
	12/4/2016	Need Some Support	18	8
	11/23/2016	Design Your Path	21	12
	11/30/2016	Magical Mirrors/Kaleidoscope	16	1
	12/20/2016	Dance Party	19	18
	1/22/2017	WuGGs to the Rescue	18	2
	1/22/2017	Designing Rockets	15	0
		Filtering Yucky Water	0	0
		Splash Down! Water Game Design	0	0
		Solar Cooker	0	0

Percentage of youth completing each activity

To further explore youth completion of activities, Club Directors were asked *to what degree did the youth complete each of the activities* using a five point Likert-type ranging from *no youth completed the activity (0%)* to *all youth completed the activity (100%).* It should be remembered these data only account for the time period between September and February. However, the data suggests some activities take more time than others. As shown in the table, only the Avatar/High Five activity was completed by all youth at each club. Although all other activities were reported to not be completed by at least some youth; most activities were completed by at least half the youth. These results supported the decision to reduce the length of the activities and the amount of reading required.

Table 6 Number and percentage of youth by amount of each activity completed

WGG Activity (number of clubs)	Percentage of Activity Completed by Youth Across All Clubs				
	No youth completed the activity 0%	Less than half completed (<50%)	About half completed (~50%)	More than half completed (>50%)	All youth completed the activity (100%)
Avatar/High Five (n=14)	0% (0)	0% (0)	0% (0)	0% (0)	100% (14)
Potato Chip (n=14)	0% (0)	0% (0)	0% (0)	43% (6)	57% (8)
Design for Sound (n=14)	7% (1)	0% (0)	14% (2)	14% (2)	64% (9)
Slime (n=13)	0% (0)	0% (0)	23% (3)	8% (1)	69% (9)
Prosthetic Leg (n=12)	0% (0)	8% (1)	17% (2)	8% (1)	67% (8)
Hover Above it (n=12)	8% (1)	8% (1)	17% (8)	0% (0)	67% (8)
Need Support (n=12)	8% (1)	0% (0)	8% (1)	25% (3)	58% (7)
Design Your Path (n=12)	0% (0)	0% (0)	17% (2)	17% (2)	67% (8)
Magical Mirrors (n=13)	0% (0)	0% (0)	8% (1)	23% (3)	69% (9)
Dance Party (n=11)	9% (1)	0% (0)	27% (3)	9% (1)	55% (6)
WuGGs (n=6)	17% (1)	0% (0)	17% (1)	0% (0)	67% (4)
Rockets (n=6)	17% (1)	17% (1)	17% (1)	0% (0)	50%(3)
Solar Cooker (n=2)	100% (2)	0% (0)	0% (0)	0% (0)	0% (0)
Splash Down (n=2)	100% (2)	0% (0)	0% (0)	0% (0)	0% (0)
Filtering Yucky Water (n=6)	33% (2)	17% (1)	0% (0)	0% (0)	50% (3)

Percentage of questions answered by activity

WISEngineering data reports also allow for examination of page completion (i.e. time youth spent on the page) and question completion (percentage of questions attempted) by activity. Table 7 presents a sample of the question completion table for data generated between September 1, 2016-April 30, 2017 for the first seven activities. These data, along with youth level data will be analyzed during the summer 2017. They will also be used to help identify clubs that are most successfully engaging youth in all aspects of the activities.

Table 7. Question completion rates by club from *WISEngineering* data reports between September 2016 and April 2017

Boys and Girls Club	Optimum Potato Chip	Design for Sound	Prosthetic Challenge	Need Some Support?	Is All Slime Engineered Equally?	Design Your Path!	Dance Party!
Bellport	41%	34%	65%	94%	49%	93%	93%
Children's Aid	90%	100%	83%	95%	95%	85%	87%
Charlottesville VA[1]	41%	62%	61%	39%	38%	33%	91%
Glen Cove	92%	25%	0%	0%	25%	0%	0%
Greenwich	91%	93%	84%	81%	91%	79%	84%
Grenville Baker	53%	61%	62%	92%	80%	90%	92%
Hempstead	48%	86%	53%	67%	0%	89%	54%
Hicksville	52%	55%	47%	14%	77%	100%	0%
Mt Vernon	92%	0%	93%	0%	92%	92%	0%
New Rochelle	35%	35%	67%	59%	44%	45%	62%
Oyster Bay	49%	75%	49%	57%	60%	65%	82%
Stamford	68%	96%	100%	96%	97%	0%	100%
Variety	84%	88%	54%	58%	67%	41%	69%

[1] *WISEngineering* combines data for VA reformat the above no decimal points

Youth Impact and Engagement

On the year 2 survey Club Director's rated student engagement on a three point Likert-type scale (*not engaged, somewhat engaged, and fully engaged*). On the year 3 survey this was updated to a four point Likert-type scale ranging from *not at all engaging* to *very engaging.* As seen in Table 8, over 70% of all Club Directors reported the activities as *somewhat engaging* to *very engaging*. The activities reported as most engaging were Potato Chip (86% of Directors report it was *very engaging)* and Prosthetic Leg (79% of Directors report it was *very engaging).* See all responses in

Table 8. Youth engagement as reported by Club Directors

WGG Activity	Level of Youth Engagement				
	Not at all engaging	A little engaging	Somewhat engaging	Very engaging	Activity not yet done
Avatar/High Five (n=14)	0% (0)	7% (1)	29% (4)	64% (9)	n/a
Potato Chip (n=14)	0% (0)	0% (0)	14% (2)	86% (12)	n/a
Design for Sound (n=12)	0% (0)	0% (0)	25% (3)	75% (9)	2
Slime (n=12)	0% (0)	0% (0)	17% (2)	83% (10)	2
Prosthetic Leg (n=12)	0% (0)	0% (0)	8% (1)	92% (11)	2
Hover Above it (n=11)	18% (2)	0% (0)	36% (4)	46% (5)	3
Need Support (n=11)	0% (0)	9% (1)	27% (3)	64% (7)	3
Design Your Path (n=12)	0% (0)	0% (0)	25% (3)	75% (9)	2

WGG Activity	Level of Youth Engagement				
	Not at all engaging	A little engaging	Somewhat engaging	Very engaging	Activity not yet done
Magical Mirrors (n=13)	0% (0)	0% (0)	23% (3)	77% (10)	1
Dance Party (n=11)	9% (1)	9% (1)	27% (3)	55% (6)	3
WuGGs (n=5)	0% (0)	0% (0)	0% (0)	100% (5)	8
Rockets (n=5)	0% (0)	0% (0)	0% (0)	100% (5)	8
Solar Cooker (n=13)	0% (0)	0% (0)	0% (0)	0% (0)	13
Splash Down (n=13)	0% (0)	0% (0)	0% (0)	0% (0)	13
Filtering Yucky Water (n=4)	0% (0)	0% (0)	75% (3)	25% (1)	10

Club Directors were also asked, "*What impact did you observe that the WISEngineering program had on youth? In particular think about youth who might not have participated in other activities?*" Directors mentioned the intellectual growth they observed. Some youth showed greater interest and understanding about the STEM field as well as gains in critical thinking. One Director noted it "was great to see the transition from them not knowing anything about what STEM was to actively engaging in each of the activities. Another wrote, "Children used their critical thinking skills to brainstorm ways to improve the model." One director praised, "there is a lot of gratification once they are complete. At the end of the projects I hear many of the youth saying they can't believe what they have accomplished." All comments are provided verbatim below.

Figure 3. Club Director's comments verbatim on the impact of WGG on youth (n=14)

- I've observed that they are more engaged when hands-on activities are involved. We have a solid routine down that when they come into the room; they look for the Access Code, just so they can begin the reading and think about what questions I will ask.
- I think some of the biggest outcomes came from modules like the prosthetic leg and WuGGs because they could wear it. Some of them kept their designs on until their parents came to pick them up. Other members see their finished products and become curious as to what the middle school members are doing. Some of these members include the 5th graders who will move up to the teen side next school year. Other modules like kaleidoscope got the members interested in giving it as a gift to their family members.
- The group was primarily having issues with working together and critical thinking but now they work well and have matured.
- Members who routinely attend the program became more inquisitive (asking questions throughout the project runs and beyond the completion of the projects as well) and become true problem solvers. While several projects were challenging to complete correctly (for example, Design for Sound), we did not present the solution immediately, but allowed members to work first in their small groups, then together as one large group, to attempt to create a functioning speaker from the materials. Another added benefit of the program stemmed from allowing members to choose their own partners or small groups, but occasionally mixing it up and assigning them, helped everyone get to know one another and, of course, learn from each other as well.
- A sense of community and accomplishment when finishing activities as a team. Exposing our members to a great program like Wise Guys and Gals Boys and Girls as STEM

Learners give them the opportunity to find a possible passion for Science Technology Engineering and MATH. Our members enjoy the different activities without realizing they are learning or applying academic skill.

- We had some of our newer 7th graders wanting to join the group. Many students want to do some of the projects they missed because other members in their grade expressed their enjoyment.
- Students seemed to become more aware of occupations that pertain to science and engineering as a whole. I believe that the students now see that science is all around them and truly does have a large impact on their daily lives.
- The activities were really engaging and sparked the member's interest. They got to explore and use their creativity without having to worry about graded assignments. They can express their ideas and put it to the test. They were able to try again if their ideas failed. It's a great learning experience to learn critical thinking and problem solving skills.
- The Partnership Dynamic was amazing.
  I noticed that most of the children loved the activities so they was always look forward to the next project. My "shy" students was opening up as time when on .
- think about youth who might not have participated in other activities?
  Participants voiced that they enjoyed the WGG projects and they wanted to try them at home. They got the materials on their own and shared them with others at the club.
- In the beginning most of the youth did not know what STEM was. It was great to see the transition from them not knowing anything about what STEM was to actively engaging in each of the activities. The youth were excited about what project they were doing for the day most of the time. However, at times they do not want to take the time out to read all of the information that is needed to successfully complete each project. When they see their peers ahead of them in the activities they start to rush through so they could start building their prototype. A huge impact I have seen with our WISE learners is that they are fascinated to see what they can accomplish at their age. Often times when the activity for the day is announced they think they will not be able to design it. There is a lot of gratification once they are complete. At the end of the projects I hear many of the youth saying they can't believe what they have accomplished. This is the purpose of WISE.
- The members were taught the importance of teamwork and how working as a team is necessary on a project of this nature, especially when experiments did not work out as planned. Children used their critical thinking skills to brainstorm ways to improve the model.
- Each member who participated in the activities thoroughly enjoyed themselves. They all showed a level of interested in the STEM field and participation was voluntary.
- The youth involved with this program have become more daring, expressive, collaborative, outspoken, patient, team members.
  This drew more introverted children, ones who were more reserved and lost in a book or a videogame after their homework was finished. The discipline they have on themselves, respect and manners instilled by committed parents is evident in hardworking efforts by these children. It was a pleasure seeing them blur boundaries, create meaningful friendships both with like-minded passionate and ambitious learners and shy withdrawn learners breaking out of their shells.

Refinement and Enhancement of WGG Activities, Facilitator Guides, Professional Development Materials and *WISEngineering* Platform

During 2016-2017 the WGG activities and *WISEngineering*[1] continued to be reviewed, revised and refined based upon what was being learned about the materials and procedures. As data were collected the evaluation team helped identify needs and in collaboration with the WGG teams designed and tested possible revisions. Several significant revisions or enhancements were made during 2016-2017.

Technology

- During 2015-2016 WGG moved to a tablet based format. This addressed many problems with lack of computers at the clubs. However, challenges with connectivity, continued. Although project management helped each club assess their internet capabilities and connectivity, individual clubs continued to complain they encountered problems. The past year options were added to *WISEngineering* that allowed users one they had uploaded *WISEngineering* (requiring internet connection) to working off line and then uploading their data at a later data.
- The functionality of the automatic grading feature for write-in responses is currently being examined in light of the very brief answers often by students and challenges related to rubric creation and accurate scoring by the system when responses are very short. Further, the possible use of the grading feature to sort reflections is in the early phases.

WGG activities

- The amount of reading and time required to complete the activities was reported to be a challenge for some clubs and according to facilitators sometimes meant youth did not complete all activities. The WGG teams are reviewing each activity to reduce the amount of reading required and number of questions that need to be answered. These edits will be done with the evaluation team to assure the WGG questions continue to assess the needed outcomes.
- A new WGG activity called "shark tank" was written that will engage youth in creation of their own WGG activity. This activity was created as an assessment tool since youth will be required to identify key elements (specifications, constraints, etc.) which can be used to evaluate youth learning.

[1] *WISEngineering* is built off of the Web-based Inquiry Science Environment (WISE), developed at Berkeley University. WISE is an open-source computer-based learning management system that allows educators to author inquiry based science projects. It was also designed as a research tool for gathering of student data in schools. WGG worked with the Hofstra Computer Science department to enhance the *WISEngineering* platform.

WGG evaluation data

- Youth responses to the *WISEngineering* embedded questions required extensive cleaning before analyses could begin[2]. For example, write in questions include multiple extra characters that had to be removed and if a youth provided more than one responses (e.g., two examples) these needed to be individually separated. The 2016-2017 data are being manually cleaned to allow for analyses. Currently, the assessment structures (i.e., ways embedded assessments are recorded) are being examined and questions will be revised.
- The evaluation team is considering the inclusion of pre-post questions to be completed by youth in *WISEngineering* and collection of additional facilitator data. The questions completed by facilitators after implementing an activity are also being reviewed.
- A challenge identified in 2016-2017 was how to identify a youth as a participant. Once a youth creates an avatar he or she is considered an active participant. However, a review of the data included some youth never proceeded beyond creating an avatar. Other youth created multiple avatars (each time they logged into the system) and as a result a single youth who completed three activities might appear as three separate youth. Manual examination of identification numbers along with feedback from the clubs allowed the evaluation team to merge data under a single identification code

Professional Development

- During 2016-2017 the Professional development videos embedded in the *WISEngineering* architecture were evaluated and when necessary minor revisions made to assure they were aligned with WGG activities. As the need for additional support was identified, additional videos were created or planned, including how to be prepared and how to log into a *WISEngineering* activity.

Extension Activities

- Based on feedback from project stakeholders and teams, as well as the evaluation results, the possibility of engaging parents with WGG activities has been examined. This work is demonstrating the potential broad impact of the project. Parent University, cite of this work, is documenting use of the WGG materials in an additional (home) informal setting. During summer 2017 parent data, including reflections and surveys, will be analyzed for evidence of the adaptability of WGG to different informal settings.
- As part of the Advisory Board meeting as well as local team meetings, WGG staff have been examining ways the materials can be disseminated or adapted. This preliminary work is being used to begin to frame a strategic plan for WGG sustainability after the current funding ends. The project website has further been enhanced in preparation of sustainability efforts during the final two years of the project.

[2] The problem was related to additional symbols and machine language which automatically downloaded when questions allowed for multiple responds. Rewording of questions will avoid this challenge.

Conclusion and Next Steps

WGG is meeting its project goals and within the proposed timeline. WGG activities are easily implemented at the B&GCs. Youth are engaged in the activities and clubs are successfully recruiting the required number of youth. Facilitators & Club Directors are successfully using the materials and generally report positive opinions the activities and professional development videos. The technology is working and issues with connectivity are being addressed. Additionally, some clubs have found creative ways to leverage their participation in WGG for additional funding or publicity.

Despite many success, WGG continues to encounter some challenges. Clubs often focused on "activity delivery" rather than "activity process." In the next year, WGG will look for ways to help clubs shift from a focus on "delivery" (getting done) to "process" (how activity is done). Facilitators sometimes forget to have youth record their work, or upload pictures and narratives, activities that will be stressed with new and returning clubs.

Examination of data within *WISEngineering* indicates there a great deal of missing data, incomplete pages and unanswered questions. Dealing with missing data, interpreting responses, and deciding what is minimum engagement to be considered a youth participant is currently being discussed. The evaluation team is developing an analytic plan that will lay out what data is essential to collect and what could be optional (given time constraints), while not overwhelming clubs. In the next year additional data may be collected from some clubs, allowing for more in-depth examination of particular questions. For example, pre-post youth assessments may be collected at some clubs or the use of the Shark Tank activity may be closely studied. The balance between encouraging youth to collaborate and collecting youth level data may be explored and will definitely be discussed before the next pilot study. Overall, assuring compliance with essential project requirements (and identifying those that are non-negotiable) will remain a concern for the next year.