

2010

Evaluation of *Design Squad*, Season 3: Final Report



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On the cover: *Design Squad* host Nate Ball offers cast members Trejonda and Nick constructive criticism on their design blueprint for the water dancing challenge. In this episode, dancer Lisa Bufano, a bilateral leg and finger amputee, calls upon the teams to deliver swim leg and hand prostheses for an underwater performance. **Credit:** Anthony Tieuli / WGBH

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Section 1: Background

Introduction

Design Squad, produced by WGBH-Boston (<http://www.wgbh.org>), premiered on the Public Broadcasting Service in October 2009. *Design Squad* is a reality television series that encourages kids ages 9-12 years to “show off their smarts as they design and build working solutions for real-world clients—people who are hungry for clever ideas from a new generation of innovators.” Each season, the series culminates in a final episode when the top two scorers compete for a \$10,000 college scholarship from the Intel Foundation.

Accompanying the Emmy and Peabody Award-winning television series are a website (<http://pbskids.org/designsquad/>), activity guides for 35 different engineering design activities (available in English and Spanish), a Teacher’s Guide for middle school science, technology, engineering, and mathematics (STEM) teachers, video assets (downloadable video animations across seven topic areas as well as video profiles of real engineers), and other guides and printable resources that may be used in formal or informal educational settings.

The underlying educational goals of *Design Squad* are to:

- Increase students' knowledge of engineering and the design process;
- Improve the public image of engineering; and
- Encourage further exploration in the fields of engineering, math, and science.

Concord Evaluation Group performed an evaluation of the third season of *Design Squad* in 2009-2010. This report summarizes our findings.

Evaluation Study Design

The evaluation study consisted of three separate research activities:

Table 1: Evaluation Study Activities

Study Components	Objectives
1. Survey of 912 <i>Design Squad</i> website users	We performed a survey of website users to assess whether WGBH is reaching a diverse audience through its Web activities.
2. Survey of 650 <i>Design Squad</i> outreach partners	We performed a survey of <i>Design Squad</i> outreach partners to assess whether WGBH is reaching a diverse audience through its outreach activities

Study Components	Objectives
<p>3. Impact study (including 559 middle school students at 8 different schools)</p>	<p>We performed an experiment (randomized block design) to explore the extent of learning and changes in attitudes of teachers and students who use <i>Design Squad</i> materials, including exploring how video assets streamed online can be used effectively in the classroom. The specific materials tested included:</p> <ul style="list-style-type: none"> • Teacher's Guide (http://pbskids.org/designsquad/parentseducators/teachers_guide.html) • Video animations, live action videos, and video profiles (http://pbskids.org/designsquad/parentseducators/teachers_guide.html) • An interactive online game (http://pbskids.org/designsquad/games/string_thing/index.html) • Additionally, teachers were encouraged, but not required, to use the website for any other resources on an as needed basis.

Section 2: Survey of Website Visitors

Study Design

WGBH hosted a Web-based survey on the home page of the *Design Squad* website with the purpose of collecting data about the demographic and background characteristics of the website visitors. We invited all unique visitors to respond to the survey. The survey was brief and collected the following data:

1. Gender
2. Age
3. Hispanic, Latino, or Spanish origin (separated out similar to the US Census)
4. Race/ethnicity
5. Locale (urban, rural, suburban)
6. State of residence
7. Zip code¹
8. Type of school (collected from children only)
 - a. Public school
 - b. Charter school
 - c. Private school
 - d. Home school
9. In which role/capacity they visited the website (collected from adults only)
 - a. Classroom teacher
 - b. After-school teacher
 - c. Librarian
 - d. Volunteer
 - e. Camp counselor
 - f. Parent
 - g. Engineer
 - h. Other
10. Perceived socioeconomic status, SES (collected from adults only)²
 - a. Low income
 - b. Middle income
 - c. High income

The survey was launched in February of 2010. The survey was made available for a period of about two months. Our goal was to collect responses from 1,000 unique respondents.

¹ We have not included a list of zip codes in this report as it encompasses several hundred different codes, but will share the full list directly with WGBH.

² Rather than pre-defining SES for respondents based on a set income level that does not take into account community-level variables like cost of living, this question asks respondents to report how they perceive their situation (i.e., do they consider themselves to be low, middle or high income?).

Findings

We collected data from over 1,200 respondents. Over 200 records contained significant amounts of missing data (responded to only one question) or the data were suspect (response patterns indicated the respondents did not take the survey seriously). After deleting records with significant missing and suspect data, we had a sample of 912 responses. As shown in Table 2, our sample included individuals from every state in the US plus the District of Columbia and Puerto Rico, except Maine.

Table 2: Proportion of Website Visitors from Each State^a

State	Number (%)	State	Number (%)	State	Number (%)
Texas	66 (7.2%)	Connecticut	16 (1.8%)	Nevada	7 (0.8%)
Massachusetts	59 (6.5%)	Iowa	16 (1.8%)	Oklahoma	7 (0.8%)
California	50 (5.5%)	Arizona	15 (1.6%)	Rhode Island	7 (0.8%)
New York	44 (4.8%)	Michigan	15 (1.6%)	Kansas	6 (0.7%)
Georgia	39 (4.3%)	New Jersey	15 (1.6%)	New Mexico	6 (0.7%)
Florida	37 (4.1%)	Minnesota	14 (1.5%)	West Virginia	6 (0.7%)
Illinois	37 (4.1%)	Tennessee	14 (1.5%)	Alaska	5 (0.5%)
Ohio	36 (3.9%)	South Carolina	13 (1.4%)	Puerto Rico	5 (0.5%)
Outside US	30 (3.3%)	Utah	13 (1.4%)	Arkansas	4 (0.4%)
North Carolina	29 (3.2%)	Colorado	11 (1.2%)	Delaware	4 (0.4%)
Pennsylvania	23 (2.5%)	Louisiana	11 (1.2%)	Mississippi	4 (0.4%)
Maryland	21 (2.3%)	Oregon	11 (1.2%)	Montana	4 (0.4%)
Wisconsin	19 (2.1%)	Indiana	10 (1.1%)	New Hampshire	4 (0.4%)
Missouri	18 (2.0%)	Alabama	8 (0.9%)	District of Columbia	3 (0.3%)
Virginia	18 (2.0%)	Hawaii	7 (0.8%)	South Dakota	2 (0.2%)
Kentucky	17 (1.9%)	Idaho	7 (0.8%)	Vermont	1 (0.1%)
Washington	17 (1.9%)	Nebraska	7 (0.8%)	Wyoming	1 (0.1%)

^a The number of unknown or missing responses equals 73 (8.0%).

The sample also included individuals from outside the US. The states that were the most heavily represented in our sample (Texas, Massachusetts, California, and New York) mirror closely the states that are represented most frequently in the web statistics that WGBH collects on a regular basis (California, Texas, New York, and Florida).

As summarized in Table 3, more of the website visitors were female (64%) than male (33%). While more than half of the website visitors were white (57%), 16% reported that they were of Hispanic, Latino or Spanish origin and 13% reported they were African-American. Other ethnic groups included Asians (11%), American Indian or Alaskan Natives (7%), and Native Hawaiian or other Pacific Islanders (3%).³

Table 3:
Demographic and Background Characteristics of Website Visitors

Characteristic	TOTAL (N = 912)	Compared to US Demographics ^a
Gender		
Female	585 (64.1%)	50%
Male	300 (32.9%)	50%
Missing/Unknown	27 (3.0%)	N/A
Hispanic, Latino, or Spanish origin		
Not of Hispanic, Latino, or Spanish origin	729 (79.9%)	84.9%
Of Hispanic, Latino or Spanish origin	147 (16.1%)	15.1%
Missing/Unknown	36 (3.9%)	N/A
Race / ethnicity		
White or Caucasian	520 (57.0%)	80.0%
Black or African-American	116 (12.7%)	12.9%
Asian	102 (11.2%)	4.4%
American Indian or Alaskan Native	59 (6.5%)	1.0%
Native Hawaiian or Other Pacific Islander	23 (2.5%)	0.2%
Location		
Suburban	394 (43.2%)	Not defined

³ Source: National Center for Education Statistics (<http://nces.ed.gov/fastfacts/display.asp?id=72>)

Characteristic	TOTAL (N = 912)	Compared to US Demographics ^a
Urban	329 (36.1%)	79.2%
Rural	121 (13.3%)	20.8%
Missing/Unknown	68 (7.5%)	N/A

NOTE: Totals may add up to greater than 100% in cases where respondents can choose more than one answer.

^a US demographic data obtained from the US Census Bureau (<http://www.fhwa.dot.gov/planning/census/cps2k.htm>) and the CIA World Factbook (<https://www.cia.gov/library/publications/the-world-factbook/geos/us.html>).

We should also note that only 1% of adults in the US describe themselves as American Indian or Alaskan Native (our sample included 7%). We have reason to believe that our survey data are inaccurate for this demographic group. First, WGBH’s web statistics show that the number of visits from Alaskan Internet Protocol (IP) addresses is among the lowest of the website’s visitors. Second, as we will discuss in Section 3, our survey of WGBH’s outreach partners revealed that fewer than 1% of the kids reached with *Design Squad* outreach activities identify themselves as American Indian or Alaskan Native. Therefore, we believe that the numbers for this group may be inflated and that the result may be due to how the item was presented and whether respondents read the question too quickly. In the survey, the list of ethnicities was presented in alphabetical order, so the American Indian or Alaskan Native option was presented first. We believe that some respondents may have only quickly glanced at the list, read this choice as “American” only and checked it without reading the rest of the text in that choice or the rest of the list of ethnicities.

As summarized in Table 3, the majority of the website visitors reported that they lived in suburban settings (43%). More than one third of website visitors (36%) reported that they lived in urban settings, while 13% reported they lived in rural settings.

We asked students to report the type of school they attended (Table 4). Most students reported that they attended public schools (71%).

Table 4:
Students' Self-Report School Types

School Type	TOTAL (N = 602)	Compared to US Students ^a
Public school	426 (70.8%)	85%
Home school	66 (11.0%)	3%
Private school	63 (10.5%)	11%
Charter school	25 (4.2%)	2%
Missing/Unknown	22 (3.7%)	N/A

^a Data obtained from the National Center for Education Statistics (http://nces.ed.gov/programs/digest/d09/tables/dt09_100.asp) and (http://nces.ed.gov/programs/digest/d09/tables/dt09_002.asp)

The sample respondents ranged in age from 6 to 70 years old. The average age was 19 years and the median age was 12 years. The US average median age is 36.8 years. Given that we are evaluating a website designed for children, it is not unexpected that the population of *Design Squad* website visitors is much younger than the US average age in the total population.

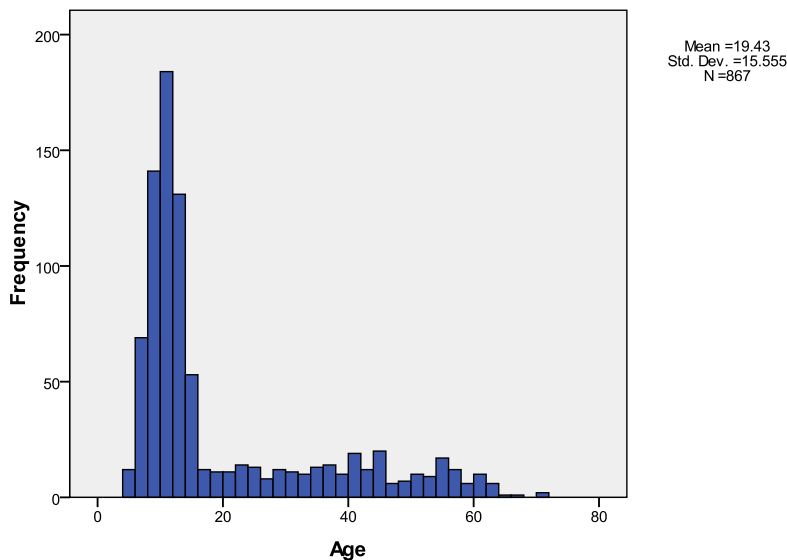


Figure 1. Frequency distribution of survey respondents' ages.

We asked the adults in our sample to indicate in what role/capacity they were visiting the website (Table 5). The majority of website visitors reported that they were visiting the site as teachers (46%). Other key groups included parents (16%) and engineers (10%). Fewer than 5% of the adults reported that they were visiting the website in any one of the following capacities:

- After-school teachers
- Volunteers
- College students
- Librarians
- Camp counselors

Individual respondents reported they were visiting the website as a(n)...

- Academic coach
- Aspiring engineer
- College administrator
- Designer
- Education consultant
- Educational outreach manager
- Engineering pre-college program coordinator
- Girl Scout program specialist
- Math science education improvement consultant
- Museum director
- Museum educator
- Outreach program administrator
- Project coordinator
- Regional service agency
- Science methods professor
- Summer camp curriculum developer
- University professor
- Volunteer coordinator
- “Woman interested in technology”

We also asked the adult respondents to report their perceived socioeconomic status. The majority of respondents perceived themselves to be middle income (66%), followed by low income (14%) and high income (13%). There are no reliable national data on the proportion of US adults who believe that they are low, middle, or high income. However, we do know that the official poverty rate according to the Census Bureau was 13.2% in 2008.⁴ So, the proportion of website visitors who perceived themselves to be low income is consistent with the US poverty rate, according to the Census Bureau.

⁴ Source: Census Bureau (<http://www.census.gov/prod/2009pubs/p60-236.pdf>)

Table 5:
Characteristics of Adult Visitors to the Website

Characteristic	TOTAL (N = 265)
Role	
Classroom teacher	121 (45.7%)
Parent, including home school parents	42 (15.8%)
Engineer	26 (9.8%)
After-school teacher	11 (4.2%)
Volunteer	11 (4.2%)
College student	4 (1.5%)
Librarian	4 (1.5%)
Camp counselor	2 (0.8%)
Other	20 (7.5%)
Missing/Unknown	24 (9.1%)
Income level	
Middle income	175 (66.0%)
Low income	37 (14.0%)
High income	34 (12.8%)
Missing/Unknown	19 (7.2%)

Summary

Design Squad website visitors in February and March of 2010 represented a diverse array of individuals from across the country. Based on these data, it appears that *Design Squad*, through its website, has succeeded in reaching out to traditionally underserved audiences such as non-white, ethnic minorities, girls, and low income audiences. Major adult audiences for the website include teachers in formal educational settings, parents, engineers and homeschooled children. Thus, the *Design Squad* website appears to be serving the needs of educators and students in both formal and informal educational settings.

- The *Design Squad* website user survey included a sample of 912 website visitors.
- The website received visitors from all 50 states (except Maine) plus the District of Columbia and Puerto Rico, as well as locations outside the US. The largest proportion of visitors was from Texas, Massachusetts, California, and New York.
- Visitors to the website were more likely to be female (64%) than male (33%).
- The racial and ethnic composition of the website visitors was diverse (43% non-white, ethnic minorities).
- The majority of website visitors reported that they were from suburban settings (43.2%).
- The website appears to be used heavily by homeschoolers (11% versus 3% nationally).
- The median age of the website visitors (12 years old) matches well with *Design Squad's* target audience (9-12 year olds).
- Most adults visiting the website reported that they were teachers, parents, and engineers – consistent with *Design Squad's* target adult population. The website also received visits from educators in informal educational settings like museums, afterschool programs and camps.
- Most adults reported that they considered themselves to be middle income, however low and high income visitors were also represented. The proportion of website visitors who perceived themselves to be low income (14%) is consistent with the US poverty rate (13% in 2008).

Section 3: Outreach Partner Survey

Study Design

CEG developed a brief Web-based survey of *Design Squad's* outreach partners as another means of assessing the degree to which *Design Squad* is reaching out to a diverse audience. WGBH invited over 3,000 of its outreach partners to participate in the survey. Our final sample included 650 outreach partners, including educators in formal or informal settings, volunteers, engineers, and parents.

We collected the following data from each program:

1. Role of the outreach partner
2. Type of program represented
3. Description of the area in which the served kids live (urban, suburban, rural)
4. Zip code⁵
5. Number of kids reached with *Design Squad*
6. Gender of kids served
7. Race/ethnicity of kids served
8. Socioeconomic status of kids served
9. Grade level of kids served (lower-elementary, upper-elementary school, middle school, high school)
10. Purposes for using *Design Squad*
11. Components of *Design Squad* used
12. How *Design Squad* was used
13. How often *Design Squad* resources were used
14. Perceived effectiveness of the activities

⁵ We have not included a list of zip codes in this report as it encompasses several hundred different codes, but will share the full list directly with WGBH.

Findings

Characteristics of the Outreach Partners

The outreach partner sample included a range of different individuals serving in many different types of roles (Table 6). By far, the most common role reported was that of the classroom teacher (62%), which may be due to the fact that Season 3’s outreach efforts targeted classroom teachers. Other common roles included engineer (5%), other educational staff (5%), after-school teachers (4%) and parents (4%).

Table 6:
Roles of Outreach Partners in Sample

Roles	TOTAL (N = 650)
Classroom teacher	402 (61.8%)
Engineer	34 (5.2%)
Other educational staff (informal teacher, curriculum specialist, consultant)	32 (4.9%)
After-school teacher	28 (4.3%)
Parent, including home school teachers	24 (4.0%)
Volunteer	22 (3.4%)
Project or program coordinator	17 (2.6%)
Librarian	15 (2.3%)
Professor or college faculty	13 (2.0%)
School administrator	9 (1.4%)
Community relations (community outreach)	9 (1.4%)
Museum staff	7 (1.1%)
Girls Scout staff	5 (0.8%)
Camp counselor	5 (0.8%)
Other (see below)	21 (3.2%)
Missing/unknown	5 (0.8%)

Partners who reported that their role fell into the “Other” category listed their roles as the following:

- Other agency / institution / non-profit / association worker (n = 4)
- Trainer (general) (n = 3)
- Program specialist (n = 3)
- Graduate or college student (n = 2)
- Retiree (n = 1)
- State supervisor (n = 1)
- Behavioral Specialist (n = 1)
- Extension 4-H (n = 1)
- Science center board member (n = 1)
- Consultant (general) (n = 1)
- University Program Administrator (n = 1)
- Communications director (n = 1)
- Anthropologist (n = 1)

Table 7 summarizes the types of programs represented in the outreach partner sample. Schools dominated the list of program types (66%), followed by Girl Scouts (5%) and volunteer professional engineers who perform outreach to kids in their communities (3.5%).

**Table 7:
Outreach Partner Programs**

Program Type	TOTAL (N = 650)
School	426 (65.5%)
Girl Scouts	31 (4.8%)
No program, I volunteer with kids in my profession / career (engineering)	23 (3.5%)
Summer camp	17 (2.6%)
Boys and Girls Clubs	14 (2.2%)
National Engineers Week program	14 (2.2%)
Library	11 (1.7%)
Museum	10 (1.5%)
4-H	8 (1.2%)
Science clubs / informal programs	8 (1.2%)

Program Type	TOTAL (N = 650)
Technology student association	7 (1.1%)
Home school	7 (1.1%)
Afterschool program	7 (1.1%)
Educational and engineering program outreach organization	7 (1.1%)
Other (see below)	49 (7.5%)
Missing/unknown	8 (1.2%)

Other program types included:

- STEM programs (general) (n = 5)
- University (n = 5)
- Teacher training (n = 5)
- Boy Scouts (n = 4)
- Intel Computer Clubhouse / Intel *Design Squad* (n = 3)
- Military Youth Center (n = 2)
- Talented and Gifted coordinator / teacher (n = 2)
- Environmental Ed Nature Center (n = 2)
- NASA Education resource center (n = 2)
- Associations (SWE, National Society of Black Engineers) (n = 2)
- YWCA (n = 1)
- State math / science program or alliance (n = 1)
- Information officer (n = 1)
- Co-op (general) (n = 1)
- Education to work programs (n = 1)
- Tech wars (n = 1)
- International environmental education program (n = 1)
- Management for education technology (n = 1)
- Church-based (n = 1)
- Regional Science Fair (n = 1)
- Challenger Learning Center (n = 1)
- Middle school and high school enrichment coordinator (n = 1)
- Bring kids to work day (n = 1)
- MSSC teacher (n = 1)
- PBS station (n = 1)
- Childcare (n = 1)
- School project (n = 1)

Characteristics of the Kids Served

Our sample of 650 outreach partners reported that they had reached out to 83,161 kids with *Design Squad*. The median number of kids reached by each programs was 60 kids. Most programs (97%) estimated that they reached around 500 kids, but a handful (n = 21) estimated that they had reached between 500 and 3,400 kids.

Table 8 summarizes the characteristics of the kids served by the *Design Squad* outreach partners. Note that these are provided as estimates only. Some programs have served hundreds of kids over the past couple of years and relied on general records or, in some cases, recall to describe the kids they had served.

The majority of the kids served by the outreach partners were located in suburban settings (47%) and urban settings (34%). Rural kids were served by 18% of the programs (21% of US citizens live in rural settings).

Design Squad outreach was conducted most often at the middle school level (56%) and upper elementary level (35%). However, outreach was also taking place at the high school (29%) and lower elementary (20%) levels, too.

We asked outreach partners to indicate the proportion of kids they served who are male versus female and the proportion of kids from different ethnic groups. On average, partners reported serving an equal proportion of boys and girls. More than one-third of the kids served by outreach partners were from low income families; about half of the kids were from middle income families, while 15% of the kids served were from high income families.

Table 8:
Characteristics of Kids Served by Outreach Partners

Characteristic	TOTAL (N = 650)
Locale ^a	
Suburban	306 (47.1%)
Urban	220 (33.8%)
Rural	118 (18.2%)
Missing / Unknown	6 (0.9%)
Grade level ^b	
Middle school	362 (55.7%)
Upper-elementary	226 (34.8%)

Characteristic	TOTAL (N = 650)
High school	187 (28.8%)
Lower-elementary	129 (19.8%)
Gender	
Weighted average proportion of kids served who are <i>male</i>	50.6% (sd = 17.7)
Weighted average proportion of kids served who are <i>female</i>	50.3% (sd = 18.5)
Income	
Weighted average proportion of kids served who are <i>middle income</i>	51.6% (sd = 22.6)
Weighted average proportion of kids served who are <i>low income</i>	37.1% (sd = 26.2)
Weighted average proportion of kids served who are <i>high income</i>	14.5% (sd = 14.1)
Race / ethnicity	
Weighted average proportion of kids served who are <i>White or Caucasian</i>	66.0% (sd = 28.0)
Weighted average proportion of kids served who are <i>Black or African-American</i>	21.0% (sd = 24.5)
Weighted average proportion of kids served who are <i>Hispanic, Latino, Spanish</i>	20.9% (sd = 21.0)
Weighted average proportion of kids served who are <i>Asian</i>	6.7% (sd = 7.7)
Weighted average proportion of kids served who are <i>American Indian or Alaskan Native</i>	1.7% (sd = 6.7)
Weighted average proportion of kids served who are <i>Native Hawaiian or Other Pacific Islander</i>	1.0% (sd = 4.0)

^a The chi square goodness-of-fit test to test the hypothesis that the proportions were equal was significant ($\chi^2_{(df=2)} = 82.52, p = 0.000$).

^b The total adds up to more than 650 because some programs reported that they served more than one grade level.

With respect to race and ethnicity, *Design Squad* outreach partners appeared to be focusing their efforts on traditionally underserved, non-white, minority communities. While the majority of the kids served were white (66%), this is much lower than the proportion of white individuals in the US (80%). Twenty-one percent of the kids served were Black or African-American and 21% were Hispanic (Blacks and Hispanics comprise 13% and 15% of the US population, respectively).

Outreach Partners' Use of *Design Squad*

We asked partners to report how frequently they used *Design Squad*. Almost one-third reported they had used *Design Squad* more than six times, and more than one-third reported that they have used *Design Squad* three to five times (38%). Slightly fewer than one-third had used *Design Squad* once or twice. The most frequently used component was the hands-on design challenges (78%), followed by the website (70%) and the TV series (30%).

Table 9:
Outreach Programs' Self-reported Use of *Design Squad*

	Frequency (%) (N = 650)
How often programs use <i>Design Squad</i>	
1-2 times	197 (30.3%)
3-5 times	248 (38.2%)
6-10 times	113 (17.4%)
10+ times	82 (12.6%)
Missing / Unknown	10 (1.5%)
Which components used	
Hands-on engineering challenges	504 (77.5%)
Website	454 (69.8%)
Series	194 (29.8%)

NOTE: The totals may add up to more than 650 because some programs may have reported more than one choice.

We asked partners to explain how they used *Design Squad* with their kids. The most common uses for *Design Squad* included supplementing existing curricula, standards, and lessons (18%), teaching STEM to kids (11%), exploring and using the website resources (10%), and using the hands-on design challenges (9%).

Table 10:
How Outreach Programs Use *Design Squad*

	Frequency (%) (N = 650)
Supplementing existing curriculum and / or standards and / or lessons	114 (17.5%)
Teach STEM, introduce general concepts and the design process	73 (11.2%)
Explored / used website resources (e.g., videos, templates, handouts, profiles)	66 (10.2%)
Used challenges / activities with the kids	56 (8.6%)
Promote / lead hands-on and / or interactive activities	43 (6.6%)
To teach kids how to brainstorm / problem solve / be creative	40 (6.2%)
To show real-world and / or career application	37 (5.7%)
Training volunteers, teachers, afterschool staff / use for professional development and in workshops	33 (5.1%)
As a model or resource to develop my plans / ideas for new and other projects	29 (4.5%)
For use in afterschool / outside of school events (club meetings, science fairs)	27 (4.2%)
For inspiration / to engage and motivate students	24 (3.7%)
To use as team-oriented / collaborative learning projects	21 (3.2%)
Use in camp setting	18 (2.8%)
To identify ideas for club / afterschool meetings / program ideas / science fairs	18 (2.8%)
Recommend / show to other teachers and adults	12 (1.8%)
Use as an outreach resource	8 (1.2%)
Classroom competitions	6 (0.9%)
Use with disadvantaged children	4 (0.6%)
Home school use	4 (0.6%)
To show that not all PBS shows are for young or old people	3 (0.5%)
To show examples to kids of other kids / engineers engaging in design process and creativity	3 (0.5%)

	Frequency (%) (N = 650)
To get ideas on how to work within teaching / money constraints	2 (0.3%)
As an arts course to promote independent thinking and design	1 (0.2%)
Whole group enrichment	1 (0.2%)
To highlight on my blog	1 (0.2%)
To teach older girls how to lead younger girls	1 (0.2%)
Virtual field trip	1 (0.2%)
Project research	1 (0.2%)

We asked partners to report on a scale of 0 to 3 how effective *Design Squad* was for their kids (0 = not effective at all, 3 = very effective). Partners reported that *Design Squad* had been effective at helping their kids...

- Develop more creative, flexible, and imaginative thinking skills (Average = 2.34, standard deviation = 0.68)
- Learn about science and engineering concepts (Average = 2.30, standard deviation = 0.64)
- Get excited about engineering (Average = 2.27, standard deviation = 0.71)
- Gain confidence in their ability to problem solve (Average = 2.12, standard deviation = 0.66)
- Understand that engineers work to make the world a better place (Average = 2.11, standard deviation = 0.74)

Summary

Design Squad outreach partner efforts appear to be widespread and extensive, reaching out to over 83,000 kids in the past three years. Furthermore, it appears that through its outreach partners, *Design Squad* has been able to reach thousands of kids who are traditionally underserved, including rural kids, low income kids, and non-white, minorities.

Design Squad's outreach partners represent a diverse group of formal and informal programs for children. While classroom teachers comprise the largest proportion of outreach partners, other common types of partners include professional engineers who volunteer to provide educational outreach to their communities; educators in informal educational settings, such as summer camps and Boys and Girls Clubs; and parents who home school their children or volunteer in their communities (e.g., as Girl Scout leaders).

Outreach partners are most commonly using the hands-on challenges, the website, and the TV series to supplement their existing science, technology, engineering and mathematics (STEM) curricula, standards, and lessons. Partners report that the resources are effective at teaching their kids to develop more creative, flexible, and imaginative thinking skills; learn about science and engineering concepts; get excited about engineering; gain confidence in their ability to problem solve; and understand that engineers work to make the world a better place. Moreover, the resources appear to be effective across a range of grade levels—from lower elementary to high school.

- The outreach partner survey included 650 outreach partners.
- The outreach partner sample included a range of different individuals serving in many different types of roles. By far, the most common role reported was that of the classroom teacher (62%). (This may be because Season 3's outreach efforts targeted classroom teachers.) Other common roles included engineer (5%), other educational staff (5%), after-school teachers (4%) and parents (4%).
- The type of programs represented in the outreach partner sample was diverse: Schools dominated the list of program types (66%), followed by Girl Scouts (5%) and volunteer professional engineers who perform outreach to kids in their communities (3.5%).
- The sample of 650 outreach partners reported that they had reached out to 83,161 kids with *Design Squad*. The median number of kids reached by the programs was 60 kids. Most programs (97%) estimated that they reached fewer than 500 kids, but a handful (n = 21) estimated that they had reached between 500 and 3,400 kids.
- The majority of the kids served by the outreach partners were located in suburban settings (47%) and urban settings (34%). Rural kids were served by 18% of the programs.
- *Design Squad* outreach was conducted most often at the middle school level (56%) and upper elementary level (35%). However, outreach was also taking place at the high school (29%) and lower elementary (20%) levels, too.
- On average, partners reported serving an equal proportion of boys and girls.
- About half of the kids served by outreach partners were from middle income families, while more than one-third were from low income families (roughly 13% of individuals in

the US were classified as “poverty-level” in 2008). Fifteen percent of the kids served were from high income families.

- With respect to race and ethnicity, *Design Squad* outreach partners appeared to be focusing their efforts on traditionally underserved, non-white, minority communities. While the majority of the kids served were white (66%), this is lower than the proportion of white individuals in the US (80%). Twenty-one percent of the kids served were Black or African-American and 21% were Hispanic (Blacks and Hispanics comprise 13% and 15% of the US population, respectively).
- Almost one-third of outreach partners reported they had used *Design Squad* more than six times. More than one-third of outreach partners reported that they have used *Design Squad* three to five times (38%). Slightly less than one-third had used *Design Squad* once or twice.
- The most frequently used *Design Squad* component was the hands-on design challenges (78%), followed by the website (70%) and the TV series (30%).
- The most common uses for *Design Squad* included supplementing existing curricula, standards, and lessons (18%), teaching STEM to kids (11%), exploring and using the website resources (10%), and using the hands-on design challenges (9%).
- Partners reported that *Design Squad* had been effective at helping their kids...
 - Develop more creative, flexible, and imaginative thinking skills
 - Learn about science and engineering concepts
 - Get excited about engineering
 - Gain confidence in their ability to problem solve
 - Understand that engineers work to make the world a better place

Section 4: Impact Study

Background

Study Design

CEG designed an experiment to test the impact of the *Design Squad* Teacher’s Guide. The study utilized a randomized block design. From a pool of middle schools that expressed interest in participating in the study, we systematically matched schools based on their demographic characteristics: specifically, the proportion of students eligible for free or reduced price lunch and the proportion of non-white, ethnic minorities. Within these four sets of matched schools, we randomly assigned one school from each pair to the treatment group and one school to the control group. One classroom from each school participated in the study, so the study included a total of eight classrooms (and eight different teachers).

Half of the classrooms in the treatment and control groups (n = 4 total) were sixth grade classrooms. Two of the classrooms in the treatment and control groups were eighth grade and two were seventh grade classrooms.

The study design is illustrated below:

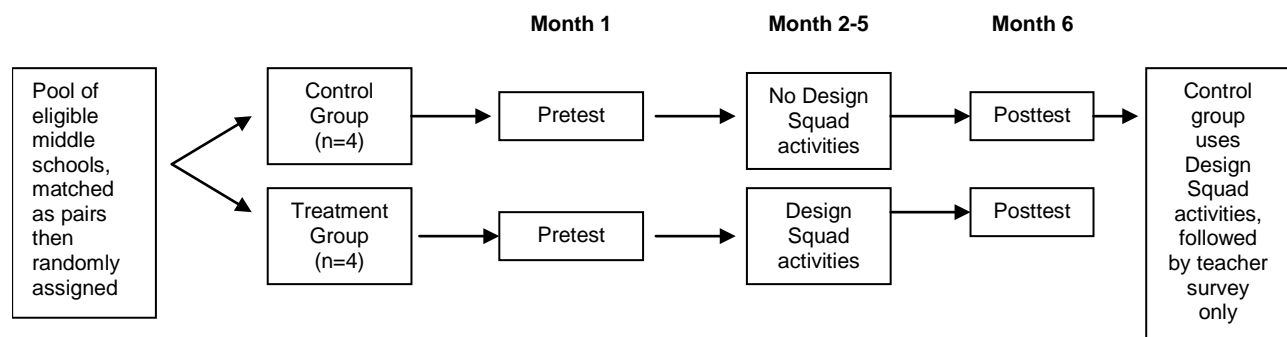


Figure 2. Randomized block design.

At the beginning of the study, teachers and students in both groups completed the pretest survey (Appendix C and D). Following the pretest survey, teachers in the treatment group were provided with the *Design Squad* Teacher’s Guide (http://www-tc.pbskids.org/designsquad/pdf/parentseducators/DS_TG_full.pdf). The Guide introduced the engineering design process to students, and included a series of challenges in which students were encouraged to explore electrical circuits, sound, Newton’s Laws, force, and air pressure.

Within each challenge, teachers had access to short videos that could be downloaded or streamed from the website (http://pbskids.org/designsquad/parentseducators/teachers_guide.html). These videos included:

- Videos introducing the design process
 - Identify the problem

- Brainstorm
- Design
- Build, test and redesign
- Share solutions
- Various, short (1-3 minute) videos, including live action videos of the cast from the TV show, profiles of engineers, and video animations of technical concepts, including:
 - Seven different videos related to the electrifying games challenges,
 - Seven different videos related to sound, and
 - Eleven different videos related to Newton’s Laws, force, air pressure, and buoyancy.
- An interactive online game designed to teach kids about sound.

We asked treatment group teachers to use the guide over a period of 4-5 months and to integrate the various challenges into their existing curriculum and lesson plans, as they saw fit. We deliberately did not attempt to prescribe how the Guide should be used. Instead, our objective was to see how teachers would decide to use it in their own classrooms.

At the end of the fifth month, teachers and students in the control group responded to the posttest survey (Appendices). Following the posttest survey, teachers in the control group were encouraged to use the *Design Squad* materials. The purpose of this approach was twofold: (1) to give classrooms a chance to use the materials (we did not want to unfairly deny classrooms a chance to use the materials simply because they were randomly assigned to the control group), and (2) we wanted to gather additional feedback from control group teachers about the resources. We did not collect student knowledge or attitude data from the control group after they used *Design Squad* because they were likely already contaminated after having responded already to the pretest and posttest.

Sample Characteristics

Schools

Table 11 summarizes the characteristics of the eight schools in our sample. The majority of the teachers in our sample reported that more than one-third of their students were eligible for free or reduced-price lunch. At least half of the teachers in our sample reported that between 10-20% of the students in their classrooms were students with special needs.

Table 11:
Demographic and Background Characteristics of the School Sample

Characteristic	Treatment Group (n = 4)	Control Group (n = 4)	TOTAL (N = 8)
Percent eligible for free or reduced-price lunch			
Fewer than 5%	1 (25.0%)	--	1 (12.5%)
20-30%	1 (25.0%)	1 (25.0%)	2 (25.0%)
31-40%	--	1 (25.0%)	1 (12.5%)
41-50%	1 (25.0%)	1 (25.0%)	2 (25.0%)
Greater than 50%	1 (25.0%)	1 (25.0%)	2 (25.0%)
Special needs			
Up to 10%	--	2 (50.0%)	2 (25.0%)
10-20%	2 (50.0%)	2 (50.0%)	4 (50.0%)
21-30%	2 (50.0%)	--	2 (25.0%)

The special needs identified in the sample classrooms included the following:

- Anxiety and emotional disorders
- Autism, including Asperger Syndrome
- Attention Deficit Disorder
- Attention Deficit Hyperactivity Disorder
- Behavioral problems
- Dwarfism
- English as a second language
- Hearing impairments
- Math-based learning disabilities
- Reading-based learning disabilities
- Multiple disabilities
- Unspecified cognitive or behavioral issues

Students

Table 12 summarizes the characteristics of the 559 students in our sample. The sample was approximately evenly split between males and females. Most of the participants in the sample

were from the sixth grade. This reflects the fact that 50% of the classrooms in our sample were sixth grade classrooms.

Table 12:
Demographic and Background Characteristics of Students in Study

Characteristic	TOTAL (N = 559)
Gender	
Male	271 (48.5%)
Female	261 (46.7%)
Missing/Unknown	27 (4.8%)
Grade	
Sixth	372 (66.5%)
Seventh	125 (22.4%)
Eighth	36 (6.4%)
Missing/Unknown	26 (4.7%)
Hispanic, Latino, or Spanish origin	
Not of Hispanic, Latino, or Spanish origin	444 (79.4%)
Of Hispanic, Latino or Spanish origin	86 (15.4%)
Missing/Unknown	29 (5.2%)
Race / ethnicity	
White or Caucasian	380 (68.0%)
Black or African-American	54 (9.7%)
Asian	23 (4.1%)
American Indian or Alaskan Native	18 (3.2%) ⁶
Native Hawaiian or Other Pacific Islander	3 (0.5%)

⁶ The proportion of students who reported they are American Indian or Alaskan Native is in doubt. As with the Web survey described in Section 2, we believe that the numbers for this group may be inflated and that the result may be due to how the item was presented and whether respondents read the question too quickly. In the survey, the list of ethnicities was presented in alphabetical order, so the American Indian or Alaskan Native option was presented first. We believe that some students may have only quickly glanced at the list, read this choice as “American” only and checked it without reading the rest of the text in that choice or the rest of the list of ethnicities. In fact, teachers in all eight schools reported that fewer than 1% of their students identify as American Indian or Alaskan Native.

The proportion of students with a Hispanic, Latino, or Spanish origin (15%) mirrored exactly the US general population proportion. The proportion of kids who reported they were Black or African-American was 10% (compared to 13% nationally).

Students ranged in age from 10 to 15 years old, with most kids falling into the 11 to 13 year old range. The average age was 12 years old (standard deviation = 0.76).

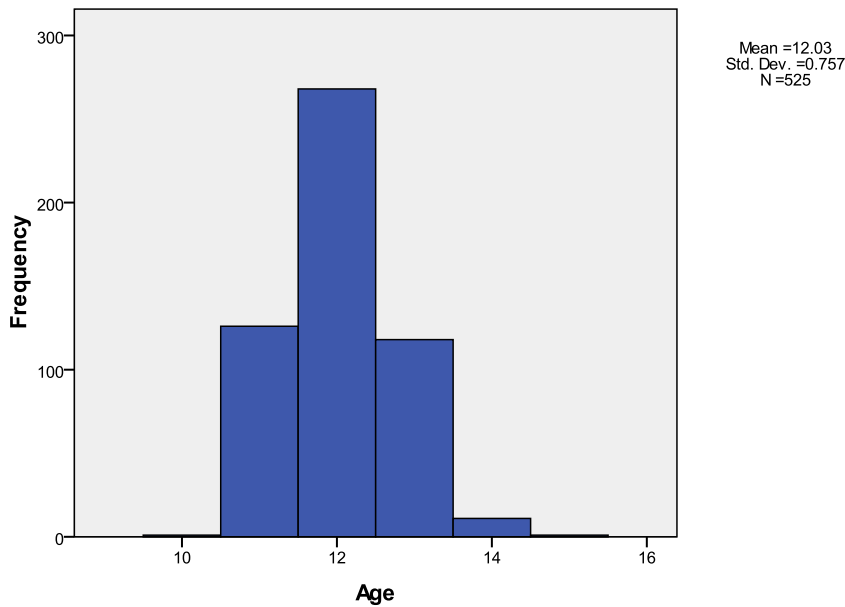


Figure 3. Distribution of student ages.

We asked students to report whether they had any previous experience doing engineering activities. As Table 13 shows, there were no significant differences between the control group and treatment group with respect to experience with engineering activities, with one exception. Students in the control group were more likely to report that they had participated in engineering clubs or after-school programs than students in the treatment group. They also were more likely to have a teacher who had reported that they knew what the engineering design process was.

Table 13:
Student Experience with Engineering Activities

Activity	Treatment Group (n = 362)	Control Group (n = 197)
I've done engineering activities in my classroom	143 (40.3%)	82 (43.4%)
I've taken an engineering class at my school	27 (7.6%)	13 (6.9%)
I've taken an engineering class during the summer	23 (6.5%)	7 (3.7%)
I've joined an engineering club or afterschool program	13 (3.7%)	19 (10.1%)*
I've built something on my own or with other people	274 (77%)	141 (74.6%)

* The difference between the treatment and control group is significant at the $p < .05$ level.

Teachers

The teachers in our sample reported having an average of 10.75 years (standard deviation = 7.23) of experience teaching science, with a range from 4 to 25 years. One teacher held a bachelor's degree, while the remaining seven reported holding a master's degree. Their major fields of study included:

- Math and Science
- Middle School Arts
- Special Education
- Psychology and Education
- Guidance and Counseling
- Elementary Education
- Curriculum and Instruction

We asked teachers to report on technology use in their classrooms. All of the teachers (n = 8) reported that they sometimes stream or download video from the Internet to show their students.

Most of the teachers (n = 6) reported that they allow their students to access the Internet in the classroom. One teacher reported that she does not allow students to access the Internet from her classroom. Another teacher reported that do not have sufficient computers in the classroom, so she cannot allow students to use the Internet.

We asked teachers whether they ever allow their students to use the Internet to access or view videos on their own in the classroom. Only two teachers reported that they allow this. Four

teachers reported that they do not allow this. Two teachers reported that their classrooms do not have the capacity to enable students to stream videos.

Four teachers reported having an interactive white board in the classroom, while four reported that they did not have such technology.

Seven teachers reported having a projector attached to a computer in their classroom. Only one teacher did not have access to this technology.

Teachers' Experience with Engineering Design Process Activities

We asked teachers to report on their familiarity with the engineering design process. One teacher (in the treatment group) reported that she had never heard of it. Four teachers reported that they had “heard of it, but were not sure” they knew what it was. The remaining three teachers (all in the control group) reported that they knew what the engineering design process was.

Five teachers reported that they led activities that use the engineering design process only once or twice per year (despite the fact that two of these teachers reported that they didn't know the design process was). The remaining three teachers indicated that they never led engineering design process activities in their classrooms (two of these teachers were in the treatment group and one was in the control group).

We asked teachers to indicate how interested their students would be in doing engineering design challenges. Five reported that their students would be very interested, two reported that their students would be somewhat interested, and one teacher reported that she did not know whether her students would be interested in doing engineering design challenges.

Findings

Student Learning Outcomes

The summative evaluation study was designed to answer the following research questions related to student learning:

- R1. Will students exposed to *Design Squad* demonstrate greater gains in **knowledge of key science constructs** (i.e., electrical circuits, sound, Newton’s Laws, force, and air pressure) than students who are not exposed to *Design Squad*?
- R2. Will students exposed to *Design Squad* demonstrate a better **understanding of the engineering design process** than students who are not exposed to *Design Squad*?
- R3. Will students exposed to *Design Squad* demonstrate a better **understanding of what engineering is all about** than students who are not exposed to *Design Squad*?

Knowledge of Key Science Constructs

To explore the question (R1) of whether students exposed to *Design Squad* learned more about key science constructs than students in the control group (who were not exposed to *Design Squad*), we developed a brief test of science constructs (see questions 16 through 21 in the Student Treatment Group or Control Group Surveys, Appendix C and D). Student knowledge scores were computed by summing the number of correct responses on the pretest and posttest surveys (the scale was 0 to 6).

To answer the research question, we performed a hierarchical linear model analysis. We included knowledge score as the dependent variable, with time (pre-test and post-test) as the repeated measure and group assignment (treatment versus control), group assignment as the fixed effect, plus the interaction term (group assignment by time). The repeated measures were modeled with a compound symmetry covariance structure, which means that the residual variation in student scores within the same class are considered independent for different students, but correlated across the two time points for each student. This accounts for the fact that some students, both pre- and post-test scores are higher than for other students, even within the same classroom and treatment condition (within student covariance = .98; within class variance = 2.38).

$$Y_{ijk} = b_{0j} + b_1 * Time + u_{0j} + \varepsilon_{ijk}$$

For Time k for Student *i* in classroom *j*

Where $u_{0j} \sim N(0, \tau_{00})$ and $\varepsilon_{ijk} \sim N(0, \sigma^2)$

Likewise, because students are nested within teachers in the design, we needed to account for the fact that within a teacher’s class, the scores are likely to be more similar than they would be if students came from different classes (measured by the intraclass correlation). To do this, we separately estimated the variation among students’ scores who have the same teacher (σ^2) and the variation in scores between teachers (τ_{00}) (even within the same group assignment). In this

case, the ICC accounted for approximately 13% of the variance in student knowledge scores. That is, 13% of residual variation in student scores comes from being in the same class.

As shown in Table 14, the interaction term was significant ($F_{(1, 559)} = 8.82, p = 0.003$). This relationship is also summarized in Figure 4 below. *The treatment group demonstrated greater gains in science content knowledge scores than the control group.*

Table 14:
Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	8.156	297.74	0.00
Time	1	559.00	9.29	0.00
Group Assignment	1	8.156	0.17	0.69
Time by Group Assignment	1	559.00	8.82	0.00

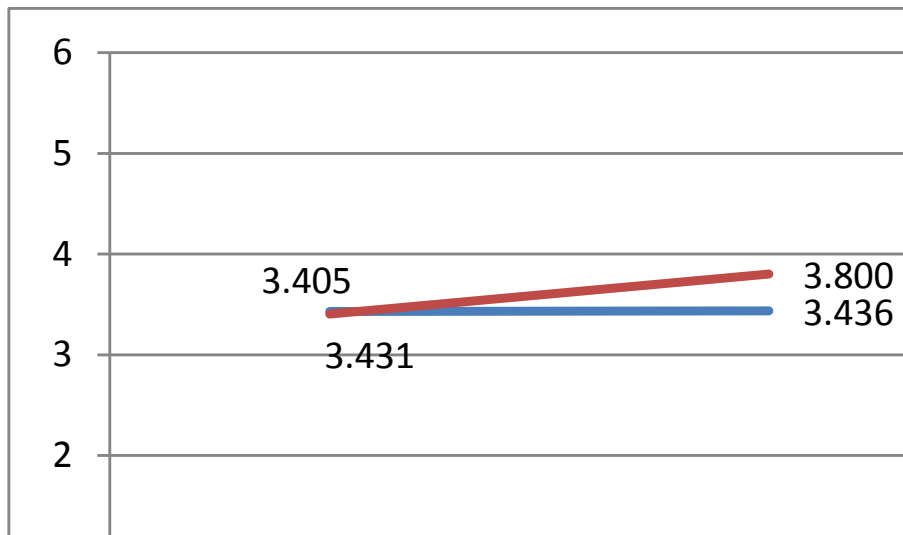


Figure 4. Pre-test and post-test average knowledge scores for control versus treatment group.

Understanding the Design Process

To explore the research question R2, we asked students to describe how they might design and build an object to solve a problem (see question 15 in the Student Treatment Group or Control Group Surveys, Appendix C and D). The goal was to see whether students could adequately describe the design process. Students’ responses were scored using the following rubric:

0 = No response or unintelligible response

1 = Student includes only one step or provides details about the items they would use to build, but no detail about the process

Sample – “Put a bell on a hook, so when the door opens the bell rings.”

2 = Student lists at least 2 steps in the design process, but not all the steps

Sample – “Get materials; read instructions; put together; make sure it works. If it doesn’t work, try again.” [Note the design process steps covered by this sample response are (1) build, (2) test, (3) redesign.]

3 = Student lists at least 4 steps in the design process

Sample – “1. I would draw out the plans. 2. Make any adjustments. 3. Start building. 4. Test the alarm. 5. Fix any problems, try again for the test. 6. Then set it up on the door.”

Thus, students could earn anywhere from 0 to 3 points for their responses.

To answer the research question, we performed a hierarchical linear model analysis. In the first stage of analysis, we included process score as the dependent variable, with time (pre-test and post-test) as the repeated measure and group assignment (treatment versus control) as the fixed effect. As described earlier, students were nested within teachers in the design so we separately estimated the variation among students’ scores who have the same teacher and the variation in scores between teachers (within group assignment).

As with our previously analysis, the repeated measures were modeled with a compound symmetry covariance structure (within student covariance = .33; within class variance= .562).

As shown in Table 15, we found no significant effects for time or group assignment (there were no differences between the treatment and control groups).

Table 15:
Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	7.721	1390.558	0.000
Time	1	435.609	0.861	0.354
Group Assignment	1	7.724	3.563	0.097

The first stage model did not include the interaction term (time by group assignment). So, in the next stage, we fitted a model that included the interaction term. However, this model did not fit the data better than the first stage model.

We hypothesized that we might see a difference between the groups if we controlled for whether or not students had previously participated in an engineering club or after-school program (recall that there was a significantly higher proportion of students in the control group who had participated in such activities, compared to the treatment group). So, we expected that engineering club experience might be mitigating any effect of being in the treatment group. We ran a model with process score as the dependent variable, and time, group assignment, and experience with engineering clubs as the fixed effects. We also included all two-way interactions and the three-way interaction in the model.

We found that the model did fit the data better than the first stage model ($\chi^2_{(df=1)} = 29.974$, $p < 0.001$). While none of the effects or interactions is significant at the $p < 0.05$ level, we observed that the three-way interaction is significant at the $p < 0.10$ level (commonly used as a cut point in exploratory research). So, while we will not report these findings as evidence of an effect, we have included these data as a way of potentially explaining the lack of a difference between the treatment and control group with respect to their understanding of the design process.

We also analyzed the data to look for differences between the students whose teachers reported being knowledgeable about the design process and those whose teachers did not. There were no significant differences between the groups.

Table 16:
Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	47.407	700.173	0.000
Time	1	422.913	1.686	0.195
Experience with engineering clubs	1	486.400	1.717	0.191
Group assignment	1	47.407	3.246	0.078
Time by group assignment	1	422.913	0.643	0.423
Time by experience with engineering clubs	1	422.916	1.952	0.163
Group assignment by experience with engineering clubs	1	486.400	0.943	0.332
Time by experience by group assignment	1	422.916	2.859	0.092

Figures 5 and 6 summarize the relationships. Looking at trends, we observed that for students in the treatment group *without* club experience, there is an upward trend.

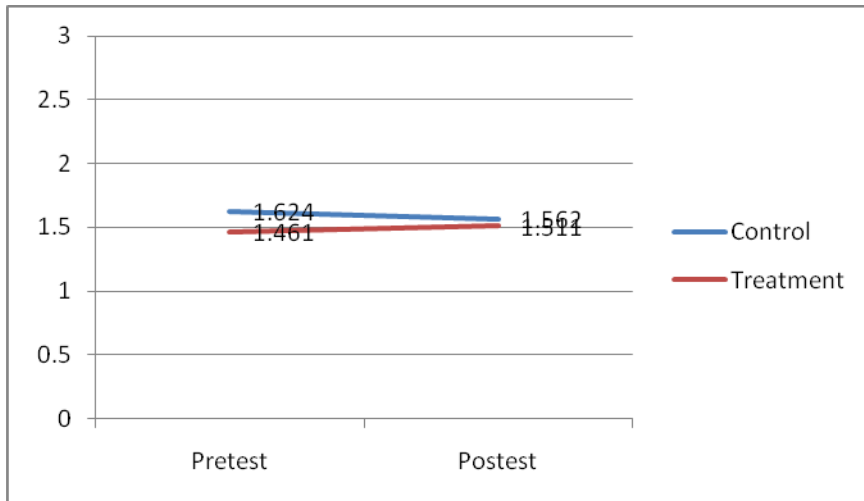


Figure 5. Students without experience in engineering clubs or after-school programs.

For students *with* experience in engineering clubs, we observed an upward trend in control group students (as expected, if the kids are learning about the design process during the study from their club). We observed no change in treatment group student scores who participated in engineer clubs. Again, these differences were only significant at the $p < 0.10$ level. Thus, there is no evidence that there were significant differences between the groups with respect to understanding of the design process.

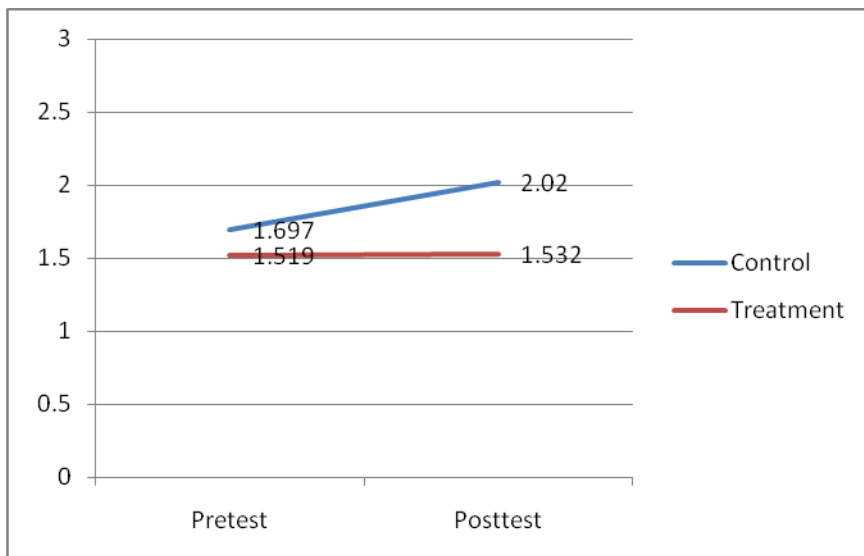


Figure 6. Students with experience in engineering clubs or after-school programs.

Understanding What Engineering is All About

To explore the research question R3, we asked students to respond to several questions designed to assess whether students understand what is involved in engineering (see questions 1, 7, 10, 13, and 14) in the Student Treatment Group or Control Group Surveys, Appendix C and D). These questions assess students' level of understanding...

- Of what engineering is
- That engineering involves having a great imagination
- That engineers do many different kinds of jobs
- That engineers sometimes have to test their work and start over again
- That engineers can work on a number of different projects and products, from designing toys to testing air quality

For each of these items, we performed a hierarchical linear model analysis.⁷ In the analysis, we included time (pre-test and post-test) as the repeated measure and group assignment (treatment versus control) as the fixed effect, in addition to the interaction between group assignment and time. The repeated measures were modeled with a compound symmetry covariance structure (within student covariance = .11; within class variance = .295).

We ran the model with the question “I know what engineering is” as the dependent variable (Question 1). The dependent variable represents a single question on a scale of 1 to 3, with 3 indicating agreement, and 1 indicating disagreement.

Table 17:
Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	7.851	9327.778	.000
Time	1	543.022	43.318	.000
Group Assignment	1	7.851	3.058	.119
Time by Group Assignment	1	543.022	18.739	.000

As shown in Table 17, the interaction term was significant ($F_{(1, 543.022)} = 43.318, p = 0.000$). This relationship is also summarized in Figure 7 below. *The treatment group demonstrated greater gains in “understanding what engineering is” than the control group.*

⁷ These items were analyzed separately because they were not highly correlated with one another – thus, we were not comfortable combining them into a scale.

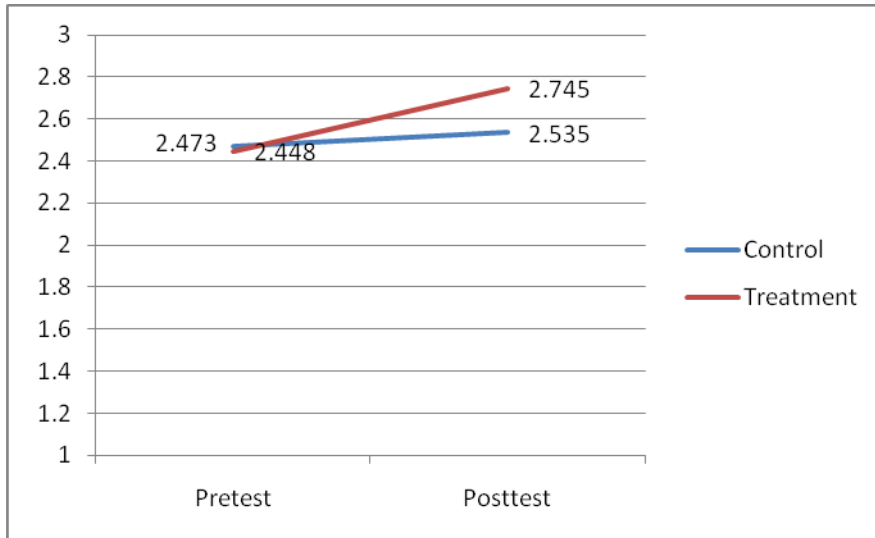


Figure 7. Pre-test and post-test average scores for control versus treatment group: Understanding what engineering is.

Next, we ran an analysis with “understanding that engineering involves having a great imagination” as the dependent variable (Question 7), time as the repeated measure and the interaction term (group assignment by time). The dependent variable represents a single question on a scale of 1 to 3, with 3 indicating agreement, and 1 indicating disagreement.

Table 18:
Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	8.752	1553.332	0.000
Time	1	549.204	5.459	0.020
Group Assignment	1	8.752	25.686	0.001
Time by Group Assignment	1	549.204	27.388	0.000

As shown in Table 18, the interaction term was significant ($F_{(1, 549.204)} = 27.388, p = 0.000$). This relationship is also summarized in Figure 8 below. *The treatment group demonstrated greater gains in understanding that “engineering involves having a great imagination” than the control group.*

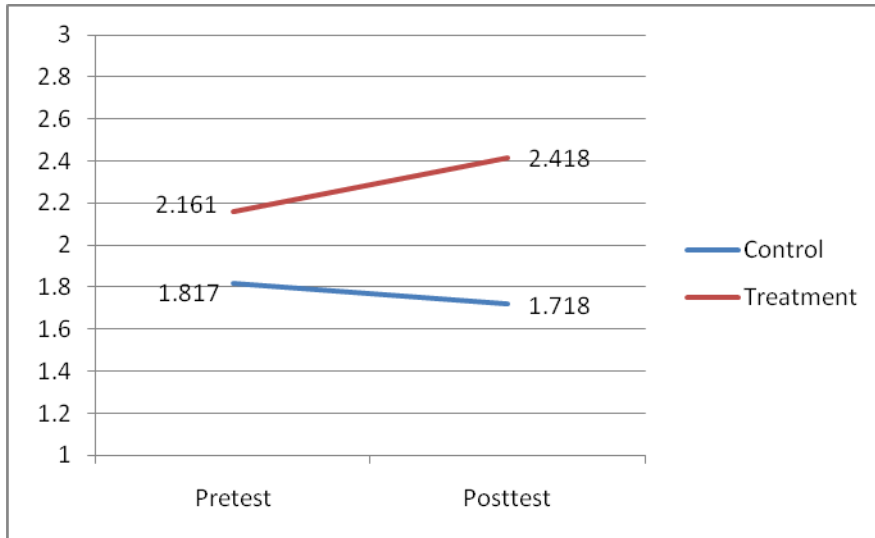


Figure 8. Pre-test and post-test average scores for control versus treatment group: Understanding that engineers must have a great imagination.

We ran an analysis with “understanding that engineers do many different types of jobs” as the dependent variable (Question 10), time as the repeated measure, group assignment as the fixed effect, plus the interaction term. The dependent variable represents a single question on a scale of 1 to 3, with 3 indicating agreement, and 1 indicating disagreement.

Table 19:
Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	8.319	2422.318	.000
Time	1	554.420	12.278	.000
Group Assignment	1	8.319	259.675	.000
Time by Group Assignment	1	554.420	4.867	.028

As summarized in Table 19, we did find a significant interaction between time and group assignment. This relationship is summarized in Figure 9 below. *The treatment group demonstrated greater gains in “understanding that engineers do many different types of jobs” than the control group.* However, these findings should be interpreted with caution, as we cannot explain the significant difference between the control and treatment group students at pretest.

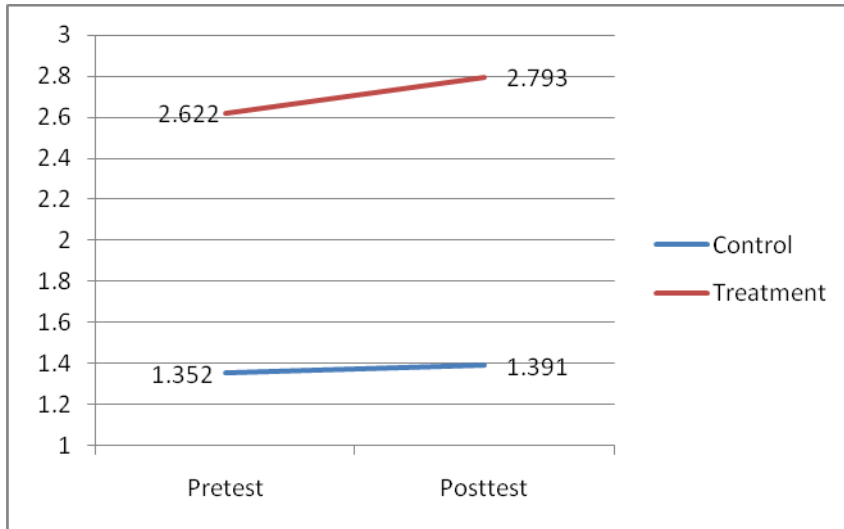


Figure 9. Pre-test and post-test average scores for control versus treatment group: Understanding that engineers do many different types of jobs.

We ran an analysis with “understanding that engineers sometimes test their work and start over again” as the dependent variable (Question 13), time as the repeated measure, group assignment as the fixed effect, plus the interaction term. The dependent variable represents a single question on a scale of 1 to 3, with 3 indicating agreement, and 1 indicating disagreement.

Table 20:
Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	9.190	3330.258	.000
Time	1	555.325	1.972	.161
Group Assignment	1	9.190	486.879	.000
Time by Group Assignment	1	555.325	3.080	.080

As shown in Table 20, the interaction term was not significant. We found that there was a significant difference between the treatment and control relationship at pretest and at posttest (see Figure 8) but that the treatment group did not make significant gains over time when compared with the control group. In other words, from the outset, the treatment group students were more aware than control group students that engineers sometimes have to test their work and start over again, and *Design Squad* did not change their level of understanding (it was already high).

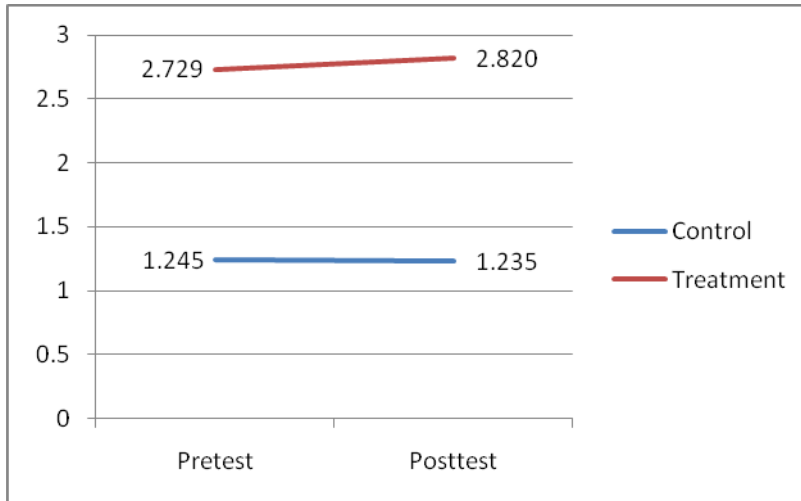


Figure 9. Pre-test and post-test average scores for control versus treatment group: Understanding that sometimes engineers have to test their work and start over again.

We ran the model with “understanding the types of projects that engineers work on” as the dependent variable (Question 14), time as the repeated measure, group assignment as the fixed effect, plus the interaction term. The dependent variable represents a single question on a scale of 0 to 5, with the score indicating the number of project types that students correctly identified as engineering-related.

Table 21:
Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	7.841	382.686	.000
Time	1	550.229	62.000	.000
Group Assignment	1	7.841	.871	.379
Time by Group Assignment	1	550.229	12.030	.000

As summarized in Table 21, we found a significant interaction between time and group assignment. This relationship is summarized in Figure 10 below. *The treatment group demonstrated greater gains in “understanding of the projects that engineers might work” on than the control group.*

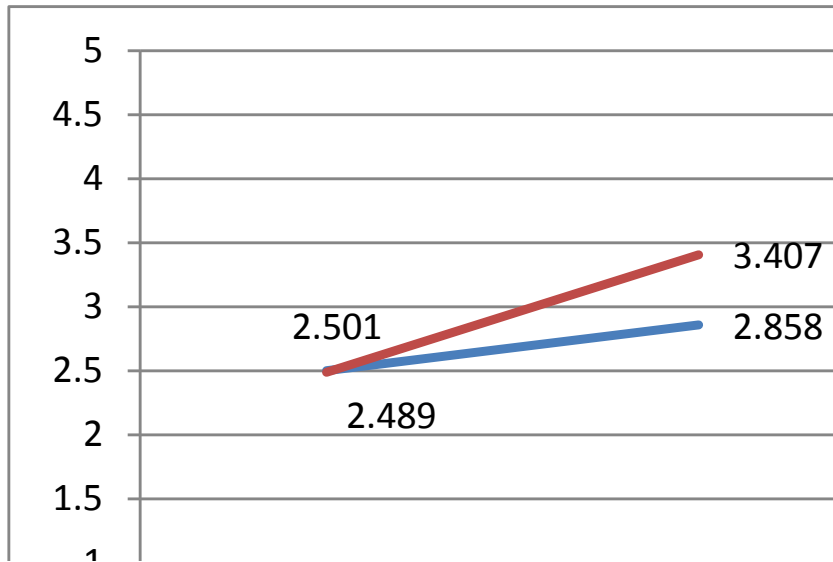


Figure 9. Pre-test and post-test average scores for control versus treatment group: Understanding of the types of projects engineers on which engineers might work.

Student Attitudes towards Engineering

We assessed the extent to which students held positive or negative attitudes towards engineering. Specifically we assessed the extent to which students believed that...

- Engineers help make people's lives better
- Engineers solve cool problems
- It would be fun to be an engineer
- Engineers solve problems that affect real people

The extent to which students believed certain stereotypes about engineering, specifically that...

- Men are better at engineering than women
- Only super smart people can succeed in engineering
- Engineering is boring

We also assessed the extent to which students reported they were interested in participating in engineering clubs, classes, or activities.

The specific research questions we sought to answer included:

R4. Will students exposed to *Design Squad* demonstrate more positive **attitudes towards engineering** over time than students who are not exposed to *Design Squad*?

R5. Will students exposed to *Design Squad* demonstrate more disbelief in **stereotypes about engineering** over time than students who are not exposed to *Design Squad*?

R6. Will students exposed to *Design Squad* demonstrate a greater level of interest in **participating in engineering activities** over time than students who are not exposed to *Design Squad*?

Student Attitudes

To examine the question of whether *Design Squad* had an impact on student attitudes towards engineering, we created an attitude scale score by summing student responses to the four separate attitude items described above.⁸ Resulting scale scores ranged from 4 to 12, with higher scores indicating more positive attitudes.

We ran a model with attitude score as the dependent variable and with time (pre-test and post-test) as the repeated measure and group assignment (treatment versus control) as the fixed effect, plus the interaction term (group assignment by time). The repeated measures were modeled with a compound symmetry covariance structure, which means that the residual variation in student scores within the same class are considered independent for different students, but correlated across the two time points for each student. This accounts for the fact that some students, both pre- and post-test scores are higher than for other students, even within the same classroom and treatment condition (within student covariance = 1.661; within class variance= 3.067).

Table 22:
Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	7.741	4350.225	0.000
Time	1	535.572	32.886	0.000
Group Assignment	1	7.741	1.576	0.246
Time by Group Assignment	1	535.572	35.192	0.000

As summarized in Table 22, we found a significant interaction between time and group assignment. This relationship is summarized in Figure 11 below. *The treatment group demonstrated greater gains in their attitudes toward engineering than the control group.*

⁸ The scale had an alpha coefficient of 0.67.

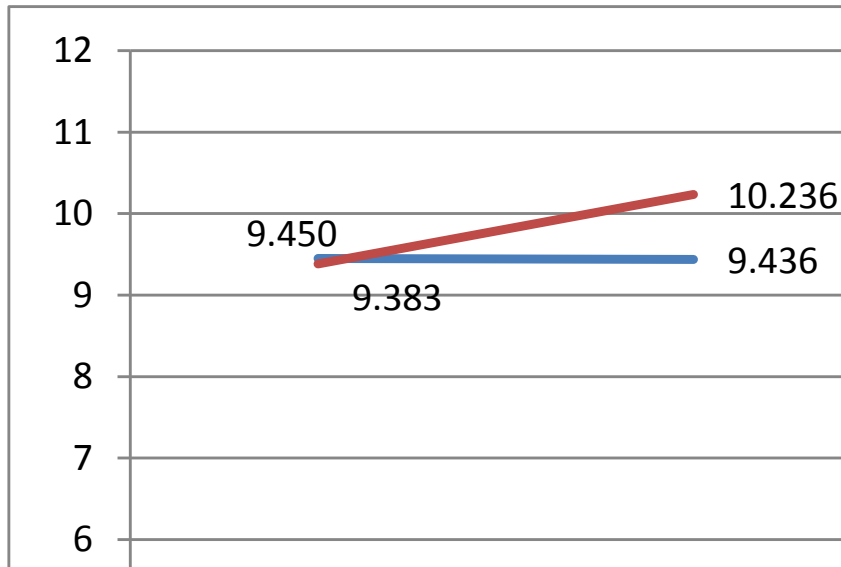


Figure 11. Pre-test and post-test average attitude scores for control versus treatment group.

Student Beliefs in Stereotypes

To examine the question of whether *Design Squad* had an impact on the extent to which students believed in the most common stereotypes about engineering, we asked students to respond to three different questions (4, 5, 6). Students responded on a scale of 1 to 3. High scores indicate that students *do not* believe the stereotypes.

We ran a model with “engineering is boring” as the dependent variable and with time (pre-test and post-test) as the repeated measure and group assignment (treatment versus control) as the fixed effect, plus the interaction term.

Table 23:
Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	9.018	2461.241	0.000
Time	1	548.941	0.223	0.637
Group Assignment	1	9.018	4.236	0.070
Time by Group Assignment	1	548.941	8.870	0.003

As summarized in Table 23, we found a significant interaction between time and group assignment. This relationship is summarized in Figure 12 below. *The treatment group demonstrated they were less likely to believe stereotypes over time than the control group.*

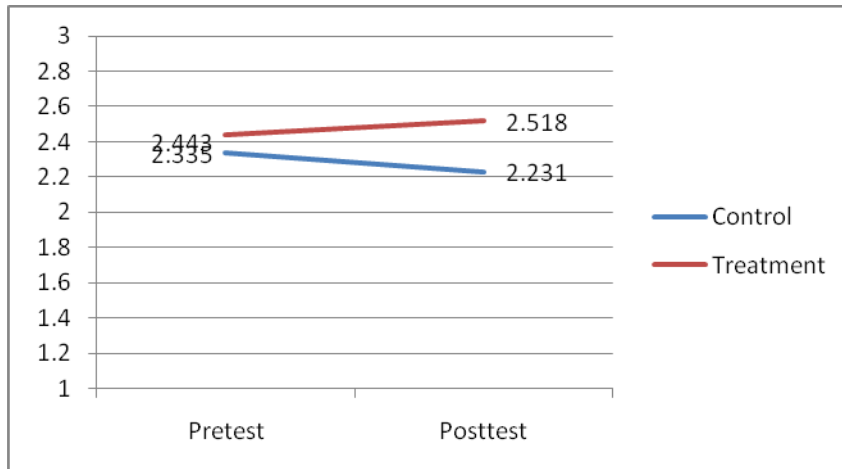


Figure 12. Pre-test and post-test average scores for control versus treatment group: Belief that engineering is boring (higher scores indicate disbelief).

Next, we ran a model with “men are better at engineering than women” as the dependent variable and with time (pre-test and post-test) as the repeated measure and group assignment (treatment versus control) as the fixed effect, plus the interaction term.

Table 24:
Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	8.050	2833.863	.000
Time	1	550.801	3.956	.047
Group Assignment	1	8.050	2.213	.175
Time by Group Assignment	1	550.801	.256	.613

There appeared to be no significant difference between the treatment group and control group over time with respect to whether they believe that men are better at engineering than women.

Finally, we ran a model with “only super smart people can succeed in engineering” as the dependent variable and with time (pre-test and post-test) as the repeated measure and group assignment (treatment versus control) as the fixed effect, plus the interaction term. There were

no significant differences between the treatment group and control group over time with respect to whether they believe that you have to be super smart to succeed in engineering.

Student Interest in Engineering Activities

To answer research question R6, we asked students to tell us whether they would be interested in participating in various engineering activities inside and outside of school. As shown in Table 25, students in the treatment group were more likely to report that they wanted to take an engineering class at their school, afterschool or during the summer, or to join an engineering club after using *Design Squad* than they were before they used it. We should also note that control group students also reported being more interested in joining an engineering club and building something when they responded to the posttest than when they responded to the pretest. So, it's not possible to attribute the changes in treatment group students' interest levels solely to *Design Squad*. But we should also note that the control group was more likely to have already participated in an engineering club than the treatment. We analyzed the data for students who had not participated in any engineering or building activities to see if any differences between the treatment and control groups would emerge, but none did.

Table 25:

Students Interested in Engineering Activities Before and After *Design Squad*

Activities	Treatment Group		Control Group	
	Before	After	Before	After
I'd like to do engineering activities in my classroom	173 (48.9%)	218 (61.8%)	94 (50%)	94 (48.2%)
I'd like to take an engineering class at my school	88 (24.7%)	115 (32.5%)*	52 (27.5%)	53 (27.2%)
I'd like to take an engineering class during the summer	26 (7.3%)	48 (13.6%)*	23 (12.2%)	21 (10.8%)*
I'd like to join an engineering club or afterschool program	45 (12.6%)	60 (16.9%)*	25 (13.2%)	30 (15.4%)*
I'd like to try and build something on my own or with other people	230 (64.6%)	205 (57.9%)	114 (60.3%)	124 (63.9%)*

* The difference from pretest to posttest is significant at the $p < 0.01$ level.

Teacher-reported Changes in Students

The evaluation was also designed to answer the following research question about perceived impacts on students:

R7. What changes, if any, will teachers observe in their students after using *Design Squad*?

We asked teachers to report any observed changes in their students as a result of using *Design Squad*. Teachers told us:

- *The students were able to achieve those “Ah ha” moments where they could see the relevance between the concepts being presented and how they affected their own personal lives. With this age group, unless they can make connections to themselves personally, the learning has no purpose for them and they don't retain the material.*
- *(I observed the students having more) confidence in themselves and a better ability to work together. They also feel more comfortable tackling an open-ended inquiry based question instead of having all the directions.*
- *Team work went to a higher level; Discussion of ideas - more sharing of ideas; Students started listening to each other.*
- *Wanting more Science! More Challenges! Some students who are not successful in class were shining! Students were asking them for advice on how to solve "X" problem. Built success for non-writers.*

Seven out of the eight teachers reported that the *Design Squad* challenges strengthened their students' ability to explain how they used the design process.

- *As a part of the evaluation process, students were required to explain their projects and their thinking behind the end result. I asked a series of questions: Using the design process, what problem did you have to solve? What steps did you and your team take to find a solution to the challenge problem? How effective was your plan? Did it Work? How do you know it worked? Over 80% of the students were able to discuss their projects in terms of the engineering process.*
- *The students started to use more vocabulary and describe events.*
- *My students had done design drawings before for projects. However, they never really understood the function of doing a drawing and planning first. Using the video clips and going through the process, most of my students understood and explained with their group projects how each step applied to the process. They also recorded each step in their science journals.*

- *Their articulation is generally poor, so hearing "pull it into the vacuum" or "stream-line it like a torpedo" is an improvement for this population.*
- *They were able to tell me how they worked to do and fine tune their product.*
- *While making observations during the challenge and listening to the group discussion going on at the different tables, I heard the students explaining their ideas to their team mates using terms consistent with correct engineering process terms.*

Seven out of the eight teachers reported that the *Design Squad* challenges strengthened their students' ability to cite examples of what an engineer does.

- *The students now understood an engineer does not have to be the person that drives the train.*
- *The video clips of real engineers helped them to see how what we are doing could become a career.*
- *They could understand the build, try, start again process - and name a few more engineering projects.*

One teacher in the control group reported that she did not observe any changes in her students after using *Design Squad*.

Student Feedback on *Design Squad*

General Feedback

We asked students in the treatment group to tell us their opinions about *Design Squad*. Their responses are summarized in Table 26. Most students agreed that the challenges were good for kids their age (79.1%), and that their friends would likely have fun doing the challenges (89.2%). More than half of the students reported that they would probably watch *Design Squad* on TV or on the Web (74.0%); 14% indicated that they already had. More than three-quarters of the students reported that they would probably tell a friend to watch *Design Squad* (77.1%). Almost three-quarters of the students indicated that they would probably visit the *Design Squad* website (73.7%); 27.5% indicated that they already had visited the website.

Table 26:
Student Feedback on *Design Squad*

	Frequency and Percent (n = 362)
Do you think the <i>Design Squad</i> challenges are good for kids your age?	
• Yes, the challenges are good for kids my age	280 (77.3%)
• No, the challenges are good for kids older than me	24 (6.6%)
• No, the challenges are good for kids younger than me	8 (2.2%)
• I don't know	42 (11.6%)
Do you think your friends would have fun doing the <i>Design Squad</i> challenges?	
• Yes	181 (50.0%)
• Maybe	135 (37.3%)
• No	12 (3.3%)
• I don't know	26 (7.2%)
Are you interested in watching the <i>Design Squad</i> show on television or on the Web site?	
• Yes, and I already have	49 (13.5%)
• Yes, I plan to	96 (26.5%)
• Maybe	123 (34.0%)
• No, I'm not planning to	81 (22.4%)
Would you tell a friend to watch <i>Design Squad</i>?"	
• Yes	100 (27.6%)
• Maybe	169 (46.7%)
• No	66 (18.2%)
• I don't know	14 (3.9%)
Are you interested in visiting the <i>Design Squad</i> website?	
• Yes, and I already have	96 (26.5%)

	Frequency and Percent (n = 362)
<ul style="list-style-type: none"> • Yes, I plan to 	49 (13.5%)
<ul style="list-style-type: none"> • Maybe 	122 (33.7%)
<ul style="list-style-type: none"> • No, I'm not planning to 	82 (22.7%)

Student Feedback on the Challenge Hand-outs

Three quarters of the students reported that they used the hand-outs (74.9%). We also asked students to share their opinions about the challenge handouts. Their feedback is summarized in Table 27. Most students reported that the instructions were mostly easy to follow (69.7%). Most students reported using the pictures in the handouts before they started designing (74.9%) and most reported the pictures to be useful (74.5%).

Table 27:
Student Feedback on *Design Squad* Challenge Handouts

	Frequency and Percent (n = 271)
Were the instructions easy to follow?	
<ul style="list-style-type: none"> • I could follow most or all of the instructions 	189 (69.7%)
<ul style="list-style-type: none"> • I could follow some of the instructions 	64 (23.6%)
<ul style="list-style-type: none"> • I could not follow the instructions 	6 (2.2%)
<ul style="list-style-type: none"> • I don't know 	5 (1.8%)
Did you look at the pictures on the student handouts before you started designing and building?	
<ul style="list-style-type: none"> • Yes 	203 (74.9%)
<ul style="list-style-type: none"> • No 	26 (10.0%)
<ul style="list-style-type: none"> • I don't know 	33 (12.2%)
Did the pictures and words on the handouts help you complete the challenges?	
<ul style="list-style-type: none"> • Yes 	202 (74.5%)
<ul style="list-style-type: none"> • No 	22 (8.1%)
<ul style="list-style-type: none"> • I don't know 	38 (14.0%)

Student Feedback on the Interactive Game and Video Clips

We asked students to provide feedback on the interactive game and the video clips. Among the students who tried the game, most reported that the interactive game was at least “a little useful” (91.3%). Among the students who viewed the video clips, most students reported that they liked the clips at least “a little” (91.3%). Slightly more than one-third of the students reported that the video clips helped them to do the challenges (37.4%) while about half reported that the clips helped only “a little” (49.7%).

Table 28:

Student Feedback on the Interactive Game and Video Clips

	Frequency and Percent
How useful was the <i>String Thing</i> interactive game on the <i>Design Squad</i> website in doing Build a Band? (n = 289)	
• Very useful	134 (46.3%)
• A little useful	130 (45.0%)
• Not useful at all	25 (8.7%)
How much did you like the <i>Design Squad</i> video clips that you watched in class? (n = 310)	
• I liked them a lot	138 (44.5%)
• I liked them a little	145 (46.8%)
• I didn't like them at all	27 (8.7%)
Did the video clips help you to do the challenges? (n = 310)	
• They helped a lot	116 (37.4%)
• They helped only a little	154 (49.7%)
• They didn't help at all	40 (12.9%)

How Teachers Used *Design Squad*

The evaluation study was designed to answer the following research questions related to program fidelity:

R8. Will teachers follow the guidance in the Teacher’s Guide or will they make adaptations and modifications to it when implementing it in their classrooms?

R9. How will teachers use the *Design Squad* resources in their classrooms?

We asked teachers to describe how they introduced the *Design Squad* activities. Teachers told us:

- *I used the activities as reinforcement to the material presented through our textbooks. For example: After completing the activity cycle for force and motion (gravity air resistance, drag, friction and buoyancy), we completed Sky Floaters and Glider Challenge. I used the activity to give real world application to the concepts taught from our science series.*
- *I taught the lessons and then used Design Squad.*
- *I taught mini-lessons before each design challenge. Next year I will incorporate each challenge within the unit.*
- *I taught the lessons as we used the challenges. I let students explore and helped with resources if they needed instruction.*
- *I taught lessons as I used Design Squad. I also supplemented the lessons with Brain Pop clips for reinforcement and/or supplement.*

We asked teachers to describe the timing of the activities. We wanted to understand whether they would attempt to try all of the activities within a given unit at once or whether they would spread the activities out over time. Half of the teachers tried all of the activities at once (mostly control group classrooms). Teachers told us:

- *Our county has specific benchmarks that must be taught and an order of instruction. The activities were incorporated as they fit within the alignment of our county's framework.*
- *I did them as a whole unit, but next year I will incorporate them into my actual units.*
- *I did each unit one at a time; I also asked them to relate their ideas to previous work.*

Teachers reported following the Teacher's Guide closely, making only minor adaptations to the challenges.

- *I used the guide as directed, except that my students recorded each step in their science journals.*
- *I just added more supplies than were required.*
- *I used small object other than paper clips - (the clips proved frustrating) we used plastic money, plastic tangram pieces, etc. for weights.*

Three of the treatment classrooms and one of the control classrooms tried the "Making it Real" lesson for each of the challenges. Of the four classrooms that tried the lesson, all of the teachers

reported that the lesson helped strengthen their students' abilities to identify and discuss the science concepts they applied.

- *I was not able to do the Making It Real lesson for each activity due to time constraints. I did pick and choose some of the suggestions where possible. It led to good discussions and was a good way to close the activity.*
- *They had to explain to each other as team pairs.*
- *They understood the need for redesign and could articulate what kept their designs from working scientifically each time.*
- *My students were able to describe the flow of electricity in the kick stick and why they designed it the way they did.*
- *On the blimp they understood about air resistance. Students, after experiencing, learned more about circuits and wiring and reversed the kick stick's direction.*

We asked teachers to tell us in what ways, if any, they used *Design Squad* to supplement or reinforce their existing curriculum. Teachers reported that they used *Design Squad* to supplement their units on:

- Buoyancy
- Difference in gases
- Electricity and circuits
- Force
- Graphing
- Gravity
- Lift
- Mass
- Motion
- Surface area
- Volume

Teachers also reported that *Design Squad* enabled them to encourage problem solving and teamwork among students, as well as their desire use inquiry-based learning in the classroom.

One teacher reported: "It put a face on sound vibrations, how circuits work and Newton's Laws. Before the experiments I thought the students knew all about these things, but listening to their groups during *Design Squad* challenges I realized they needed to see it."

Other teachers reported on some of the challenges they faced in implementing *Design Squad*.

- *Some students very competitive. Some students were not accepting of others ideas. "They were right and everyone else was wrong."*

- *I would need to figure out how to have the activity take longer for some. Gathering enough materials for almost 180 students was difficult as well as storage.*

Integration of the Videos, Hands-on Challenges, and the Website

The evaluation was also designed to answer the following research question about the integration of resources:

R10. How, if at all, will teachers integrate all the different *Design Squad* components into their lessons, namely the hands-on challenges, the videos, and the website?

Teachers reported accessing the videos in two different ways. Four teachers downloaded them, saved them to a computer, and then played them for the class. Four teachers streamed them (playing the videos directly from the website). One teacher reported having trouble playing the videos on her computer because she did not have a compatible correct media player (such as Windows Media Player).

We asked teachers to describe how they used the *Design Squad* videos, the hands-on challenges and the website together. Some teachers used the videos to reinforce concepts taught in the classroom, while other teachers showed the videos as an introduction to the material. Half of the teachers agreed that the videos enhanced the challenges. Teachers told us:

- *I used the video clips to introduce the activities, reinforce concepts and illustrate the engineering process used to design solutions for the problems presented. The challenges were used as a learning tool to teach/reinforce a concept through hands-on inquiry and the website were used as a resource for information and additional activities.*
- *I used the video to set up the activity and to heighten the students' interests.*
- *I used the String Thing activity with my students. Many students had their own laptop to do it by themselves. If they wanted to, they could come to my speakers and play their piece for the class.*
- *I followed the teacher lesson plans exactly - using the video clips and challenges. When we had extra time I showed them some of the episodes. They did the games for homework.*
- *I accessed the website and showed my students the additional activities. I also used the website to show the video clips of each portion of the design process as we learned the process. They read, brainstormed ideas, drew sketches, and prepared a list of materials. I supplied materials and they proceeded to construct, test, and redesign.*

Teachers also told us:

- *The challenges/activities have to fit with the county requirements and there needs to be enough time to incorporate the material from Design Squad and the requirements prescribed by the school board. This can be difficult.*
- *I thought that the clips and activities worked well together.*
- *It was good to use the website and video because it provided continuity of content.*
- *Video clips teach the theory, the hands-on challenge lets it become real and the website shows the real people trying it.*
- *I feel the students had a better understanding of the design process and were able to go through the process independently if they viewed the video clips first. The website provided more information and activities once my students were introduced and excited by the design process.*

A couple teachers reported that their students had some difficulty understanding the video clips and that they (the teachers) needed to explain more about what was happening in the videos for students to grasp it. This appears to be attributable to the fact that the video clips were only brief, decontextualized segments that were only several seconds in length. Students who were unfamiliar with the show *Design Squad* seemed to struggle to understand what the context of the video clips was and this may have prevented them from grasping the content that was being conveyed in the clips.

- *The students did not "catch on" to the video clips, especially the one with the girls' band referring to aerial views of events. The connection had to be explained by the teacher.*
- *I showed the video clips with the design process. (I) wish it was the same Design Squad episode for each process to see the progression. Some of my students needed more than a video "clip"; As a teacher I feel that using them together as one package is helpful; I also feel there needs to be more offered for sixth grade to gain a greater understanding of the idea.*
- *Computer did not have enough memory - took time to download and rename based on content. Could only play episode from computer and could not save. Great that it is all on website - periodic issues w/ district Internet service can be a problem.*

Three of the eight teachers reported that they accessed the website frequently beyond just the Teacher's Guide page to access full episodes to show their classes. Two others indicated that they did so once or twice. Three teachers reported that they did not access the website beyond the Teacher's Guide page.

- *Found episode with light and color to help with that unit.*

- *I accessed the other activities and showed them to my students. I also showed them the other videos of seasons 1-3.*
- *I have in the past and still use video clips of challenges to support concepts I am teaching. I have also used other challenges when they fit in with my curriculum.*
- *I looked at other projects, the challenges and downloaded videos.*
- *I showed parts of the actual episodes and the games.*

Impact on Teachers

The evaluation was designed to answer the following research questions about the impact on teachers:

R11. Will teachers who use *Design Squad* report having a greater level of **comfort leading design challenges** in their classrooms than teachers who do not use *Design Squad*?

R12. Will teachers who use *Design Squad* report having greater **knowledge about engineering** than teachers who do not use *Design Squad*?

R13. Will teachers who use *Design Squad* report having more positive **attitudes towards engineering** than teachers who do not use *Design Squad*?

R14. Will teachers who use *Design Squad* be less likely to demonstrate a **belief in stereotypes about engineering** than teachers who do not use *Design Squad*?

Comfort Leading Design Challenges

Before and after using *Design Squad*, we asked teachers how comfortable they were leading design challenges with their students. As shown in Table 29, teachers in the treatment group were significantly more comfortable after using *Design Squad* than were teachers in the control group (who had not yet used *Design Squad*).

Table 29:
Teacher Comfort Level with Leadings Challenges

How comfortable are you...	Average Pre-test Rating (sd)		Average Post-test Rating (sd)	
	Control	Treatment	Control	Treatment
...leading hands-on activities with kids?	2.00 (0.0)	1.75 (0.5)	2.00 (0.0)	2.00 (0.0)
... leading open-ended activities (i.e. activities that have many possible solutions or answers)	2.00 (0.0)	1.00 (0.0)	2.00 (0.0)	1.75 (0.5)
...talking with kids about what engineers do or what engineering is?	2.00 (0.0)	1.75 (0.5)	2.00 (0.0)	1.75 (0.5)
...using a student-centered problem-solving process?	1.75 (0.5)	1.00 (0.0)	1.75 (0.5)	1.75 (0.5)
Average total scores	7.75 (0.5)	5.50 (0.6)	7.75 (0.5)	7.25 (1.5)*

* A Wilcoxon Signed Ranks Test was performed due to the small sample sizes and the non-normality of the distributions. Pre-test scores and post-test scores were compared for the treatment group teachers. The increase over time in comfort scores for the treatment group was significant ($Z = -1.64$, $p = 0.05$).

Knowledge about Engineering

We asked teachers to indicate their level of agreement with a series of statements about engineering on a scale of 1 to 3, with 1 indicating disagreement and 3 indicating agreement. Both control and treatment group teachers were knowledgeable about engineering at pretest and at posttest.

Table 30:
Teacher Knowledge about Engineering

	Average Pre-test Rating (sd)		Average Post-test Rating (sd)	
	Control	Treatment	Control	Treatment
Engineers need to have a great imagination	3 (0.0)	2.5 (0.6)	2.3 (1.2)	2.8 (0.5)
Engineers do many different kinds of jobs	3 (0.0)	3 (0.0)	3 (0.0)	3 (0.0)
Engineers sometimes have to test their work and start over again	3 (0.0)	3 (0.0)	3 (0.0)	3 (0.0)

Attitudes towards Engineering

We asked teachers to indicate their level of agreement with a series of attitudes about engineering on a scale of 1 to 3, with 1 indicating disagreement and 3 indicating agreement. As Table 31 shows, teachers held positive attitudes toward engineering before using *Design Squad* as well as after using it. There were no differences observed over time or between the treatment and control group teachers.

Table 31:
Teacher Attitudes towards Engineering

	Average Pre-test Rating (sd)		Average Post-test Rating (sd)	
	Control	Treatment	Control	Treatment
Engineers help make people's lives better.	3 (0.0)	3 (0.0)	3 (0.0)	3 (0.0)
Engineers solve "cool" problems.	2.7 (0.5)	2.5 (0.6)	3 (0.0)	2.7 (0.5)
It would be fun to be an engineer.	3 (0.0)	3 (0.0)	3 (0.0)	2.6 (0.8)
Engineers solve problems that affect real people.	3 (0.0)	3 (0.0)	3 (0.0)	3 (0.0)

Belief in Stereotypes about Engineering

We asked teachers to indicate their level of agreement with a series of stereotypes about engineering on a scale of 1 to 3, with 1 indicating disagreement and 3 indicating agreement. As Table 32 shows, there were no differences observed over time or between the treatment and control group teachers.

Table 32:
Teacher Beliefs about Stereotypes Related to Engineering

	Average Pre-test Rating (sd)		Average Post-test Rating (sd)	
	Control	Treatment	Control	Treatment
Men are better than women at engineering.	1.5 (1.0)	1.3 (0.5)	1.0 (0.0)	1.0 (0.0)
Only super smart people can succeed in engineering.	2.0 (0.8)	2.0 (1.0)	1.3 (0.6)	1.5 (0.6)
Engineering is boring.	1.5 (1.0)	1.3 (0.5)	1.0 (0.0)	1.3 (0.5)

Teacher Feedback on *Design Squad*

We asked teachers to rate the quality of *Design Squad* by indicating their level of agreement with a series of statements about the resources. As summarized in Table 33, all teachers agreed that their students were engaged by *Design Squad* and that it presented science concepts in a way that was understandable to students. All teachers agreed that *Design Squad* helped their students understand the engineering design process in a way that appropriately challenging. All teachers in our sample agreed that *Design Squad* encouraged their students to brainstorm and collaborate with one another.

All teachers agreed that *Design Squad* made them feel comfortable leading design challenges and helped them to use a student-centered problem solving process with their students.

Seven out of the eight teachers agreed that *Design Squad* made their students more excited about engineering as a career choice and provided an opportunity for students to educate one another about the design process.

Table 33:
Teacher Ratings of *Design Squad*

	Strongly Disagree	Disagree	Agree	Strongly Agree
My students were engaged by <i>Design Squad</i> .	0 (0%)	0 (0%)	2 (25%)	6 (75%)
<i>Design Squad</i> presented science concepts in an understandable way for my students.	0 (0%)	0 (0%)	2 (25%)	6 (75%)
<i>Design Squad</i> helped my students understand the engineering design process (brainstorm, design, build, test, evaluate, and redesign).	0 (0%)	0 (0%)	2 (25%)	6 (75%)
<i>Design Squad</i> did NOT help me feel comfortable leading engineering design challenges with the kids.	6 (75%)	2 (25%)	0 (0%)	0 (0%)
<i>Design Squad</i> was appropriately challenging for the kids in my classroom.	0 (0%)	0 (0%)	4 (50%)	4 (50%)
<i>Design Squad</i> encouraged my students to brainstorm with each other.	0 (0%)	0 (0%)	3 (38%)	5 (63%)
<i>Design Squad</i> did NOT encourage my students to collaborate with one another.	5 (63%)	3 (38%)	0 (0%)	0 (0%)
<i>Design Squad</i> provided an opportunity for classmates to educate one another about the engineering design process or science concepts.	0 (0%)	1 (13%)	3 (38%)	4 (50%)
<i>Design Squad</i> made my students more excited about engineering as a career choice.	0 (0%)	1 (13%)	3 (38%)	4 (50%)
<i>Design Squad</i> did NOT help me to use a student-driven problem-solving process in my classroom.	5 (63%)	3 (38%)	0 (0%)	0 (0%)

Seven of the eight teachers reported that they were *highly* likely to use the *Design Squad* resources again, and one of them indicated that she planned to search the site over the summer for additional guides to use next year in her classroom. Only one teacher indicated that she was only “somewhat likely” to use the *Design Squad* resources again in her classroom.

Seven of the eight teachers also reported that they were *highly* likely to recommend *Design Squad* to other teachers, and one teacher indicated that she already had recommended the resources to other teachers. Only one teacher indicated that she was only “somewhat likely” to recommend the resources.

Seven of the eight teachers reported that they believed that their students would be *very interested* in doing engineer design challenges again. One of the seven reported that her students had already been requesting more challenges since doing the *Design Squad* challenges. A different teacher reported that she thought her science honor students would be more interested than her other students. Only one teacher reported that her students would definitely not be interested in doing similar challenges again, but she did not provide an explanation.⁹

Finally, we asked teachers to tell us what they might tell other teachers about *Design Squad*. They said:

- *Design Squad challenges increase students' understanding. The challenges help students learn to work together, talk and discuss ideas. It is wonderful to see students take a situation, solve the situation and produce a working product. The challenges help the teacher to step back, let students discover while you ask questions allowing the students to learn & put ideas together. The teacher is giving guidance and not keeping the students from trying ideas and learning what works and does not work.*
- *Great hands-on; good instructions; good connection to subjects (just not too fond of video clips)*
- *I would tell other teachers that the Design Squad challenges are real life processes that develop inquiry in students. They also help students understand what engineering is all about and give students a design process that is a life skill.*
- *It is worth the work of collecting materials because the students really learn the concepts and they enjoy science class.*
- *The activities are interesting so that students are engaged and some even wanted to come in to work on their project during lunch.*
- *The Design Squad challenge is very user friendly. The challenges are explained well and the out of pocket costs are minimal. The Challenges can be easily adapted to almost any curriculum.*

⁹ This is not the same teacher who reported that she was only slightly like to use or recommend *Design Squad* again.

- *Try one activity after a unit to reinforce and then with the student responses and products; you will "see" the effectiveness of its teaching.*

Summary

Students

- Five hundred and fifty-nine students across eight different schools participated in the study.
- Students exposed to *Design Squad* demonstrated greater gains than students who were not exposed to *Design Squad* in the following ways:
 - They learned more about key science constructs (i.e., electrical circuits, sound, Newton’s Laws, force, and air pressure).
 - They developed a better understanding of what engineering is.
 - They demonstrated a better understanding that engineering involves having a great imagination.
 - They demonstrated a better understanding of projects that engineers might work on.
 - They demonstrated more positive attitudes towards engineering.
 - They were less likely to believe the stereotype that “engineering is boring.”
- Students in the treatment group reported...
 - They thought the *Design Squad* challenges were good for kids their age (79.1%).
 - They thought their friends might have fun doing the *Design Squad* challenges (89.2%).
 - They would probably watch *Design Squad* on TV or on the Web (74.0%) -- 14% reported that they already had.
 - They would tell a friend to watch *Design Squad* (77.1%).
 - They would probably visit the *Design Squad* website (73.7%) -- 27.5% indicated that they already had.
 - The instructions were mostly easy to follow (69.7%).
 - Most students reported using the pictures in the handouts before they started designing (74.9%) and most reported the pictures to be useful (74.5%).
 - Among the students who tried the game, most reported that the interactive game was at least “a little useful” (91.3%).
 - Among the students who viewed the video clips, most students reported that they liked the clips at least “a little” (91.3%).
 - Slightly more than one-third of the students reported that the video clips helped them to do the challenges (37.4%) while about half reported that the clips helped only “a little” (49.7%).
- Teachers in the treatment group reported that they observed positive changes in their students’ behaviors after using *Design Squad*. Teachers observed students:
 - Making the connection between the concepts and their own lives.
 - Exhibiting more confidence and comfort with open-ended inquiry.
 - Demonstrating teamwork—being better able to work together and listen to one another.
 - Asking for more science and more challenges.
 - Success among students who were not normally successful in class.

- Seven out of eight teachers observed that the challenges strengthened their students' ability to explain how they used the design process. Teachers observed students using new vocabulary and describing events and explaining their steps (sometimes verbally, sometimes in written form) to their teachers and to each other.
- Seven out of the eight teachers reported that the *Design Squad* challenges strengthened their students' ability to cite examples of what an engineer does and helped them expand their definition of what engineers do (beyond just driving a train, for example).
- We did not observe differences between the treatment and control groups with respect to the following:
 - From the outset of the study, the treatment group students were more aware than control group students that engineers sometimes have to test their work and start over again, and *Design Squad* did not change their level of understanding (it was already high).
 - We did not observe a difference in students' understanding of the engineering design process over time, but trends in the data hint that students in the treatment group learned more about the design process than students in the control group. However, there is insufficient evidence to draw inferences about the impact of *Design Squad* on student understanding of the design process.
 - There was no significant difference between the treatment group and control group, over time, with respect to whether they believed that you have to be “super smart to succeed in engineering” and whether “men are better at engineering than women.”
 - While students in the treatment group developed a better understanding that engineers do many different types of jobs than the control group, the treatment group scored significantly higher on this measure at pretest, too. So, this finding is inconclusive.
 - Students exposed to *Design Squad* reported an increased desire to participate in engineering classes at their school, afterschool or during the summer, and to join an engineering club. But, we also observed an increased desire to participate in engineering activities among students who were not exposed to *Design Squad*. Thus, it is not possible to attribute the changes in treatment group students' interest levels solely to *Design Squad*.

Teachers

- Eight teachers participated in the study.
- Most teachers reported that they used the *Design Squad* activities to reinforce the content they were covering in their lesson plans, incorporating the challenges into each unit.
- Half of the teachers used all the activities in their class all at once (mostly control group classrooms), while the other half spread the challenges out over several of their already existing curriculum units. Teachers who used all the activities at once reported that they would spread them out over several units next year.
- Teachers reported following the Teacher's Guide closely, making only minor adaptations to the challenges.

- Three of the treatment classrooms and one of the control classrooms tried the “Making it Real” lesson for each of the challenges. Of the four classrooms that tried the lesson, all of the teachers reported that the lesson helped strengthen their students’ abilities to identify and discuss the science concepts they applied.
- Teachers reported that they used *Design Squad* to supplement their units on:
 - Buoyancy
 - Difference in gases
 - Electricity and circuits
 - Force
 - Graphing
 - Gravity
 - Lift
 - Mass
 - Motion
 - Surface area
 - Volume
- Teachers reported that *Design Squad* enabled them to encourage problem solving and teamwork among students, as well as their desire use inquiry-based learning in the classroom.
- Some teachers used the videos to reinforce concepts taught in the classroom, while other teachers showed the videos as an introduction to the material. Half of the teachers agreed that the videos enhanced the challenges.
- A couple teachers reported that their students had some difficulty understanding the video clips and that they (the teachers) needed to explain more about what was happening in the videos for students to grasp it. This appears to be attributable to the fact that the video clips were only brief, decontextualized segments that were only several seconds in length. Students who were unfamiliar with the show *Design Squad* seemed to struggle to understand what the context of the video clips was and this may have prevented them from grasping the content that was being conveyed in the clips.
- Three of the eight teachers reported that they accessed the website frequently beyond just the Teacher’s Guide page to access full episodes to show their classes. Two others indicated that they did so once or twice. Three teachers reported that they did not access the website beyond the Teacher’s Guide page.
- Both control and treatment group teachers were knowledgeable about engineering at pretest and at posttest.
- Teachers held positive attitudes toward engineering before using *Design Squad* as well as after using it. There were no differences observed over time or between the treatment and control group teachers.
- All teachers agreed that their students were engaged by *Design Squad* and that it presented science concepts in a way that was understandable to students.
- All teachers agreed that *Design Squad* helped their students understand the engineering design process in a way that appropriately challenging.
- All teachers in our sample agreed that *Design Squad* encouraged their students to brainstorm and collaborate with one another.
- All teachers agreed that *Design Squad* made them feel comfortable leading design challenges and helped them to use a student-centered problem solving process with their students.
- Seven out of the eight teachers agreed that *Design Squad* made their students more excited about engineering as a career choice and provided an opportunity for students to educate one another about the design process.

- Seven of the eight teachers reported that they were *highly* likely to use the *Design Squad* resources again.
- Seven of the eight teachers also reported that they were *highly* likely to recommend *Design Squad* to other teachers, and one teacher indicated that she already had recommended the resources to other teachers.
- Seven of the eight teachers reported that they believed that their students would be *very interested* in doing engineer design challenges again. One of the seven reported that her students had already been requesting more challenges since doing the *Design Squad* challenges.

Appendix A: Website Visitor Survey

Pop-up Demographics Survey: Design Squad

Hi! We'd like to learn a little bit more about the people that use this website. We will keep all of your answers private and we will not ask for your name!

1. **Are you a:**

- a. Male
- b. Female

2. **How old are you?** (drop-down list of 1 through 70+)

3. **Are you of Hispanic, Latino, or Spanish origin?**

- a. Yes
- b. No

4. **Are you...**

(check all that apply)

- a. American Indian or Alaskan Native
- b. Asian
- c. Black or African American
- d. Indian or Middle Eastern
- e. Native Hawaiian or Other Pacific Islander
- f. White or Caucasian

5. **In what kind of area do you live?**

- a. Urban (in a city)
- b. Suburban (near a city, but not in the city)
- c. Rural (far from any cities)

6. **In what state do you live?** (Drop down of states, including option for outside US)

7. **What is your five-digit zip code?**

8. (Not displayed for respondents 18 years and older) **What is your school like?**

- a. Public school
- b. Charter school
- c. Private school
- d. Home school

9. (Not displayed for children 17 and under) **Are you visiting the website as a...**

- a. Classroom teacher
- b. After-school teacher
- c. Librarian
- d. Volunteer
- e. Camp counselor
- f. Parent
- g. Engineer
- h. Other: _____

10. (Not displayed for children 17 and under) **WGBH wants to make sure that our website reaches people in all types of communities. How would you describe yourself? (Remember, we cannot trace your answers back to you)**

- a. Low income
- b. Middle income
- c. High income

Appendix B: Outreach Partner Survey

Outreach Partner Survey: Design Squad

WGBH is interested in learning more about the audience that is reached through its Outreach Partners like you. This survey should take you just over 5 minutes. We will keep all of your answers private and we will not ask for your name!

1. Are you a...?

- a. Classroom teacher
- b. After-school teacher
- c. Librarian
- d. Volunteer
- e. Camp counselor
- f. Parent
- g. Engineer
- h. Other_____

2. What type of program do you represent?

- a. School
- b. Boys and Girls Clubs
- c. 4-H
- d. Girl Scouts
- e. Boy Scouts
- f. YMCA
- g. YWCA
- h. Summer Camp
- i. Library
- j. Museum
- k. National Engineers Week program
- l. I volunteer with kids in my profession / career
- m. Other_____

3. Which of the following best describes the area in which the kids you serve live?

- a. Urban (near a city)
- b. Suburban (near a city, but not in the city)
- c. Rural (far from any cities)

4. What is your 5-digit zip code: _____

5. I use Design Squad with my kids to: (Choose all that apply)

- a. Breakdown stereotypes about engineering
- b. Showcase the design process in action
- c. Highlight various engineering careers for kids
- d. Other_____

6. What components of Design Squad do you use? (Choose all that apply)

- a. The series
- b. The website
- c. The hands-on engineering challenges

7. How effective were the activities in helping your kids...

	Not effective at all	Somewhat effective	Effective	Very effective
...gain confidence in their ability to problem solve?				
...develop more creative, flexible, and imaginative thinking skills?				
...understand that engineers work to make the world a better place?				
...learn about science and engineering concepts?				
...get excited about engineering?				

8. In your own words, please describe how you have used the Design Squad resources:

9. **How many times in the past year** have you used the Design Squad resources with the kids you serve?

- a. 1-2
- b. 3-5
- c. 6-10
- d. 10+

10. Please give us your best guess as to how many kids you have reached with Design Squad:

11. For the following questions, please give us your **best guess** as to the % kids in each category.

What percent of the kids you serve are...

- a. Male _____%
- b. Female _____%

Should add up to 100%

- a. Hispanic, Latino, or Spanish _____%
- b. **Not** Hispanic, Latino, or Spanish _____%

Should add up to 100%

- a. American Indian or Alaskan Native _____%
- b. Asian _____%
- c. Black or African American _____%
- d. Indian or Middle Eastern _____%
- e. Native Hawaiian or Other Pacific Islander _____%
- f. White or Caucasian _____%

Should add up to 100%

- a. Low income _____%
- b. Middle income _____%
- c. High income _____%

Should add up to 100%

12. In what grade(s) are most of the students you serve? (Choose all that apply)

- a. Lower-elementary school
- b. Upper-elementary school
- c. Middle school
- d. High school

Appendix C: Student Treatment Group Survey

Design Squad Student Survey

Your Name _____

Please answer the following questions about science and engineering.

Please do your best.

Thank you for your help!

Note to teachers: PLEASE REMOVE THIS COVER SHEET FROM THE SURVEY **JUST BEFORE** MAILING IT BACK TO US. STUDENTS' NAMES SHOULD NOT APPEAR ANYWHERE IN THE SURVEYS EXCEPT ON THIS PAGE.

Part 1 of this packet contains questions that students should answer **before** you try the Design Squad challenges (Allow 5-10 minutes for this part)

Part 2 of this packet contains questions that students should only answer **after** you have tried the Design Squad challenges (Allow 20-25 minutes for this part)

Part 1

You should answer these questions BEFORE you try out the Design Squad challenges.

1. Do you know what engineering is?

- a. Yes, I know what it is
- b. Maybe, but I'm not sure
- c. No, I don't know what it is

2. Please give an example of something an engineer might work on.

Below are some sentences about engineering. We want to know whether you agree or disagree. Please read each sentence carefully and **circle a number** to tell us if you agree or not. There are no right or wrong answers!

	I agree	I agree a little bit	I don't agree
3. Engineers help make people's lives better.	1	2	3
4. Engineering is boring.	1	2	3
5. Men are better than women at engineering.	1	2	3
6. Only super smart people can succeed in engineering.	1	2	3
7. Engineers need to have a great imagination.	1	2	3
8. Most people my age don't know what engineering is.	1	2	3
9. Engineers solve cool problems.	1	2	3
10. Engineers do many different kinds of jobs.	1	2	3
11. It would be fun to be an engineer.	1	2	3
12. Engineers solve problems that affect real people.	1	2	3
13. Engineers sometimes have to test their work and start over again.	1	2	3

You should answer these questions BEFORE you try out the Design Squad challenges.

14. Which of the following are projects that engineers might work on? **(Circle all that apply)**

- a. They design toys
- b. They test the quality of the air
- c. They navigate submarines
- d. They design musical instruments
- e. They design hot air balloons and blimps
- f. All of these
- g. None of these

15. Imagine that you wanted to design and build an electronic alarm that would buzz every time someone opened the door to your room at home.

Please describe all the steps you might take to design and build the alarm.

Scoring:

0 = No response or unintelligible response

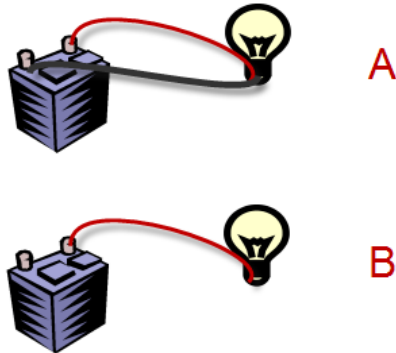
1 = Student lists items, but does not include process OR student includes process but not the items

2 = Student provides more detail about the items and the process, but does not mention testing the design

3 = Student provides details about items and process, including a testing phase

You should answer these questions BEFORE you try out the Design Squad challenges.

16. Cathy is learning about electrical circuits and she has set-up two different experiments



Which one of these experiments will make the light bulb **turn on**?

- a. Bulb A will turn on
- b. Bulb B will turn on
- c. Both will turn on

17. Which of the following is the best example of a **conductor**?

- a. Rubber
- b. Glass
- c. Copper
- d. Wood

18. Tina has a balloon filled with helium and she wants to make it **neutrally buoyant**. Which of the following is the best way to do this?

- a. She can stretch the balloon
- b. She can add a small weight to the balloon
- c. She can fill the balloon with more air
- d. She can let all the air out of the balloon

You should answer these questions BEFORE you try out the Design Squad challenges.

19. If you threw each of the following objects through the air across a playground with equal force, which one would **have the least drag**?
- a. A soccer ball
 - b. A cardboard box
 - c. A football
 - d. A magazine
20. Imagine that you made a musical instrument with strings. What's the best way to produce the **lowest pitch**?
- a. Decrease the gauge of the string
 - b. Increase the tension of the string
 - c. Decrease the tension and increase the gauge of the string
 - d. Stretch the string as much as you can
21. Why do you think cupping your hand behind your ear helps you more easily hear what someone is saying?
- a. It blocks out sound waves from a person's voice
 - b. It increases the frequency of the sound
 - c. It makes all of the other noises around you go away
 - d. It captures more sound waves
22. Some schools and communities offer different engineering activities to kids. If the following were available to you, which **might** you be interested in doing? (You may choose more than one answer)
- a. I would like to do more engineering activities in my classroom
 - b. I would like to take an engineering class at my school
 - c. I would like to take an engineering class during the summer
 - d. I would like to join an engineering club or after-school program
 - e. I would like to try and build something on my own or with other people

You should answer these questions BEFORE you try out the Design Squad challenges.

23. Which of the following have you done before? (You may choose more than one answer)

- a. I've done engineering activities in my classroom
- b. I've taken an engineering class at my school
- c. I've taken an engineering class during the summer
- d. I've joined an engineering club or after-school program
- e. I've built something on my own or with other people

THANK YOU

PLEASE GIVE THIS PACKET TO YOUR TEACHER

**DO NOT REMOVE THE STAPLE FROM THIS SECTION
UNTIL YOUR TEACHER TELLS YOU TO REMOVE IT**

You should answer these questions AFTER you try out the Design Squad challenges

Part 2

You should answer these questions AFTER you try out the Design Squad challenges

1. Do you know what engineering is?

- a. Yes, I know what it is
- b. Maybe, but I'm not sure
- c. No, I don't know what it is

2. Please give an example of something an engineer might work on.

Below are some sentences about engineering. We want to know whether you agree or disagree. Please read each sentence carefully and **circle a number** to tell us if you agree or not. There are no right or wrong answers!

	I agree	I agree a little bit	I don't agree
3. Engineers help make people's lives better.	1	2	3
4. Engineering is boring.	1	2	3
5. Men are better than women at engineering.	1	2	3
6. Only super smart people can succeed in engineering.	1	2	3
7. Engineers need to have a great imagination.	1	2	3
8. Most people my age don't know what engineering is.	1	2	3
9. Engineers solve cool problems.	1	2	3
10. Engineers do many different kinds of jobs.	1	2	3
11. It would be fun to be an engineer.	1	2	3
12. Engineers solve problems that affect real people.	1	2	3
13. Engineers sometimes have to test their work and start over again.	1	2	3

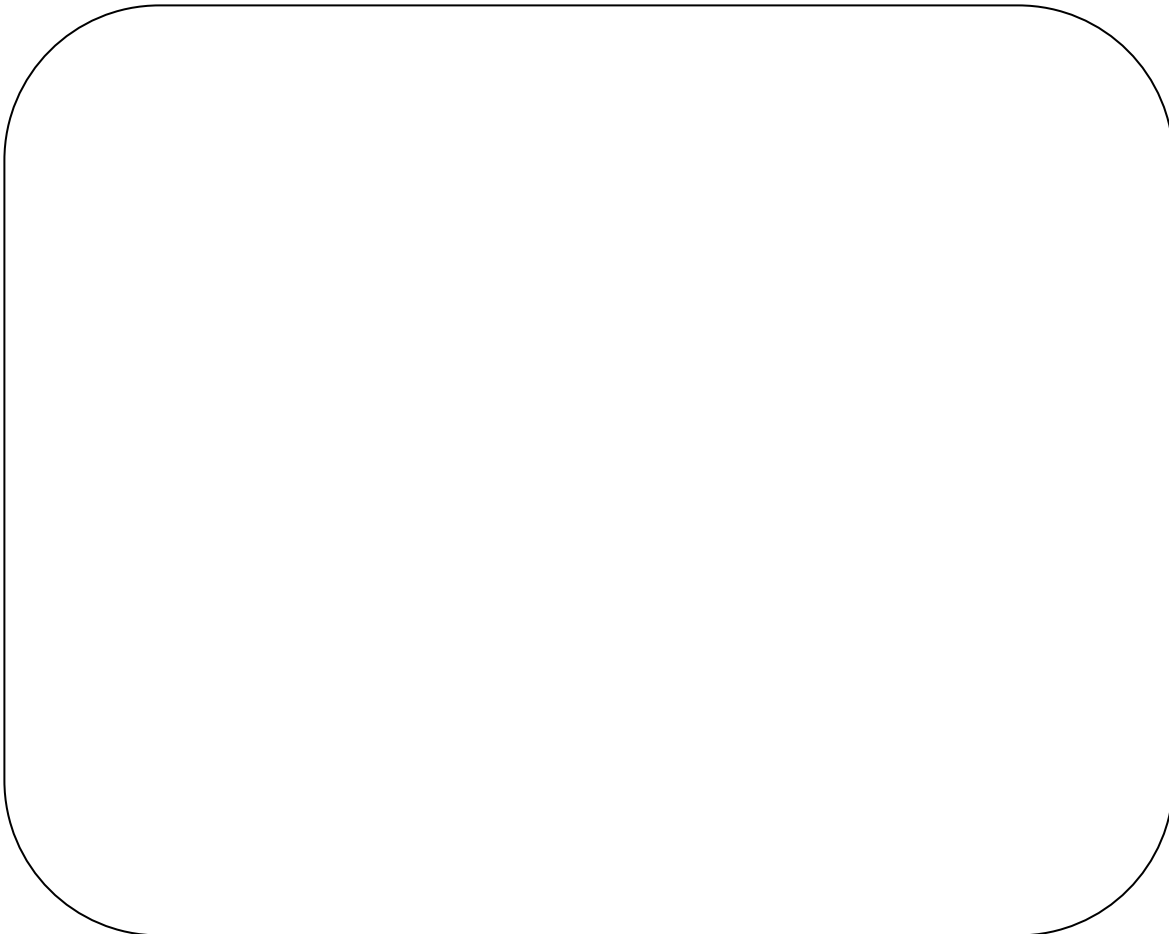
You should answer these questions AFTER you try out the Design Squad challenges

14. Which of the following are projects that engineers might work on? **(Circle all that apply)**

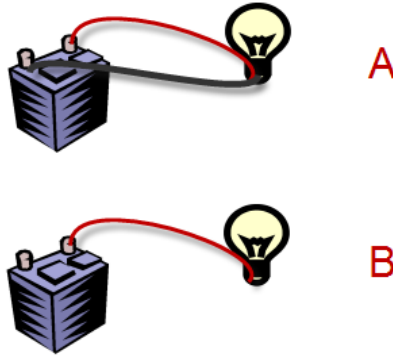
- a. They design toys
- b. They test the quality of the air
- c. They navigate submarines
- d. They design musical instruments
- e. They design hot air balloons and blimps
- f. All of these
- g. None of these

15. Imagine that you wanted to design and build an electronic alarm that would buzz every time someone opened the door to your room at home.

Please describe all the steps you might take to design and build the alarm.



16. Cathy is learning about electrical circuits and she has set-up two different experiments



Which one of these experiments will make the light bulb **turn on**?

- a. Bulb A will turn on
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- a. She can stretch the balloon
- b. She can add a small weight to the balloon
- c. She can fill the balloon with more air
- d. She can let all the air out of the balloon

You should answer these questions AFTER you try out the Design Squad challenges

19. If you threw each of the following objects through the air across a playground with equal force, which one would **have the least drag**?
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20. Imagine that you made a musical instrument with strings. What's the best way to produce the **lowest pitch**?
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 - b. Increase the tension of the string
 - c. Decrease the tension and increase the gauge of the string
 - d. Stretch the string as much as you can
21. Why do you think cupping your hand behind your ear helps you more easily hear what someone is saying?
- a. It blocks out sound waves from a person's voice
 - b. It increases the frequency of the sound
 - c. It makes all of the other noises around you go away
 - d. It captures more sound waves
22. Some schools and communities offer different engineering activities to kids. If the following were available to you, which **might** you be interested in doing? (You may choose more than one answer)
- a. I would like to do more engineering activities in my classroom
 - b. I would like to take an engineering class at my school
 - c. I would like to take an engineering class during the summer
 - d. I would like to join an engineering club or after-school program
 - e. I would like to try and build something on my own or with other people

You should answer these questions AFTER you try out the Design Squad challenges

23. Which of the following have you done before? (You may choose more than one answer)

- a. I've done engineering activities in my classroom
- b. I've taken an engineering class at my school
- c. I've taken an engineering class during the summer
- d. I've joined an engineering club or after-school program
- e. I've built something on my own or with other people

Now, we'd like to ask you some questions about *Design Squad*.

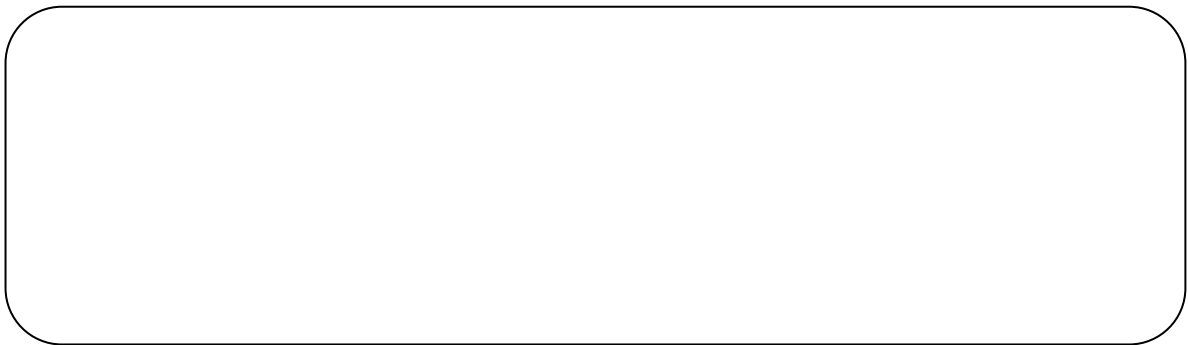
24. Do you think the *Design Squad* challenges are **good for kids your age**?

- a. Yes, the challenges are good for kids my age
- b. No, the challenges are good for kids older than me
- c. No, the challenges are good for kids younger than me
- d. I don't know

25. Do you think **your friends would have fun** doing the *Design Squad* challenges?

- a. Yes
- b. Maybe
- c. No
- d. I don't know

26. What did you **learn** while doing the Design Squad challenges?



You should answer these questions AFTER you try out the Design Squad challenges

27. When you were doing the challenges, how did the design process help you to **solve the problems**?

28. Provide **two** examples of **what engineers do** to help to improve people's lives.

a.

b.

29. Did you read the student hand-outs?

- a. Yes
- b. No

30. If yes, were the **instructions** easy to follow?

- a. I could follow **most or all** of the instructions
- b. I could follow **some** of the instructions
- c. I could **not** follow the instructions
- d. I don't know

You should answer these questions AFTER you try out the Design Squad challenges

31. Did you look at the **pictures on the student-handouts** before you started designing and building?

- a. Yes
- b. No
- c. I don't know

32. Did the **pictures and words** on the handouts help you complete the challenges?

- a. Yes
- b. No
- c. I don't know

33. How useful was the *String Thing* interactive game on the *Design Squad* website in doing Build a Band?

- a. Very useful
- b. A little useful
- c. Not useful at all
- d. I didn't play that game

34. How much did you like the *Design Squad* **video clips** that you watched in class?

- a. I liked them a lot
- b. I liked them a little
- c. I didn't like them at all
- d. I didn't see any videos

35. Did the **video clips** help you to do the challenges?

- a. They helped a lot
- b. They helped only a little
- c. They didn't help at all
- d. I didn't see any videos

You should answer these questions AFTER you try out the Design Squad challenges

36. Are you interested in watching the *Design Squad* show on **television or on the Web site?**

- a. Yes, and I already have
- b. Yes, I plan to
- c. Maybe
- d. No, I'm not planning to

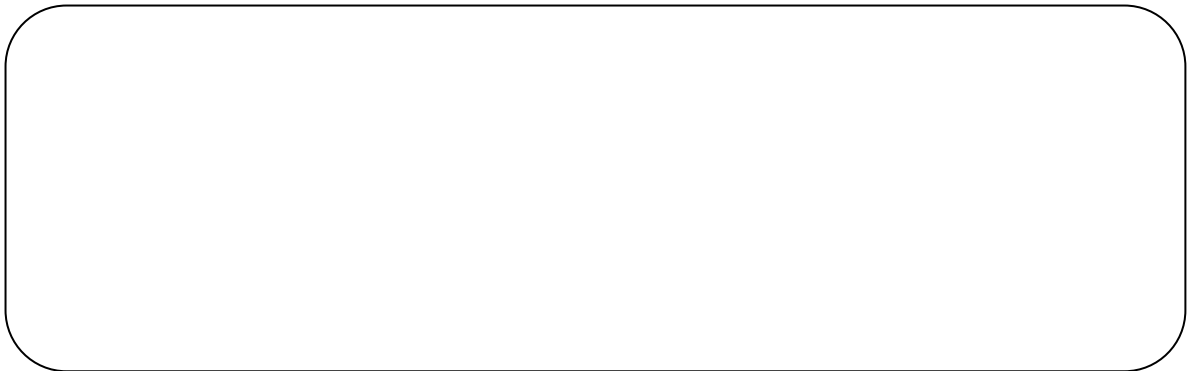
37. Would you tell a friend to watch *Design Squad*?

- a. Yes
- b. Maybe
- c. No
- d. I don't know, we didn't watch it in my class

38. Are you interested in visiting the *Design Squad website*?

- a. Yes, and I already have
- b. Yes, I plan to
- c. Maybe
- d. No, I'm not planning to

39. What would you tell someone (good or bad) about using *Design Squad* in your class?



You should answer these questions AFTER you try out the Design Squad challenges

And now, we have just a few questions about you:

40. Are you a:

- a. Boy
- b. Girl

41. Circle your grade:

- a. 6th grade
- b. 7th grade
- c. 8th grade

42. How old are you? _____

43. Are you of Hispanic, Latino, or Spanish origin? (Circle only one)

- a. Yes
- b. No

44. What is your race? (Circle one or more)

- a. American Indian or Alaskan Native
- b. Asian
- c. Black or African American
- d. Native Hawaiian or Other Pacific Islander
- e. White
- f. Other; Please specify _____

**When you are done, please hand this packet back to your teacher.
THANK YOU!**

Appendix D: Student Control Group Survey

Design Squad Student Survey

Your Name _____

Please answer the following questions about science and engineering.

Please do your best.

Thank you for your help!

Note to teachers: PLEASE REMOVE THIS COVER SHEET FROM THE SURVEY **JUST BEFORE** MAILING IT BACK TO US. STUDENTS' NAMES SHOULD NOT APPEAR ANYWHERE IN THE SURVEYS EXCEPT ON THIS PAGE.

Part 1 of this packet contains questions that you should answer **during Week 1** (Allow 5-10 minutes for this part)

Part 2 of this packet contains questions that you should answer **during Week 5** (Allow 15-20 minutes for this part)

Part 1

1. Do you know what engineering is?

- a. Yes, I know what it is
- b. Maybe, but I'm not sure
- c. No, I don't know what it is

2. Please give an example of something an engineer might work on.

Below are some sentences about engineering. We want to know whether you agree or disagree. Please read each sentence carefully and **circle a number** to tell us if you agree or not. There are no right or wrong answers!

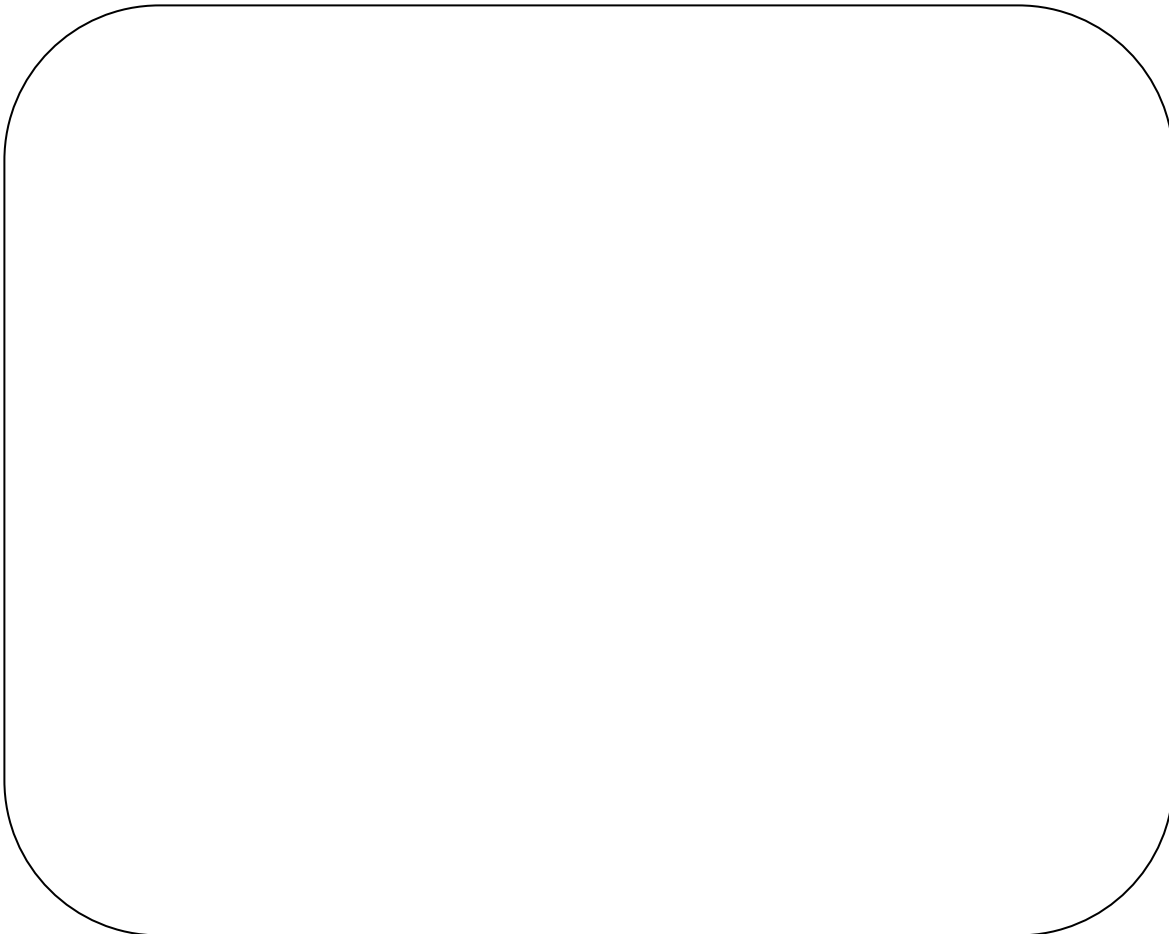
	I agree	I agree a little bit	I don't agree
3. Engineers help make people's lives better.	1	2	3
4. Engineering is boring.	1	2	3
5. Men are better than women at engineering.	1	2	3
6. Only super smart people can succeed in engineering.	1	2	3
7. Engineers need to have a great imagination.	1	2	3
8. Most people my age don't know what engineering is.	1	2	3
9. Engineers solve cool problems.	1	2	3
10. Engineers do many different kinds of jobs.	1	2	3
11. It would be fun to be an engineer.	1	2	3
12. Engineers solve problems that affect real people.	1	2	3
13. Engineers sometimes have to test their work and start over again.	1	2	3

14. Which of the following are projects that engineers might work on? **(Circle all that apply)**

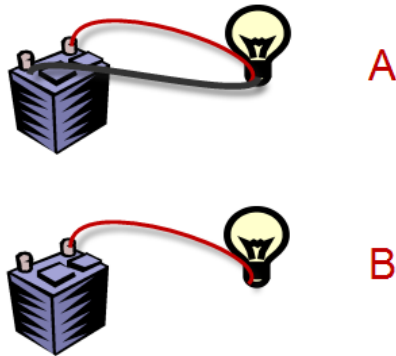
- a. They design toys
- b. They test the quality of the air
- c. They navigate submarines
- d. They design musical instruments
- e. They design hot air balloons and blimps
- f. All of these
- g. None of these

15. Imagine that you wanted to design and build an electronic alarm that would buzz every time someone opened the door to your room at home.

Please describe all the steps you might take to design and build the alarm.



16. Cathy is learning about electrical circuits and she has set-up two different experiments



Which one of these experiments will make the light bulb **turn on**?

- a. Bulb A will turn on
- b. Bulb B will turn on
- c. Both will turn on

17. Which of the following is the best example of a **conductor**?

- a. Rubber
- b. Glass
- c. Copper
- d. Wood

18. Tina has a balloon filled with helium and she wants to make it **neutrally buoyant**. Which of the following is the best way to do this?

- a. She can stretch the balloon
- b. She can add a small weight to the balloon
- c. She can fill the balloon with more air
- d. She can let all the air out of the balloon

19. If you threw each of the following objects through the air across a playground with equal force, which one would **have the least drag**?
- a. A soccer ball
 - b. A cardboard box
 - c. A football
 - d. A magazine
20. Imagine that you made a musical instrument with strings. What's the best way to produce the **lowest pitch**?
- a. Decrease the gauge of the string
 - b. Increase the tension of the string
 - c. Decrease the tension and increase the gauge of the string
 - d. Stretch the string as much as you can
21. Why do you think cupping your hand behind your ear helps you more easily hear what someone is saying?
- a. It blocks out sound waves from a person's voice
 - b. It increases the frequency of the sound
 - c. It makes all of the other noises around you go away
 - d. It captures more sound waves
22. Some schools and communities offer different engineering activities to kids. If the following were available to you, which **might** you be interested in doing? (You may choose more than one answer)
- a. I would like to do more engineering activities in my classroom
 - b. I would like to take an engineering class at my school
 - c. I would like to take an engineering class during the summer
 - d. I would like to join an engineering club or after-school program
 - e. I would like to try and build something on my own or with other people

23. Which of the following have you done before? (You may choose more than one answer)

- a. I've done engineering activities in my classroom
- b. I've taken an engineering class at my school
- c. I've taken an engineering class during the summer
- d. I've joined an engineering club or after-school program
- e. I've built something on my own or with other people

THANK YOU
PLEASE GIVE THIS PACKET TO YOUR TEACHER

**DO NOT REMOVE THE STAPLE FROM THIS SECTION
UNTIL YOUR TEACHER TELLS YOU TO REMOVE IT**

Part 2

1. Do you know what engineering is?

- a. Yes, I know what it is
- b. Maybe, but I'm not sure
- c. No, I don't know what it is

2. Please give an example of something an engineer might work on.

Below are some sentences about engineering. We want to know whether you agree or disagree. Please read each sentence carefully and **circle a number** to tell us if you agree or not. There are no right or wrong answers!

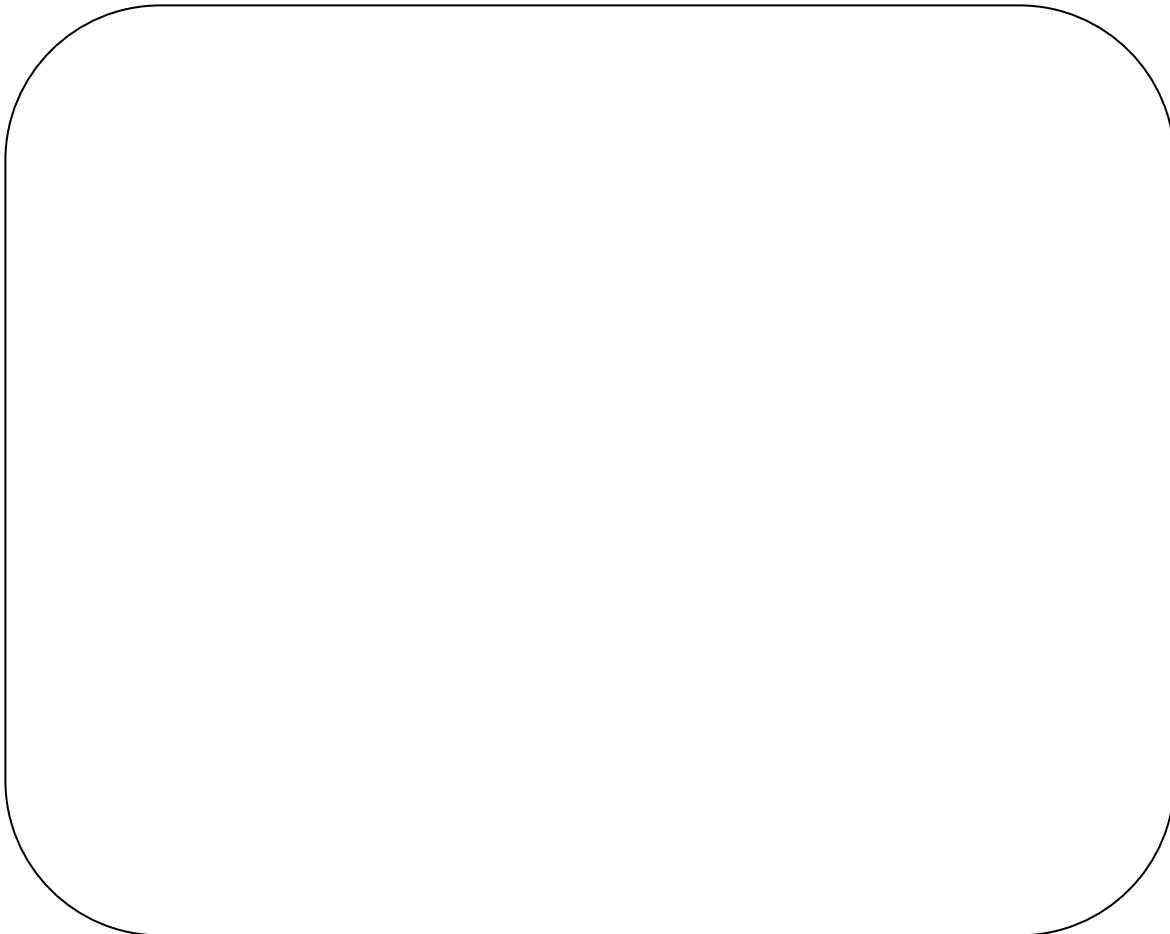
	I agree	I agree a little bit	I don't agree
3. Engineers help make people's lives better.	1	2	3
4. Engineering is boring.	1	2	3
5. Men are better than women at engineering.	1	2	3
6. Only super smart people can succeed in engineering.	1	2	3
7. Engineers need to have a great imagination.	1	2	3
8. Most people my age don't know what engineering is.	1	2	3
9. Engineers solve cool problems.	1	2	3
10. Engineers do many different kinds of jobs.	1	2	3
11. It would be fun to be an engineer.	1	2	3
12. Engineers solve problems that affect real people.	1	2	3
13. Engineers sometimes have to test their work and start over again.	1	2	3

14. Which of the following are projects that engineers might work on? **(Circle all that apply)**

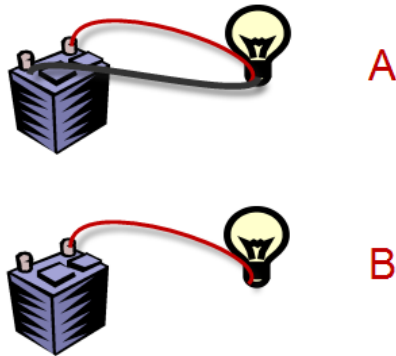
- a. They design toys
- b. They test the quality of the air
- c. They navigate submarines
- d. They design musical instruments
- e. They design hot air balloons and blimps
- f. All of these
- g. None of these

15. Imagine that you wanted to design and build an electronic alarm that would buzz every time someone opened the door to your room at home.

Please describe all the steps you might take to design and build the alarm.



16. Cathy is learning about electrical circuits and she has set-up two different experiments



Which one of these experiments will make the light bulb **turn on**?

- a. Bulb A will turn on
- b. Bulb B will turn on
- c. Both will turn on

17. Which of the following is the best example of a **conductor**?

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- b. Glass
- c. Copper
- d. Wood

18. Tina has a balloon filled with helium and she wants to make it **neutrally buoyant**. Which of the following is the best way to do this?

- a. She can stretch the balloon
- b. She can add a small weight to the balloon
- c. She can fill the balloon with more air
- d. She can let all the air out of the balloon

19. If you threw each of the following objects through the air across a playground with equal force, which one would **have the least drag**?
- a. A soccer ball
 - b. A cardboard box
 - c. A football
 - d. A magazine
20. Imagine that you made a musical instrument with strings. What's the best way to produce the **lowest pitch**?
- a. Decrease the gauge of the string
 - b. Increase the tension of the string
 - c. Decrease the tension and increase the gauge of the string
 - d. Stretch the string as much as you can
21. Why do you think cupping your hand behind your ear helps you more easily hear what someone is saying?
- a. It blocks out sound waves from a person's voice
 - b. It increases the frequency of the sound
 - c. It makes all of the other noises around you go away
 - d. It captures more sound waves
22. Some schools and communities offer different engineering activities to kids. If the following were available to you, which **might** you be interested in doing? (You may choose more than one answer)
- a. I would like to do more engineering activities in my classroom
 - b. I would like to take an engineering class at my school
 - c. I would like to take an engineering class during the summer
 - d. I would like to join an engineering club or after-school program
 - e. I would like to try and build something on my own or with other people

23. Which of the following have you done before? (You may choose more than one answer)

- a. I've done engineering activities in my classroom
- b. I've taken an engineering class at my school
- c. I've taken an engineering class during the summer
- d. I've joined an engineering club or after-school program
- e. I've built something on my own or with other people

And now we have just a few questions about you:

24. Are you a:

- a. Boy
- b. Girl

25. Circle your grade:

- a. 6th grade
- b. 7th grade
- c. 8th grade

26. How old are you? _____

27. Are you of Hispanic, Latino, or Spanish origin? (Circle only one.)

- a. Yes
- b. No

28. What is your race? (Circle one or more)

- a. American Indian or Alaskan Native
- b. Asian
- c. Black or African American
- d. Native Hawaiian or Other Pacific Islander
- e. White
- f. Other; Please specify _____

**When you are done, please hand this packet back to your teacher.
THANK YOU!**

Appendix E: Teacher Treatment Group Survey

Design Squad Teacher Survey

Your name _____

Thank you for taking the time to participate in this survey.

We appreciate your time and willingness to share your experiences!

Part 1 of this packet contains questions that you should answer **before** you try the Design Squad challenges with your students (Allow 5-10 minutes for this part)

Part 2 of this packet contains questions that you should answer **after** you have tried all the Design Squad challenges with your students (Allow 15-20 minutes for this part)

You should answer these questions BEFORE you try out the Design Squad challenges

Part 1

To be completed BEFORE you try out
the Design Squad challenges.

You should answer these questions BEFORE you try out the Design Squad challenges

1. How long have you been a science teacher? _____ years
2. How long have you worked at your school? _____ years

Do you ever use any of the following media? Please place an X in the boxes that describe what you use.

	YES	We have the capability, but I DON'T do this	We do NOT have the capability
3. Do you ever stream or download video from the Internet to show to your students?			
4. Do you allow your students to visit websites in your classroom?			
5. Do you allow your students to view streamed or downloaded video clips on their own in your classroom?			
6. Do you have an interactive white board?			
7. Do you have a computer connected to a projector?			

8. What proportion of the kids in your school are eligible for free or reduced price lunch? _____ %
9. What proportion of the kids in your classroom have special needs? _____ %
have special needs
10. Please describe the special needs in your classroom:

You should answer these questions BEFORE you try out the Design Squad challenges

11. What is the highest academic degree you hold?

- a. Bachelor's degree; major(s): _____
- b. Master's degree; field of study: _____
- c. Doctorate; field of study: _____
- d. Other; please describe: _____

12. How familiar are you with the "design process" that engineers use to solve problems?

- a. I've never heard of it
- b. I've heard of it, but I'm not sure what it is
- c. I know what it is

13. How many times a year do you lead activities that use the engineering design process?

- a. Never
- b. 1 - 2
- c. 3 - 5
- d. 6 - 10
- e. 10+

14. How interested do you think your students would be in doing engineering design challenges?

- a. Very interested
- b. Somewhat interested
- c. They would not be interested at all
- d. I don't know

You should answer these questions BEFORE you try out the Design Squad challenges

Please indicate your level of comfort with the following activities by marking an X in the box that best describes how you feel.

How comfortable are you...	Not at all comfortable	Somewhat comfortable	Comfortable
15.... leading hands-on activities with kids?			
16.... leading open-ended activities (i.e. activities that have many possible solutions or answers)			
17.... talking with kids about what engineers do or what engineering is?			
18....using a student-centered problem-solving process?			

19. Please give an example of how you, as a science teacher, might encourage students to use the design process to guide your students through a student-centered problem-solving activity in your classroom.

You should answer these questions BEFORE you try out the Design Squad challenges

Below are some statements about engineering. We want to know whether you agree or disagree. Please read each sentence carefully and **circle a number** to tell us if you agree or not.

	I agree	I agree a little bit	I don't agree	Unsure
20. Engineers help make people's lives better.	1	2	3	4
21. Engineering is boring.	1	2	3	4
22. Men are better than women at engineering.	1	2	3	4
23. Only super smart people can succeed in engineering.	1	2	3	4
24. Engineers need to have a great imagination.	1	2	3	4
25. Most students don't know what engineering is.	1	2	3	4
26. Engineers solve "cool" problems.	1	2	3	4
27. Engineers do many different kinds of jobs.	1	2	3	4
28. It would be fun to be an engineer.	1	2	3	4
29. Engineers solve problems that affect real people.	1	2	3	4
30. Engineers sometimes have to test their work and start over again.	1	2	3	4

Please STOP here.

THANK YOU!

You should answer these questions AFTER you try out the Design Squad challenges

**DO NOT GO TO THE NEXT SECTION UNTIL YOU HAVE
COMPLETED THE DESIGN SQUAD CHALLENGES**

You should answer these questions AFTER you try out the Design Squad challenges

Part 2

To be completed AFTER you try out the Design Squad challenges with your students.

You should answer these questions AFTER you try out the Design Squad challenges

1. How familiar are you with the “design process” that engineers use to solve problems?
 - a. I’ve never heard of it
 - b. I’ve heard of it, but I’m not sure what it is
 - c. I know what it is

2. How interested do you think your students would be in doing engineering design challenges?
 - a. Very interested
 - b. Somewhat interested
 - c. They would not be interested at all
 - d. I don’t know

Please indicate your level of comfort with the following activities by marking an X in the box that best describes how you feel.

How comfortable are you...	Not at all comfortable	Somewhat comfortable	Comfortable
3. ... leading hands-on activities with kids?			
4. ... leading open-ended activities (i.e. activities that have many possible solutions or answers)			
5. ... talking with kids about what engineers do or what engineering is?			
6. ...using a student-centered problem-solving process?			

You should answer these questions AFTER you try out the Design Squad challenges

7. Please give an example of how you, as a science teacher, might encourage students to use the design process to guide your students through a student-centered problem-solving activity in your classroom.



You should answer these questions AFTER you try out the Design Squad challenges

Below are some statements about engineering. We want to know whether you agree or disagree. Please read each sentence carefully and **circle a number** to tell us if you agree or not.

	I agree	I agree a little bit	I don't agree	Unsure
8. Engineers help make people's lives better.	1	2	3	4
9. Engineering is boring.	1	2	3	4
10. Men are better than women at engineering.	1	2	3	4
11. Only super smart people can succeed in engineering.	1	2	3	4
12. Engineers need to have a great imagination.	1	2	3	4
13. Most students don't know what engineering is.	1	2	3	4
14. Engineers solve "cool" problems.	1	2	3	4
15. Engineers do many different kinds of jobs.	1	2	3	4
16. It would be fun to be an engineer.	1	2	3	4
17. Engineers solve problems that affect real people.	1	2	3	4
18. Engineers sometimes have to test their work and start over again.	1	2	3	4

You should answer these questions AFTER you try out the Design Squad challenges

Now, we'd like to ask you some questions about your experience with *Design Squad teacher's guide*

19. In what ways, if any, did *Design Squad* teacher's guide **supplement or reinforce your existing curriculum**? Please be specific.

20. Please describe how you used the video clips, the Design Squad hands-on challenges and the website.

21. Please describe the timing of the activities for each challenge (For example, did you do all the activities within a given unit at once or did you spread them out over time, or some other approach?)

You should answer these questions AFTER you try out the Design Squad challenges

22. Please describe how you introduced students to the science content in the units (For example, did you teach a related lesson prior to using *Design Squad* or did you teach the lessons as you used Design Squad, or some other approach?)

23. What **advantages and disadvantages** do you see to using the video clips, Design Squad hands-on challenges and website together as one “package.”

24. What **specific changes**, if any, did you see in your students as a result of you using the *Design Squad Teacher’s Guide*?

You should answer these questions AFTER you try out the Design Squad challenges

25. Did you do the “Making it Real” lesson for each of the challenges?

- a. Yes
- b. No

26. If Yes, did the *Design Squad* challenges strengthen your students’ ability to **identify and discuss the science concepts they applied**?

- a. Yes
- b. No

27. If Yes, please provide specific examples:

28. Did the *Design Squad* challenges strengthen your students’ ability to **explain how they used the design process**?

- a. Yes
- b. No

29. If Yes, please provide specific examples:

You should answer these questions AFTER you try out the Design Squad challenges

30. Did the *Design Squad* challenges strengthen your students' ability to **cite examples of what an engineer does**?

- a. Yes
- b. No

31. If Yes, please provide specific examples:

32. Did you use the **Design Squad video clips and engineering profiles** in your classroom? (Please circle all that apply)

- a. Yes, I downloaded them (saved the video clips to the computer, and then played them)
- b. Yes, I streamed them (played the video clips directly from the website)
- c. Yes, I tried to use them, but I had some technical problems (Please explain: _____)
- d. No, I did not use the video clips at all

33. Did the **video clips** enhance the challenges?

- a. Yes
- b. Somewhat
- c. No
- d. I didn't use any video clips

You should answer these questions AFTER you try out the Design Squad challenges

34. Did you use the *Design Squad website beyond the teacher's guide page*?

- a. Yes, I frequently accessed the site
- b. Yes, once or twice
- c. No

35. If Yes, what did you use:

36. If you made **any adaptations** to the challenges, as they were specified in the Guide, please describe what you did and why.

Please circle the numbers below that best reflect your **level of agreement** with each of the following statements about the *Design Squad* experience.

	Strongly Disagree	Disagree	Agree	Strongly Agree	I don't know
37. My students were engaged by Design Squad.	1	2	3	4	N/A
38. Design Squad presented science concepts in an understandable way for my students.	1	2	3	4	N/A
39. Design Squad helped my students understand the engineering design process (brainstorm, design, build, test, evaluate, and redesign).	1	2	3	4	N/A
40. Design Squad did NOT help me feel comfortable leading engineering design challenges with the kids.	1	2	3	4	N/A

You should answer these questions AFTER you try out the Design Squad challenges

	Strongly Disagree	Disagree	Agree	Strongly Agree	I don't know
41. Design Squad was appropriately challenging for the kids in my classroom.	1	2	3	4	N/A
42. Design Squad encouraged my students to brainstorm with each other.	1	2	3	4	N/A
43. Design Squad did NOT encourage my students to collaborate with one another.	1	2	3	4	N/A
44. Design Squad provided an opportunity for classmates to educate one another about the engineering design process or science concepts.	1	2	3	4	N/A
45. Design Squad made my students more excited about engineering as a career choice.	1	2	3	4	N/A
46. Design Squad did NOT help me to use a student-driven problem-solving process in my classroom.	1	2	3	4	N/A

47. How likely are you to **use** the Design Squad challenges again?

- a. Not at all likely
- b. Somewhat likely
- c. Extremely likely

48. How likely are you to **recommend** the Design Squad challenges to others?

- a. Not at all likely
- b. Somewhat likely
- c. Extremely likely

You should answer these questions AFTER you try out the Design Squad challenges

49. How interested do you think your students would be in **doing engineering design challenges again**?

- a. Very interested
- b. Somewhat interested
- c. They would not be interested at all
- d. I don't know

50. What would you **tell other teachers** about leading the *Design Squad* challenges?

THANK YOU!

Please mail this entire packet in the self-addressed stamped envelope back to Veridian inSight, along with:

- All student packets (with the first page that includes student first and last name removed)
- All student assent forms
- All parental permission forms

Appendix F: Teacher Control Group Surveys

Design Squad Teacher Survey

Your name _____

Thank you for taking the time to participate in this survey.

We appreciate your time and willingness to share your experiences!

Part 1 of this packet contains questions that you should answer **during Week 1** (Allow 5-10 minutes for this part)

Part 2 of this packet contains questions that you should answer **during Week 5** (Allow 5 minutes for this part)

You should answer these questions during Week 1

Part 1

To be completed during **Week 1**

1. How long have you been a science teacher? _____ years
2. How long have you worked at your school? _____ years

Do you ever use any of the following media? Please place an X in the boxes that describe what you use.

	YES	We have the capability, but I DON'T do this	We do NOT have the capability
3. Do you ever stream or download video from the Internet to show to your students?			
4. Do you allow your students to visit websites in your classroom?			
5. Do you allow your students to view streamed or downloaded video clips on their own in your classroom?			
6. Do you have an interactive white board?			
7. Do you have a computer connected to a projector?			

8. What proportion of the kids in your school are eligible for free or reduced price lunch? _____ %

9. What proportion of the kids in your classroom have special needs? _____ %
have special needs

10. Please describe the special needs in your classroom:

11. What is the highest academic degree you hold?

- a. Bachelor's degree; major(s): _____
- b. Master's degree; field of study: _____
- c. Doctorate; field of study: _____
- d. Other; please describe: _____

12. How familiar are you with the "design process" that engineers use to solve problems?

- a. I've never heard of it
- b. I've heard of it, but I'm not sure what it is
- c. I know what it is

13. How many times a year do you lead activities that use the engineering design process?

- a. Never
- b. 1 - 2
- c. 3 - 5
- d. 6 - 10
- e. 10+

14. How interested do you think your students would be in doing engineering design challenges?

- a. Very interested
- b. Somewhat interested
- c. They would not be interested at all
- d. I don't know

Please indicate your level of comfort with the following activities by marking an X in the box that best describes how you feel.

How comfortable are you...	Not at all comfortable	Somewhat comfortable	Comfortable
15. ... leading hands-on activities with kids?			
16. ... leading open-ended activities (i.e. activities that have many possible solutions or answers)			
17. ... talking with kids about what engineers do or what engineering is?			
18. ...using a student-centered problem-solving process?			

19. Please give an example of how you, as a science teacher, might encourage students to use the design process to guide your students through a student-centered problem-solving activity in your classroom.

You should answer these questions during Week 1

Below are some statements about engineering. We want to know whether you agree or disagree. Please read each sentence carefully and **circle a number** to tell us if you agree or not.

	I agree	I agree a little bit	I don't agree	Unsure
20. Engineers help make people's lives better.	1	2	3	4
21. Engineering is boring.	1	2	3	4
22. Men are better than women at engineering.	1	2	3	4
23. Only super smart people can succeed in engineering.	1	2	3	4
24. Engineers need to have a great imagination.	1	2	3	4
25. Most students don't know what engineering is.	1	2	3	4
26. Engineers solve "cool" problems.	1	2	3	4
27. Engineers do many different kinds of jobs.	1	2	3	4
28. It would be fun to be an engineer.	1	2	3	4
29. Engineers solve problems that affect real people.	1	2	3	4
30. Engineers sometimes have to test their work and start over again.	1	2	3	4

Please STOP here.

THANK YOU!

You should answer these questions during Week 5

**DO NOT GO TO THE NEXT SECTION UNTIL INSTRUCTED TO
DO SO BY VERIDIAN INSIGHT**

You should answer these questions during Week 5

Part 2

To be completed during **Week 5**

1. How familiar are you with the “design process” that engineers use to solve problems?
 - a. I’ve never heard of it
 - b. I’ve heard of it, but I’m not sure what it is
 - c. I know what it is

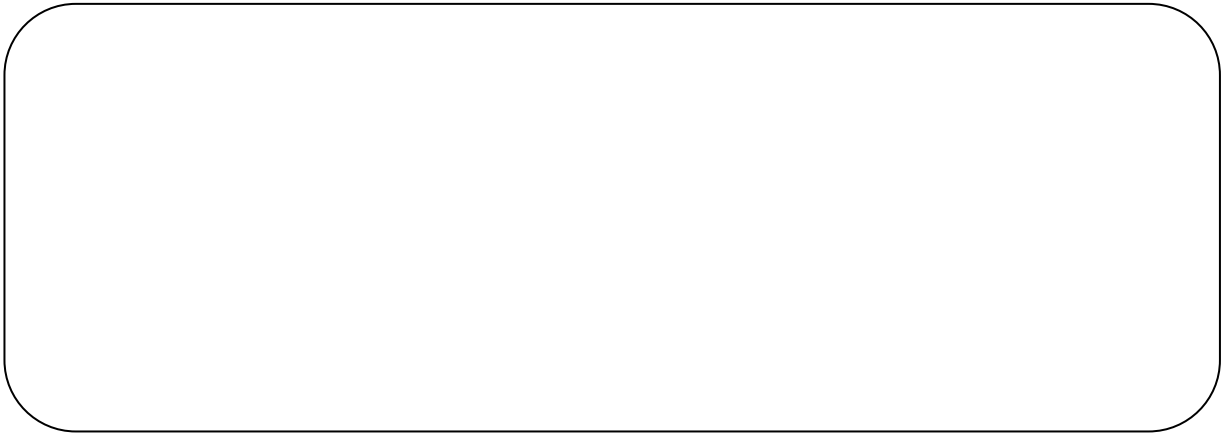
2. How interested do you think your students would be in doing engineering design challenges?
 - a. Very interested
 - b. Somewhat interested
 - c. They would not be interested at all
 - d. I don’t know

Please indicate your level of comfort with the following activities by marking an X in the box that best describes how you feel.

How comfortable are you...	Not at all comfortable	Somewhat comfortable	Comfortable
3. ... leading hands-on activities with kids?			
4. ... leading open-ended activities (i.e. activities that have many possible solutions or answers)			
5. ... talking with kids about what engineers do or what engineering is?			
6. ...using a student-centered problem-solving process?			

You should answer these questions during Week 5

7. Please give an example of how you, as a science teacher, might encourage students to use the design process to guide your students through a student-centered problem-solving activity in your classroom.



Below are some statements about engineering. We want to know whether you agree or disagree. Please read each sentence carefully and **circle a number** to tell us if you agree or not.

	I agree	I agree a little bit	I don't agree	Unsure
8. Engineers help make people's lives better.	1	2	3	4
9. Engineering is boring.	1	2	3	4
10. Men are better than women at engineering.	1	2	3	4
11. Only super smart people can succeed in engineering.	1	2	3	4
12. Engineers need to have a great imagination.	1	2	3	4
13. Most students don't know what engineering is.	1	2	3	4
14. Engineers solve "cool" problems.	1	2	3	4
15. Engineers do many different kinds of jobs.	1	2	3	4
16. It would be fun to be an engineer.	1	2	3	4
17. Engineers solve problems that affect real people.	1	2	3	4
18. Engineers sometimes have to test their work and start over again.	1	2	3	4

THANK YOU!

Please mail this entire packet in the self-addressed stamped envelope back to Veridian inSight, along with:

- All student packets (with the first page containing student first and last name removed)
- All student assent forms
- All parental permission forms

Design Squad Follow-Up Teacher Survey: Control Group Only

Your name _____

Thank you for taking the time to participate in this survey.

We appreciate your time and willingness to share your experiences!

(This survey will be administered after the control group schools use the Design Squad challenges)

7. Did you do the “Making it Real” lesson for each of the challenges?
- Yes
 - No
8. If *Yes*, did the *Design Squad* challenges strengthen your students’ ability to **identify and discuss the science concepts they applied**?
- Yes
 - No
9. If *Yes*, please provide specific examples:
10. Did the *Design Squad* challenges strengthen your students’ ability to **explain how they used the design process**?
- Yes
 - No
11. If *Yes*, please provide specific examples:

12. Did the *Design Squad* challenges strengthen your students' ability to **cite examples of what an engineer does**?

- a. Yes
- b. No

13. If Yes, please provide specific examples:

14. Did you use the **Design Squad video clips and engineering profiles** in your classroom? (Please circle all that apply)

- a. Yes, I downloaded them (saved the video clips to the computer, and then played them)
- b. Yes, I streamed them (played the video clips directly from the website)
- c. Yes, I tried to use them, but I had some technical problems (Please explain: _____)
- d. No, I did not use the video clips at all

15. Did the **video clips** enhance the challenges?

- a. Yes
- b. Somewhat
- c. No
- d. I didn't use any video clips

16. Did you use the *Design Squad* website beyond the teacher's guide page?

- a. Yes, I frequently accessed the site
- b. Yes, once or twice
- c. No

17. If Yes, what did you use:

18. If you made **any adaptations** to the challenges, as they were specified in the Guide, please describe what you did and why.

Please circle the numbers below that best reflect your **level of agreement** with each of the following statements about the *Design Squad* experience.

	Strongly Disagree	Disagree	Agree	Strongly Agree	I don't know
19. My students were engaged by Design Squad.	1	2	3	4	N/A
20. Design Squad presented science concepts in an understandable way for my students.	1	2	3	4	N/A
21. Design Squad helped my students understand the engineering design process (brainstorm, design, build, test, evaluate, and redesign).	1	2	3	4	N/A
22. Design Squad did NOT help me feel comfortable leading engineering design challenges with the kids.	1	2	3	4	N/A

	Strongly Disagree	Disagree	Agree	Strongly Agree	I don't know
23. Design Squad was appropriately challenging for the kids in my classroom.	1	2	3	4	N/A
24. Design Squad encouraged my students to brainstorm with each other.	1	2	3	4	N/A
25. Design Squad did NOT encourage my students to collaborate with one another.	1	2	3	4	N/A
26. Design Squad provided an opportunity for classmates to educate one another about the engineering design process or science concepts.	1	2	3	4	N/A
27. Design Squad made my students more excited about engineering as a career choice.	1	2	3	4	N/A
28. Design Squad did NOT help me to use a student-driven problem-solving process in my classroom.	1	2	3	4	N/A

29. How likely are you to **use** the Design Squad challenges again?

- a. Not at all likely
- b. Somewhat likely
- c. Extremely likely

30. How likely are you to **recommend** the Design Squad challenges to others?

- a. Not at all likely
- b. Somewhat likely
- c. Extremely likely

31. How interested do you think your students would be in **doing engineering design challenges again**?

- a. Very interested
- b. Somewhat interested
- c. They would not be interested at all
- d. I don't know

32. What would you **tell other teachers** about leading the *Design Squad* challenges?

THANK YOU!