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Camp FETCH! Guide: Evaluation Report

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CEG

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Chapter 1: Introduction

Objectives

WGBH Boston (wgbh.org) was awarded a grant from the National Science Foundation to, in part, develop outreach materials based on the children's television series *FETCH! with Ruff Ruffman.* The outreach materials were designed to help typically underserved kids learn about science in informal camp or after-school settings. The centerpiece of this effort was the *Camp FETCH! Guide* (the Guide). The Guide is meant for anyone who wants to lead hands-on science activities with six- to ten-year-olds: camp counselors, afterschool providers, teachers, librarians, museum staff, and others. The Guide features seven activities, each of which is accompanied by Leader Notes that explain how to carry out an activity from start to finish. The Guide focuses on three different science themes: air, chemistry, and simple machines.[1]

Figure 1. Pages from the Camp FETCH! Guide.

WGBH hired Concord Evaluation Group (CEG) to conduct a test of the Guide, including three hands-on science activities in summer of 2011. This document summarizes the results of that study.

[1] From the website http://pbskids.org/fetch//parentsteachers/activities/campfetch.html

The goal of the study was to assess the Guide's impact on kids'

- Knowledge of science concepts, such as chemistry, gravity, and levers;
- Attitudes and beliefs about science; and
- Satisfaction with the FETCH! activities.

Another goal of the study was to assess

- Camp counselors' confidence for teaching science after using the Guide; and
- Perceived value of the Guide for use in camp settings, including ways to enhance the Guide.

Study Design

To recruit camps for the study, WGBH sent an invitation to participate in the study their existing camp outreach partners in the greater Boston area. WGBH also distributed informational fliers to potential participants at a meeting of the American Camp Association in California in February 2011. And finally, they contacted the New England ACA office to ask for their help to invite Boston area camps to participate. Representatives from camps that were interested in participating in the study completed a brief screening survey online and, if qualified, were contacted by CEG for enrollment in the study.

We created matched pairs of sites (matched with respect to type of camp, aggregate income level of the program participants, and race/ethnicity distribution of the kids). One site from each pair was randomly assigned to the treatment or control groups.
Twelve camps were invited to participate in the study. This study used a randomized block design. Of the 12 sites in our sample, 6 were randomly assigned to the treatment condition and 6 were randomly assigned to the control condition. The study design is illustrated below:

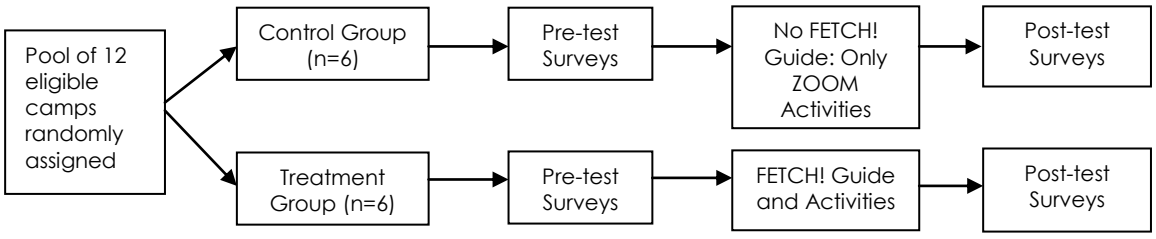


Figure 2. Randomized block design.

After parental consent was obtained, kids and counselors completed pre-test surveys at the start of the study. After completing the pre-test surveys, treatment group camps (camp counselors) were instructed to use the Guide to lead 3 activities with their kids (see Appendix). Control group sites were instructed to use a set of 3 non-FETCH! activities (ZOOM activities) that were arts-and-crafts and not science-based (see Appendix). After the camps completed their respective activities, we returned to the camps to administer post-test surveys to kids and counselors.

We should note that after administering pre-test surveys at control group camps, we began to notice that kids were curious about the "correct" answers to the science questions and also wanted to discuss the attitude questions. Before we could intervene, some counselors explained the answers to the kids or expressed to them their own attitudes toward science. We believed that this behavior might influence the control group kids' responses to the post-test surveys. So, for data analysis purposes, we made the decision to compare treatment group post-test responses to control group pre-test responses because we believe this offered a more pure control condition.

As an incentive to participate, all camps received a box of supplies they could use to lead the activities as well as a check for $100 to purchase any additional materials, as needed. Additionally, after completing the post-test surveys, we provided control group camps with the Guide so they could review it and provide feedback to us, as well as use it to lead activities with future groups of campers (which will not be part of the study).

Participants

Camps

Twelve camps located in southern New England participated in the study. Half of the camps were school-based programs. Another 25% were YMCA camps. The remaining three were Boys & Girls Club camps (2) or Girl Scouts camps (1). Half of the camps were located in urban locations. Of the other 5 camps, 4 were suburban camps and 1 was rural. One-third of the camps reported that they served large Black or Hispanic populations (more than 30% minority) and half of the camps reported that they served a high proportion (more than 30%) low income families.

Table 1:

Camp Characteristics

Characteristic	Control Group Frequency & Percent (N = 6)	Treatment Group Frequency & Percent (N = 6)	TOTAL Frequency & Percent (N = 12)
Camp type			
School-based	4 (66.7%)	2 (33.3%)	6 (50.0%)
YMCA	2 (33.3%)	1 (16.7%)	3 (25.0%)
Boys & Girls Club	0 (0.0%)	2 (33.3%)	2 (16.7%)
Girl Scouts	0 (0.0%)	1 (16.7%)	1 (8.3%)
Camp location			
Urban	3 (50.0%)	3 (50.0%)	6 (50.0%)
Suburban	3 (50.0%)	2 (33.3%)	5 (41.7%)
Rural	0 (0.0%)	1 (16.7%)	1 (8.3%)
Population served			
More than 30% Black or African-American	1 (16.7%)	3 (50.0%)	4 (33.3%)
More than 30% Hispanic	2 (33.3%)	2 (33.3%)	4 (33.3%)
More than 30% low income families	2 (33.3%)	4 (66.7%)	6 (50.0%)

Kids

The kids' demographic and background characteristics are summarized in the table below. The overall sample contained slightly more females than males, but this difference was not statistically significant. The sample mirrored fairly closely, the racial and ethnic breakdown of the general U.S. population. However, kids in the control group sample were significantly more likely to report that they were white than were kids in the treatment group. We controlled for this difference in our analyses.

Table 2:

Kids' Demographic and Background Characteristics

Characteristic	Control Group Frequency & Percent (N = 93)	Treatment Group Frequency & Percent (N = 76)	TOTAL Frequency & Percent (N = 169)
Gender			
Female	43 (46.2%)	47 (61.8%)	90 (53.3%)
Male	50 (53.8%)	29 (38.2%)	79 (46.7%)
Age			
7	3 (3.2%)	3 (3.9%)	6 (3.6%)
8	38 (40.9%)	27 (35.5%)	65 (38.5%)
9	29 (31.2%)	23 (30.3%)	52 (30.8%)
10	19 (20.4%)	16 (21.1%)	35 (20.7%)
11	2 (2.2%)	4 (5.3%)	6 (3.6%)
12	2 (2.2%)	3 (3.9%)	5 (3.0%)
Race/ethnicity			
White or Caucasian	53 (57.0%)	30 (39.5%)[2]	83 (49.1%)
Hispanic, Latino, or Spanish	12 (12.9%)	12 (15.8%)	24 (14.2%)
Black or African-American	17 (18.3%)	22 (28.9%)	39 (23.1%)
Asian	9 (9.7%)	12 (15.8%)	21 (12.4%)
American Indian or Alaskan Native	2 (2.2%)	2 (2.6%)	4 (2.4%)
Native Hawaiian or Other Pacific	1 (1.1%)	1 (1.3%)	2 (1.2%)

NOTE: Totals for race/ethnicity may add up to greater than 100% in cases where respondents chose more than one answer.

[2] The control group contained significantly more white students than did the treatment group (chi square (df=1) = 4.457, p = .035). There were no other significant differences between the groups with respect to race/ethnicity.

Despite our explicit instructions to sites to only include kids between the ages of 8 and 10 in the study, most camps included kids outside of the prescribed age range. Among the 188 kids in the original sample, the kids' ages ranged from 6 to 13 years old. As we have seen in other studies, in informal settings, like summer camps, it is often difficult or impossible to prevent the kids outside the prescribed age range from participating. *For analytic purposes, we have removed the kids who were younger than 7 or older than 12.* This resulted in a total sample size of 169 kids. The average age of the control group was 8.84 years (standard deviation = 1.003) and the average age of the treatment group was 9.00 years (standard deviation = 1.143). This difference was not significantly different.

Camp Counselors

The sample included 37 counselors across the 12 camps. The number of counselors that led activities in the camps ranged from 1 to 8 at each camp, with an average of 3 counselors per camp.

The counselors were evenly split between males (51%) and females (49%). One-quarter of the counselors were non-white minorities. Counselors' educational backgrounds varied widely. Roughly half of the counselors (54%) were students enrolled in high school or college. Another one-quarter of the counselors were college graduates. Eleven percent of the counselors had graduate degrees. Most college students and college graduates reported majoring in education-related fields.

Counselors reported having between 0 and 34 years of experience working school-aged kids (Such as a parent volunteer, elementary school teacher or teacher aide, middle/high school teacher, afterschool program leader or volunteer, camp counselor, sports coach, tutor, or scout leader). However, the counselor who reported having 34 years was an outlier—that is, the balance of the counselors reported having no more than 17 years of experience. Thus, if we remove the outlier, we find that the average number of years working with kids was 5.12 years (standard deviation = 4.189). The average for the control group camps was significantly higher than the average for the treatment group camps (7.85 years versus 2.95 years, respectively).[3]

Counselors in the control group also reported a significantly greater number of years working in camp settings with kids than counselors in the treatment group: 6.31 years versus 2.07 years.[4]

Most counselors reported that they had experience working with elementary and middle schoolers:

- Preschool = 21.6%

[3] t (31) = 3.504, p = .001.
[4] t (15.816) = 2.776, p = .014.

- Elementary (K-5) = 67.6%
- Middle school (6-9) = 62.2%
- High school (9-12) = 32.4%
- Older than high school = 2.7%

About one-quarter of the sample (26.5%) reported that they had prior experience leading STEM activities with kids, again mostly in the elementary and middle school age range.

Table 3:

Camp Counselor Demographic and Background Characteristics

Characteristic	Frequency & Percent (N = 37)
Gender	
Male	19 (51.4%)
Female	18 (48.6%)
Race/ethnicity	
White or Caucasian	26 (74.3%)
Hispanic, Latino, or Spanish	4 (11.4%)
Black or African-American	5 (14.7%)
Asian	1 (2.9%)
Missing / Unknown	2 (5.4%)
Educational background	
Still in high school	7 (18.9%)
High school diploma / Still in college	13 (35.1%)
Four-year college degree	9 (24.3%)
Graduate degree	4 (10.8%)
Missing / Unknown	4 (10.8%)

NOTE: Totals for race / ethnicity may add up to greater than 100% in cases where respondents chose more than one answer.

Chapter 2: Findings

Science Knowledge

Evaluation Question: Will kids who tried the Camp FETCH! activities demonstrate greater knowledge of science concepts (such as chemistry, gravity, and levers) than kids who did not try the activities?

We assessed kids' learning outcomes with a set of 6 questions on which kids could earn a total of 8 points (see items 8-13 in Appendix C).[5] As summarized in the figure below, we found evidence that kids who tried the Camp FETCH! activities demonstrated greater knowledge of science concepts (such as chemistry, gravity, and levers) than kids who did not try the activities ($F_{(1, 12.487)} = 4.692$, $p = .05$.).

[5] To compare the control and treatment groups' science knowledge, we performed a hierarchical linear model analysis with kids' total scores on the assessment items as the dependent variable. Because kids were nested within camps in the design, we needed to account for the fact that within a camp, the scores were likely to be more similar than they would be if kids came from different camps (measured by the intraclass correlation). To do this, we separately estimated the variation among kids' scores who attended the same camp and the variation in scores between camps.

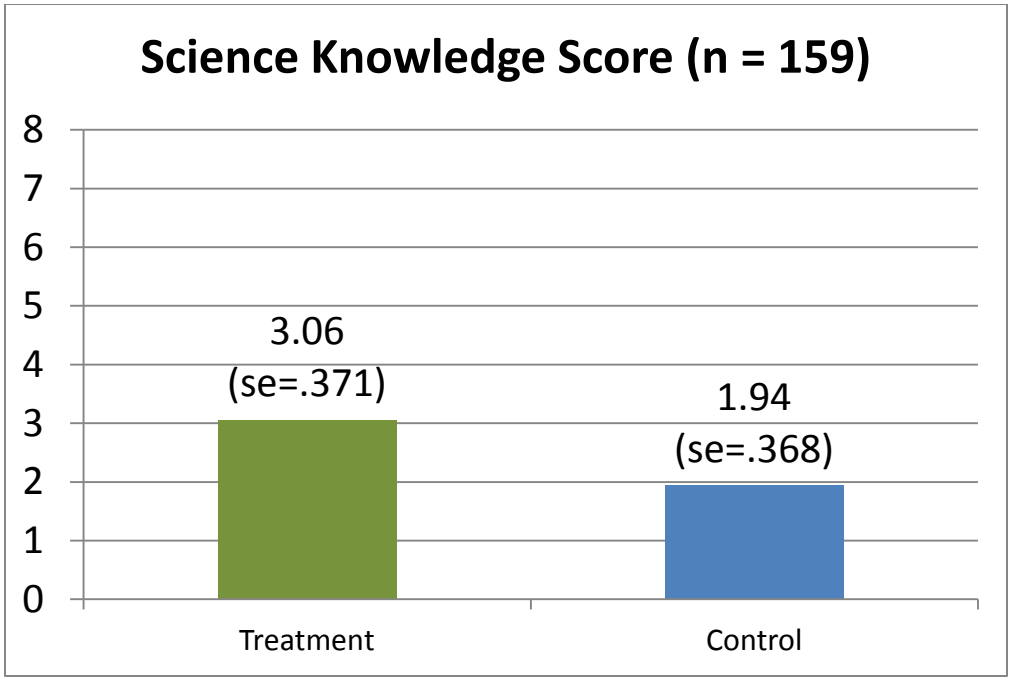


Figure 3. The treatment group kids demonstrated significantly greater science knowledge than control group kids: F (1, 12.487) = 4.692, p = .05.

In addition to this direct learning measure, we also asked kids in the treatment group to self-report what they thought they learned from the FETCH! activities. They told us they learned…

- Acid could clean stuff.
- Acids work better for copper cleanup.
- Different liquids can make different reactions.
- About acids and bases.
- Different reactions.
- About chemical reactions, electricity and other things.
- How to make pennies shiny.
- That bleach, cola and vinegar all clean pennies.
- That cola can clean a coin.
- You can clean a penny with an acid.
- That ketchup can clean pretty good.
- Ketchup can clean more than looks.
- Ketchup cleans copper.
- Ketchup cleans pennies best,
- Ketchup cleans pennies.

- Ketchup cleans.
- Ketchup is good at cleaning copper.

Several kids also told us what they learned from the Sky Diver activity:

- I learned something by making a parachute is that the bigger the bag the more air it and makes it float.
- That if you are in a parachute and want to go down first, it should be smaller.
- A trash bag work as parachutes.
- The canopy makes the parachute work.
- How to make a float.
- That to land on the ground last, make your parachute bigger.
- I learn that a parachute could float if it had more force.

Finally, some kids described what they learned more generally:

- How to make stuff that I didn't know how to make before.
- I learned a lot of things.
- I learned it's really fun.
- It was fun and I learned a lot of things.
- That it is good to try new experiences.

Treatment group camp counselors also summarized what the kids in their camp learned from the activities. Most referred to the Copper Cleanup activity in their comments:

- Copper clean up - acids and bases; sky divers - teamwork and canopy.
- Difference between a base and an acid. Creativity. About parachutes.
- Doing the copper cleanup the campers learned that multiple substances can clean a penny and they also learned the difference between acid and bases.
- How to use everyday items to solve problems. They also learned the characteristics of items and ideas they don't know about.
- Learned about levers in action figures and how to slow the falling process.
- Specifically they enjoyed the copper cleanup because it showed them how powerful and different household objects can be.
- They learned about acids and bases during copper clean up.
- They learned the difference between acids and bases.
- They worked well together in order to complete the activities in a fun environment (completely different to school).
- We learned about simple machines (levers, inclined planes), air pressure and power and chemical reactions.
- Which parachutes worked best.

Attitudes and Beliefs about Science

Evaluation Question: Will kids who tried the Camp FETCH! activities demonstrate more positive attitudes and beliefs about science than kids who did not try the activities?

We asked kids to indicate, on a scale of 1 (strongly disagree) to 5 (strongly agree) the extent to which they held the following attitudes and beliefs about science:

- Science is fun.
- Science is for nerds.
- Scientists are creative.
- Men are better scientists than women.
- It would be "cool" to be a scientist.
- I would like to be a scientist someday.
- Scientists can make a positive difference in the world.

We performed an analysis to look for difference in attitudes between the treatment and control group kids. As summarized in the table below, there were no significant differences between the treatment and control group kids—kids in both groups reported positive attitudes at the start of the study and there was little room for improvement or differentiation between the groups.

Table 4:

Kids' Attitudes toward Science

Attitude/Belief	Treatment Group Average	Control Group Average
Science is fun.	3.78 (0.961)	3.81 (1.035)
Science is for nerds.	2.04 (1.199)	2.14 (1.264)
Scientists are creative.	4.03 (1.046)	4.00 (1.089)
Men are better scientists than women.	2.09 (1.262)	2.35 (1.365)
It would be "cool" to be a scientist.	3.60 (1.127)	3.81 (1.217)

Attitude/Belief	Treatment Group Average	Control Group Average
I would like to be a scientist someday.	3.01 (1.336)	2.88 (1.127)
Scientists can make a positive difference in the world.	3.99 (0.973)	4.02 (0.976)

Counselor Outcomes

Evaluation Question: Will counselors who used the Camp FETCH! Guide demonstrate more confidence for teaching science and engineering than counselors who did not use the Guide?

We assessed counselor comfort levels by asking them to indicate their comfort with a series of 8 activities on a scale of 1 (very uncomfortable) to 5 (very comfortable) at pre-test and at post-test:

- Communicating with kids in a way they can understand
- Organizing/planning a science activity
- Leading hands-on science activities with kids
- Helping kids engage in the design and building process
- Helping kids to learn how to define a problem
- Helping kids use math and science to solve problems
- Helping kids work together to solve problems
- Helping kids understand how science, technology, engineering and math relate to their lives

We found no significant differences between camp counselors in the treatment group versus counselors in the control group with respect to their comfort leading science activities with kids. We also found no significant changes from pre-test to post-test with respect to comfort level in either the treatment or the control group.

As summarized in the table below, counselors in both groups reported being comfortable leading science activities at the outset and this did not change as a result of using the Guide. This might be due, in part, to the counselors' own backgrounds in science and education—because of their own interests they may have been more willing to participate in the study than counselors who were not as comfortable leading science activities. In fact, at pre-test and post-test, three-quarters of the counselors reported that they believed it was appropriate to teach science in a camp setting. Thus, science appears to be a subject they are comfortable discussing at camp.

Table 5:

Camp Counselors' Post-test Comfort Level Leading Science Activities

Activity	Treatment Group Average	Control Group Average
Communicating with kids in a way they can understand	4.57 (1.089)	4.75 (0.622)
Organizing/planning a science activity	3.86 (1.351)	4.17 (0.718)
Leading hands-on science activities with kids	4.14 (1.099)	4.25 (0.622)
Helping kids engage in the design and building process	4.29 (1.267)	4.50 (0.522)
Helping kids to learn how to define a problem	4.21 (1.251)	4.58 (0.515)
Helping kids use math and science to solve problems	4.00 (1.177)	4.18 (0.603)
Helping kids work together to solve problems	4.54 (1.127)	4.50 (0.674)
Helping kids understand how science, technology, engineering and math relate to their lives	4.07 (1.141)	4.33 (0.651)

Satisfaction with the Guide

Evaluation Questions: Will program participants report they are satisfied with the Guide and the activities (including counselors and kids)? Do counselors perceive a value in using the Guide in camp settings? Why or why not?

Kids

We asked kids to report whether they enjoyed the FETCH! activities. As summarized in the table below, kids' favorite activities were Action Figure and Copper Cleanup. Based on our own observations of the groups at the post-test meeting, we were not surprised to learn that kids were enthusiastic about the Copper Cleanup activity. At the camps, we observed that kids were quite excited to tell us about how surprised they were that ketchup could clean a copper penny.

Table 6:

Kids' Self-reported Enjoyment of the FETCH! Activities

Activity	Number & Percent that Enjoyed it
Action Figure: Create a Jumping Jack puppet with levers and string	40 out of 52 (77%)
Copper Cleanup: Use different liquids to clean pennies	48 out of 65 (74%)
Sky Diver: Design a parachute	29 out of 46 (63%)

We also asked counselors to report on how much their campers enjoyed the FETCH! activities. As summarized in the table below, counselors confirmed the kids' reports that one of their favorite activities was Copper Cleanup. However, the counselors thought that the kids seemed to enjoy the Sky Diver activity more than the Action Figure (which contradicts kids' own self-reports).

Table 7:

Kids' Enjoyment of the FETCH! Activities, According to Counselors

Activity	Percent of Counselors who Reported Kids Enjoyed it (N = 14)
Sky Diver: Design a parachute	11 (78.7%)
Copper Cleanup: Use different liquids to clean pennies	9 (64.3%)
Action Figure: Create a Jumping Jack puppet with levers and string	5 (35.7%)

More than one-third (37%) of the kids reported that they have done activities like the FETCH! activities in school, but 21% reported that they would rather do them at camp than at school. Another 21% reported that they would prefer to do these activities at school, while 43% reported that they would like to do these types of activities at camp and at school. Only 8% of kids reported that they would not like to do these types of activities anywhere.

Finally, we asked kids to suggest ways to enhance the activities. All of the comments included suggestions to enhance the Copper Cleanup activity:

- You could add food coloring to the clear liquids in copper cleanup.
- By not using household cleaners.
- Copper clean up should use more ingredients.
- More chemical reaction things or chemistry.
- We can try new liquids to make new reactions.

Counselors

Although we did not observe a measureable impact of the Guide on counselors' comfort level in leading science activities, most counselors did report that the Guide was helpful to them in leading the activities for the following reasons:

- Gave decent instructions to follow on how activity works.
- Gave instructions and materials.
- Great lesson plans.

- It gave structure and focus to the activities and gave simple, easy to follow instructions.
- It provided good instructions and helpful guiding questions about what we learned.
- The instructions were very clear.
- The FETCH guide helped out a lot because it let you know exactly what kind of materials you need for the activities.
- The instructions for setting up were helpful.
- We had the FETCH guide to help better understand the science terms.
- Very explanatory and informative.
- (They were) safe, fun activities and original activities for the kids.
- It was perfect. I like the science guide and experiments.
- I think the FETCH guide is perfect!

Eleven out of 14 (79%) treatment group counselors reported that they would recommend the activities to other camps. Two of the 3 remaining counselors indicated they wouldn't recommend them because they either had older kids who were not challenged by the activities or younger kids who found it difficult to understand the activities. Note that these were kids younger than 8 or older than 10 years of age (which was outside the age range we had instructed the camps to include in the activities). One other counselor did not like the activities, generally, and thought there were other science resources s/he would use at camp.

Counselors offered the following general feedback on the appropriateness of the Guide and the activities for their campers:

- The activities were appropriate because the kids are learning the same thing in school.
- They were appropriate. They enjoyed the activities and most were capable of being responsible and cautious in the activities.
- They were appropriate. They understood them and enjoyed doing them, although some activities were confusing for them.
- They were appropriate because they had the opportunity to enjoy themselves with also thinking for themselves.
- I believe they were appropriate because they were hands on, not too complex and interesting.
- They seemed to be on the right level for them. Nothing was too advanced or basic for them. Everything they did had an attainable goal for them.

Counselors offered the following feedback on two of the three activities (they made no comments about Sky Diver).

Copper Cleanup

- Copper cleanup had a lot of prep.
- Copper cleanup was a little difficult for the younger kids.
- Some also wanted to combine the chemicals over and over again on copper clean up and tempest in a teacup, creating a mess.
- The copper cleanup was appropriate, yet as a counselor leading the activity I didn't feel I was given the information to correctly and scientifically explain the results.
- The ammonia wasn't a good idea. The smell is too strong.
- Ammonia was a problem (smell).
- The ammonia in the copper clean up lab was hard for the children to work with.

Action Figure

- The science of the action figure was too "fiddly" and difficult for the campers rendering it into an arts and crafts activity.
- Was hard for the children to get the concept of levers through the action figure. Also children were easily upset because the figures did not come out right.
- Confusion during the action figures project was a problem.
- The action was a little difficult because they didn't work as well as expected.

Other Resources

Two of the six treatment group camps set-up a Camp FETCH! Club (offered an as option in the Guide). One camp offered prizes to the "best" group at the end of each activity, while the other provided prizes to all the campers who completed all the activities. The other camps indicated that they didn't have time in their schedules to add the extra work of organizing the activities into a Club format.

Two counselors reported that they sought out additional FETCH! activities online after using the Guide. One other counselor reported that she reviewed the FETCH! Hands-On Science Training online.

Control Group Feedback

After the study was finished, we asked control group counselors to review the Guide and share their feedback with us. Two of the 6 counselors responded. Neither had ever offered activities like these at their camps. They told us the Guide was:

- Very colorful, easy to read, science terms explained in a way the kids could understand and someone with non-science instruction skills could use. It's something we could incorporate in to a science week. I like that the materials are low cost; we are on a tight budget so that's something we pay attention to.
- (Contained) very neat ideas. Most of the activities are simple and fun and the kids would enjoy the end result just as much as the process.

The only concern voiced by one counselor was:

- Interest level. Many kids don't want to think about school outside of school. You would have to disguise the activities for a while until they were really engaged in them.

Suggestions

Treatment group and control group counselors reported several suggestions for improving the activities or the Guide:

- Make the activities feel less like school (3).
- Include easier activities for less advanced kids.
- Include cheaper materials.
- Have the counselors or whoever is running the activity have more experience in science or with the program. In general, maybe offer a course explaining everything before camp starts.
- In the back or front of the guide put the list of need materials so when starting a club, I can purchase all the materials ahead of time with the sheet.
- More info on explaining results.
- Bigger, more ambitious experiments which correctly portray science as a subject which can amaze and entertain children in a camp setting.
- "Theme" the activities more so that they are linked from day to day.

Chapter 3: Summary

Impact on Kids

We found evidence that kids who tried the Camp FETCH! activities demonstrated greater knowledge of science concepts (such as chemistry, gravity, and levers) than kids who did not try the activities.

When we asked kids what they learned, they were most likely to mention that they learned about acids, bases, and chemical reactions. Several kids also told us that they learned how manipulate materials to design a parachute that could fall at different speeds. Some kids made general comments about what they learned:

- How to make stuff that I didn't know how to make before.
- I learned a lot of things.
- I learned it's really fun.
- It was fun and I learned a lot of things.
- That it is good to try new experiences.

Treatment group camp counselors confirmed these statements made by the kids. They added:

- Creativity.
- How to use everyday items to solve problems.
- To work well together in order to complete the activities.

We asked kids to report whether they enjoyed the FETCH! activities. Most kids reported enjoying all of the activities and their favorite activities were Action Figure and Copper Cleanup. We also observed that kids were enthusiastic about the Copper Cleanup activity. At the camps, kids were quite excited to tell us about how surprised they were that ketchup could clean a copper penny, for example.

More than one-third (37%) of the kids reported that they have done activities like the FETCH! activities in school, but 21% reported that they would rather do them at camp than at school. Another 21% reported that they would prefer to do these activities at school, while 43% reported that they would like to do these types of activities at camp and at school. Only 8% of kids reported that they would not like to do these types of activities anywhere.

We did not see an impact of the activities on kids' attitudes and beliefs about science. Kids in both groups reported positive attitudes at the start of the study and there was little room for improvement or differentiation between the groups.

Impact on Camp Counselors

Counselors in both groups reported being comfortable leading science activities at the outset of the study and this did not change as a result of using the Guide. This might be due, in part, to the counselors' own backgrounds in science and education—because of their own interests they may have been more willing to participate in the study than counselors who were not as comfortable leading science activities.

Although we did not observe a measureable impact of the Guide on counselors' comfort level in leading science activities, most counselors did report that the Guide was helpful to them in leading the activities. Eleven out of 14 (79%) treatment group counselors reported that they would recommend the activities to other camps.

Counselors offered the following general feedback on the appropriateness of the Guide and the activities for their campers:

- The activities were appropriate because the kids are learning the same thing in school.
- They were appropriate. They enjoyed the activities and most were capable of being responsible and cautious in the activities.
- They were appropriate. They understood them and enjoyed doing them, although some activities were confusing for them.
- They were appropriate because they had the opportunity to enjoy themselves with also thinking for themselves.
- I believe they were appropriate because they were hands on, not too complex and interesting.
- They seemed to be on the right level for them. Nothing was too advanced or basic for them. Everything they did had an attainable goal for them.

Suggestions

Based on the study findings and the suggestions made by kids and counselors, we offer the following suggestions for WGBH to consider when developing future iterations of the Guide or the activities:

- Given the popularity of the Copper Cleanup activity, consider adding related activities or extension activities so that kids can further explore chemistry and chemical reactions.

- Given the strong objection to ammonia, WGBH may want to consider removing ammonia from the list of suggested materials for any activity.

- WGBH may want to consider offering a single and complete "shopping list" for individuals that want to purchase materials for all the activities in the Guide at one time.

- WGBH may want to consider adding optional items or materials to the suggested list of materials in cases where they are a little more expensive (such as pH strips).

Appendix A: FETCH! Activities

Action Figure

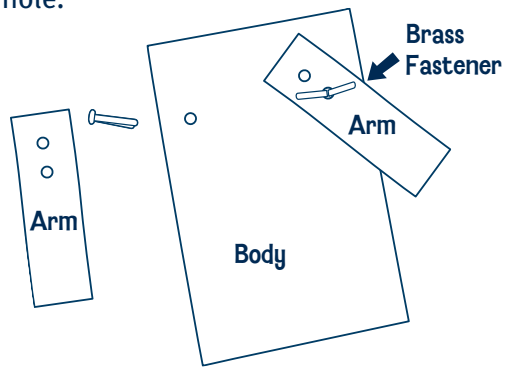
Create a Jumping Jack puppet with levers and string. Then make it dance!

1 Get what you need.
- 1 rectangle of thin cardboard (5" x 8")
- 2 3" x 5" index cards cut in half lengthwise
- hole punch • 4 brass fasteners • string
- scissors • construction paper • tape or glue
- markers

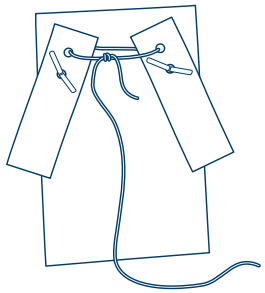
2 Make arms. With a hole punch, make two holes near the top of one of the index card strips, as shown. Leave about a half-inch between the holes. Do the same to a second strip.

3 Make armholes on the body. Punch a hole on each side of the cardboard rectangle, about two inches down from the top, one on each side.

4 Attach the arms. Use brass fasteners to attach the arms to the body. Be sure to use the **lower** armhole.



5 Add string. Pull the arms down against the body. Loop string through the top holes on the arms and tie, letting the extra string hang down. Pull on the string. What happens? You've just created two levers. The brass fasteners are the fulcrums—the point on which the levers rotate.



6 Add legs. Create legs the same way you made the arms.

7 Connect arms and legs. How can you attach a string to both the arms and legs to make them move at the same time?

8 Add personality! Once the arms and legs are working, it's time to get creative. Use markers and construction paper to make a character of your own. Punch a hole at the top and add a loop of string to make it easy to hold.

Chew on This!

A lever is a bar that's attached to a pivot (turning point) called a fulcrum. You use a lever when you flush a toilet, paddle a boat, or cut with scissors—they're everywhere! Some are good at moving something heavy—a crowbar, for example, can pry open a door that's stuck. Levers can also make something move fast—a baseball bat hitting a ball, for instance, or a catapult hurling a stone.

Dig Deeper

Take it outside. Make another action figure, decorating it with materials found in nature—you might try acorn eyes, pine-needle hair, a leaf jacket, and bark pants.

Jack-of-all-trades. Create a Jumping Jack puppet where the levers are NOT arms or legs. Can you use levers to make a tail that wags, ears that flap, or wings that fly? Can you make a Ruff or Blossom action figure?

Did You Know?

The Jumping Jack is an old fashioned mechanical toy. In Germany, it was called a Hampelmann. Made of wood, these dancing puppets were often clowns, jesters, or animals. Lots of mechanical toys from the past have hilarious names. There's the Whirligig (a wind-powered spinning toy), the Flipperdinger (which suspended a ball in a stream of air), and the Gee Haw Whimmy Diddle (a propeller toy).

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FETCH!

Action Figure

Check out the Ruff toy I made. He dances! He leaps! He's got team spirit! He's Rufftastic! Who needs a store-bought action figure when you can customize your own? Now it's your turn. Use your toy-making talents to create a super hero, an alien, or a mini-you!

Copper Cleanup

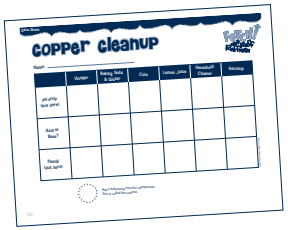
In this crazy cleaning experiment, can you make pennies sparkle with . . . ketchup? . . . baking soda? . . . or cola?

1 Get what you need.
• 7 dull pennies • 6 cups • a spoon • 3 spoonfuls of vinegar • 3 spoonfuls of cola • 3 spoonfuls of lemon juice • 2 spoonfuls of baking soda and some water • 3 spoonfuls of household cleaner with ammonia • 3 spoonfuls of ketchup • paper towels • bowl or cup of water for rinsing • 6 strips of pH paper • data sheet (see below)

2 Add pennies. Line up the cups in front of the data sheet and put a penny in each cup. Place the extra penny on the sheet—it's known as a "control." You'll use it later to compare with the others.

3 Add liquids. In each cup, put enough of each liquid to cover the penny: household cleaner, baking soda and water, vinegar, lemon juice, cola, and ketchup.

4 Make a prediction. Let the pennies sit for at least five minutes. Which liquids do you think will shine the pennies the best?


Copper Cleanup

Data Sheet
Use separate data sheet to record your observations.

5 Test for more information.
While you wait, find out more about your liquids. Using pH paper, discover if each is an acid or a base.
- Dip one end of a pH paper strip in the first cup: If it turns reddish, it's an acid; if it turns bluish-green, it's a base.
- Place the strip on your data sheet and write down whether the liquid is an acid or a base.
- Repeat these steps with each liquid and a fresh strip of pH paper.

6 Check pennies. Use a spoon to remove the penny from the first cup. Rinse it in water and dry it. Then place it on the data sheet. Repeat with the other pennies. Keep your hands as clean as possible.

7 Draw conclusions. Look at your control penny and compare it to the others. How do the other pennies look in comparison? Which liquids shined the pennies the best? Can you tell if one type of liquid—acid or base—did the best job?

Chew on This!

Pennies are made with copper. After they've been exposed to air for a while, a dull coating of copper and oxygen, called copper oxide, forms on them. When some acids (like the ones you used) come in contact with copper, there's a chemical reaction that dissolves the copper oxide, making the penny shiny again. But the bases you tested left the pennies looking dull. Bases don't cause a chemical reaction with copper (or any metal), so they can't dissolve copper oxide.

Safety Tip

Keep mixtures away from clothes, eyes, and mouth. No tasting!

Dig Deeper

Speed cleaning. Want to shine your pennies even faster? Add a spoonful of salt to vinegar or lemon juice. Swirl a penny around in the mix and watch it shine up before your eyes.

Copper coating. Use copper from pennies to coat another object. Put about ten dull pennies in a cup with a vinegar and salt mix. After a few minutes, remove the pennies, but keep the liquid. Add a steel nail or paper clip. Wait about 10 minutes to a half hour. The copper oxide from the pennies will transfer to the nail or paper clip, changing its color.

Did You Know?

Pennies haven't been made of pure copper since 1857. Today, most are made of zinc with a copper coating. Since 2007, it has cost more than a penny to make a penny—$1.00 in pennies is now made from $1.67 in metals.

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Copper Cleanup

Ahoy, mateys! I be wantin' to play pirate, but alas, me only treasure is a handful o' dull, pitiful pennies—an insult to a swashbuckling seadog like meself! Yer cap'n commands ye to shine 'em up to look like gold doubloons. Make haste, or I'll have ye walkin' the plank!

Copper Cleanup

Name: _____

	Vinegar	Baking Soda & Water	Cola	Lemon Juice	Household Cleaner	Ketchup
pH strip (put here)						
Acid or Base?						
Penny (put here)						

Place dull penny here for comparison.
This is called the control.

Sky Diver

Design a parachute that floats safely to the ground—no crash landings allowed!

1 Get what you need.

• 10" squares of: lightweight plastic (like clear bags from the grocery store) • heavyweight plastic (like thick trash bags) • tissue paper • notebook or copier paper • 8" pieces of string or thread (4 per parachute) • scissors • clear tape • large paper clips

2 Test your materials.

Compare the different types of materials and pick the one you think will make the best parachute. What are some tests you can do to decide which material to use?

3 Make a parachute.

Tape string to each corner of the parachute—try to use even lengths of string. Then tape the ends together around a large paper clip.

4 Float it.

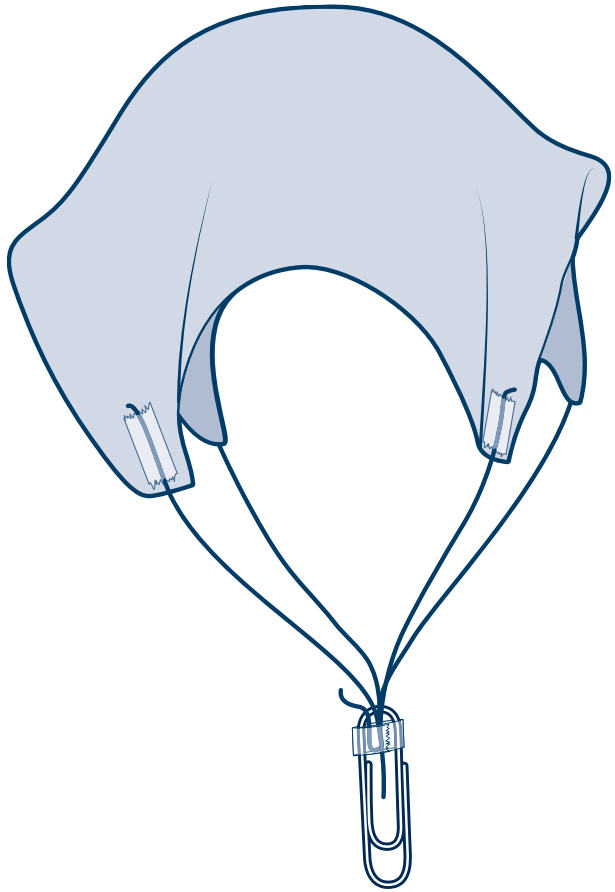
Hold up your parachute and drop it. What happens as it falls to the ground?

5 Design and test another parachute.

Select a different material and make another parachute. Compare how it falls with the parachute you made earlier.

6 Make it big!

Make a parachute at least double the size of the others you made. What adjustments do you need to make to get the bigger parachute to work?



Chew on This!

When you throw something into the air, it falls because gravity pulls it to the ground. As a parachute falls, the part that fills with air is called the canopy. A parachute works because air gets trapped in the canopy and slows its fall. This is the result of air resistance—the force of the air against the canopy.

Dig Deeper

Take it outside. Test your parachute on a windy day. What difference does the wind make?

Super-size it! Can you make a really big parachute—so big, it's super-sized? Using what you know about making a parachute, make one that's big enough to float safely when dropped from a significant height, like in an open stairwell or out a window. If necessary, get permission first before dropping your extra-large parachute!

Did You Know?

In August 1960, Joseph Kittinger set the record for the highest parachute jump. He jumped from a height of 102,800 feet—three times higher than most planes fly! He was so high up, he had to wear a special pressurized suit to stay safe. As he fell, Kittinger hit a top speed of 614 mph! He landed safely in a desert in New Mexico and his record still stands today.

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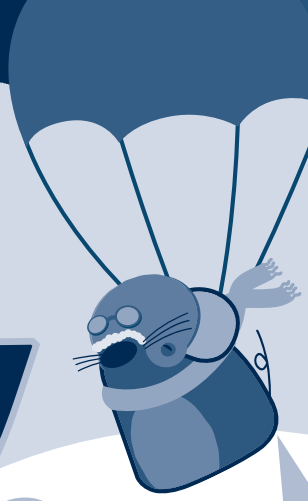
Fold

FETCH!



sky Diver

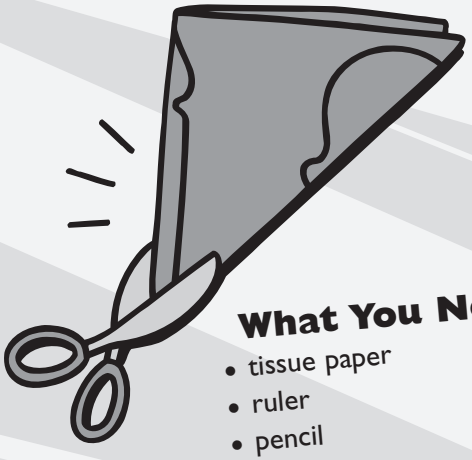
Chet's last hobby was fire ant juggling—he lost a few whiskers in that experiment! Now he wants to try sky diving, and there's no stopping him! Can you design a parachute to keep my little buddy safe?

GOOO FETCH!

Appendix B: ZOOM Activities

Papel Picado

Papel Picado means **"pierced paper"** in Spanish. In Mexico, artists use special tools to **pierce** through many layers of paper at once. They design Papel Picado banners to **celebrate holidays**.



What You Need

- tissue paper
- ruler
- pencil
- scissors
- 6-foot piece of string or yarn
- glue stick

1 Use a pencil and ruler to **draw** a 12-inch by 12-inch square on a piece of tissue paper. **Cut** out the square.

2 Fold the square in half to make a triangle. **Fold** it in half again and then one more time to make a smaller triangle.

3 Think of symbols that stand for the holiday you are celebrating. For example, if your Papel Picado is for your **birthday**, you can use candles and balloons.

4 Draw half of each symbol on the **folded edges** of your triangle. Leave space between each of your symbols.

5 Cut out your symbols and **open** the tissue paper.

Sent in by Ricardo and Jessica C. of TX

ZOOMon

You can make a **banner** of four or five Papel Picado squares. First **cut** a piece of yarn or string about six feet long. Then **put** glue along the tops of the squares. **Fold** the top edges over the yarn. **Leave** an inch of space between each square. **Leave** about six inches at each end. Ask an adult to help you **hang up** your banner.

Rubber Band Stamps

1 Cut the rubber bands into different sizes. Tape them to the cardboard in a cool design. Make sure the rubber band pieces don't overlap.

2 Color the rubber bands with markers or press them into the ink from your stamp pad. Then stamp away. Try making a border around a piece of paper or stamp the whole sheet—use your imagination!

Join the STAMPede. Send your stamped stationery to ZOOM.

ZOOMdo™

What You Need

cardboard • scissors • rubber bands • double-sided tape • stamp pads with washable ink or washable markers • paper (to stamp on)

Sent in by Becca S. of Livingston, NJ

If you want to make letters of the alphabet, make sure you tape the letter on backwards, so when you stamp it, it prints forwards.

Try It Out!

ZOOMon™

Now that you've made your rubber band stamp, try using rubber bands of different sizes to create a different design. What other materials can you use to create a stamp? Try using different vegetables or carving an eraser or styrofoam.

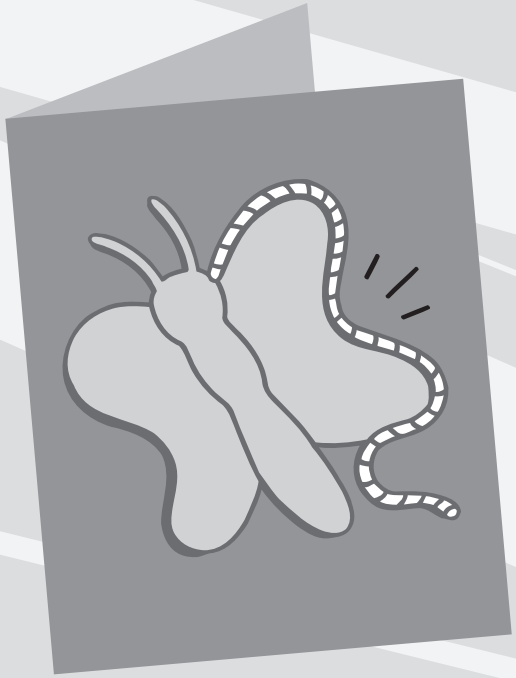
Yarn Cards

ZOOMdo™

What You Need

- construction paper or poster board
- pencil
- white glue
- scissors
- yarn (many colors)

Draw a picture with yarn!



1. **Fold** your paper in half to make a card.
2. Use your pencil to **draw** a simple design, like a butterfly or a house, on the front of the card.
3. **Trace** over part of your drawing with glue.
4. **Cut** a piece of yarn and stick it to the glue. Keep adding glue and yarn until you have **covered** all the lines. You can also use yarn to **fill** in the spaces inside the lines.
5. Let the glue **dry**.
6. **Write** a message inside and give it to a friend!

Sent in by Philippa of Ontario, Canada

ZOOMon™

What other things can you glue to your card to decorate it? You might want to use **felt, beads, or pipe cleaners**. Write to ZOOM at **pbskids.org/zoom** and tell us how you decorated your card.

Appendix C: Kids' Survey Items

Kids' Survey Items

[Pre-test both groups, Post-test treatment group only] Please check a box in each row to tell us how much you agree or disagree with each sentence:

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
1. Science is fun.	☐	☐	☐	☐	☐
2. Science is for nerds.	☐	☐	☐	☐	☐
3. Scientists are creative.	☐	☐	☐	☐	☐
4. Men are better scientists than women.	☐	☐	☐	☐	☐
5. It would be "cool" to be a scientist.	☐	☐	☐	☐	☐
6. I would like to be a scientist someday.	☐	☐	☐	☐	☐
7. Scientists can make a positive difference in the world.	☐	☐	☐	☐	☐

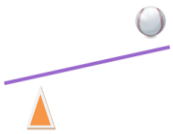
Now, we need your help solving some science problems. Please do your best:

8. **[Pre-test both groups, Post-test treatment group only]** Tom and his friends are going to jump out of an airplane using parachutes. Tom wants to be the first one to land on the ground. What should he do?

    a. Make his parachute bigger
    b. Make his parachute smaller
    c. Make his parachute thicker
    d. Make his parachute more colorful

9. **[Pre-test both groups, Post-test treatment group only]** What is the name of the force that makes parachutes fall to the ground instead of staying in the air?

10. **[Pre-test both groups, Post-test treatment group only]** Cindy made a ball launcher. Please circle the **fulcrum** on the ball launcher below:



11. **[Pre-test both groups, Post-test treatment group only]** Name two things that are made with or use levers.

    a. _____
    b. _____

12. **[Pre-test both groups, Post-test treatment group only]** Sean found some old copper pots and pans and he wants to make them shiny again. Which one of these items would help him the most?

    a. Water
    b. Soap
    c. Cola
    d. Ketchup

13. **[Pre-test both groups, Post-test treatment group only]** Please explain why:

14. **[Post-test control group only]** How much did you enjoy each of the following activities? **Place a check in the box that tells us how much you liked each activity.**

	I Loved It	I Liked It	I Liked It Only a Little	I Did Not Like It at All	I Didn't Do the Activity
Papel Picado: Make a banner from pierced paper	☐	☐	☐	☐	☐
Rubber Band Stamps: Make a stamp with rubber bands and a stamp pad or markers	☐	☐	☐	☐	☐
Yarn Cards: Make cards with paper and yarn	☐	☐	☐	☐	☐

15. **[Post-test treatment group only]** How much did you enjoy each of the following activities? **Place a check in the box that tells us how much you liked each activity.**

	I Loved It	I Liked It	I Liked It Only a Little	I Did Not Like It at All	I Didn't Do the Activity
Action Figure: Create a Jumping Jack puppet with levers and string	☐	☐	☐	☐	☐
Copper Cleanup: Use different liquids to clean pennies	☐	☐	☐	☐	☐
Sky Diver: Design a parachute	☐	☐	☐	☐	☐

16. **[Post-test both groups]** Do you ever do these kinds of activities at school?

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

17. **[Post-test both groups]** Would you rather do these kinds of activities at camp or at school?

    a. I'd rather do these activities at school
    b. I'd rather do these activities at camp
    c. I like doing these activities at camp AND school
    d. I don't like doing these activities anywhere

18. **[Post-test both groups]** What did you learn from these activities, if anything?

19. **[Post-test treatment group only]** How can we make the activities better?

20. **[Pre- and post-test both groups]** Are you

    a. Male
    b. Female

21. **[Pre- and post-test both groups]** How old are you? _____

22. **[Pre- and post-test both groups]** What grade will you be in this fall? _____

23. **[Pre- and post-test both groups]** Which of the following best describes you? **(Circle all that apply)**

    a. White or Caucasian
    b. Hispanic, Latino, or Spanish
    c. Black or African-American
    d. Asian
    e. American Indian or Alaskan Native
    f. Native Hawaiian or Other Pacific Islander

Appendix D: Counselors' Survey Items

Counselors' Survey Items

[Both groups, pre-test and post-test] How comfortable are you doing the following?

	Very Comfortable	Somewhat Comfortable	Neutral	Somewhat Uncomfortable	Very Uncomfortable
1. Communicating with kids in a way they can understand	□	□	□	□	□
2. Organizing/planning a science activity	□	□	□	□	□
3. Leading hands-on science activities with kids	□	□	□	□	□
4. Helping kids engage in the design and building process	□	□	□	□	□
5. Helping kids to learn how to define a problem	□	□	□	□	□
6. Helping kids use math and science to solve problems	□	□	□	□	□
7. Helping kids work together to solve problems	□	□	□	□	□
8. Helping kids understand how science, technology, engineering and math relate to their lives	□	□	□	□	□

9. **[Both groups, pre-test and post-test]** In your opinion, which of the following types of activities are appropriate to do in a camp setting? **(Circle all that apply)**

   a. Arts and crafts
   b. Sports
   c. Science
   d. Math
   e. Reading
   f. Other: _____

10. **[Treatment group only, post-test]** How much did your campers enjoy each of the following activities? **Place a check in the box that tells us how much the group liked each activity.**

	They Loved It	They Liked It	They Liked It Only a Little	They Did Not Like It at All	We Didn't Do the Activity
Action Figure: Create a Jumping Jack puppet with levers and string					
Copper Cleanup: Use different liquids to clean pennies					
Sky Diver: Design a parachute					

11. **[Control group only, post-test]** How much did your campers enjoy each of the following activities? **Place a check in the box that tells us how much the group liked each activity.**

	They Loved It	They Liked It	They Liked It Only a Little	They Did Not Like It at All	We Didn't Do the Activity
Papel Picado: Make a banner from pierced paper					
Rubber Band Stamps: Make a stamp with rubber bands and a stamp pad or markers					
Yarn Cards: Make cards with paper and yarn					

12. **[Both groups, post-test]** What did your campers learn from these activities, if anything?

13. **[Treatment group only, post-test]** Were the activities appropriate for the kids in your camp? Why or why not?

14. **[Treatment group only, post-test]** Did you set-up a FETCH! Club, with membership cards, points, stickers, or a celebration or prize, etc.? Please tell us how you set-up the Club:

15. **[Treatment group only, post-test]** What problems, if any, did you encounter?

16. **[Treatment group only, post-test]** Before this summer, had you ever offered these kinds of activities at camp?
    a. Yes
    b. No
    c. I don't know
17. **[Treatment group only, post-test]** Would you recommend these activities to other camps?
    a. Yes, definitely
    b. Yes, probably
    c. No, probably not
    d. No, definitely not

18. **[Treatment group only, post-test]** If not, why not?

19. **[Treatment group only, post-test]** In what ways did the Camp FETCH! guide help you, if at all, to lead the activities?

20. **[Treatment group only, post-test]** Did you use any of the online resources? If so, which ones? **(Circle all that apply)**
    a. Finding leader notes and activity sheets for other FETCH activities
    b. The FETCH Hands-On Science Training
    c. Watching FETCH episodes
    d. Playing FETCH games online
    e. Other: _____
    f. None

21. Which of the following activities, if any, are you likely to try at your camp in the future? **(Circle all that apply)**
    a. A one-time FETCH! activity
    b. A FETCH! Week, with one activity a day
    c. A day-long FETCH! Festival, featuring many activities
    d. A weekly series of activities (e.g., a different FETCH! activity every Thursday)
    e. A two-day activity (e.g., making ice cream the first day; inventing different ice cream flavors the next)
    f. None of these. Please explain: _____

22. How can we make the activities or the Camp FETCH guide better for other camps?