2010

"*FETCH!*" Season 5 Summative Evaluation: Teaching Math through Television

Prepared by:

Concord Evaluation Group, LLC

Prepared for:

WGBH, in support of National Science Foundation Grant #0813513

Citation

Paulsen, C.A. & Bransfield, C.P. (2010). "*FETCH!*" Season 5 Summative Evaluation: Teaching Math through Television. In support of National Science Foundation Grant No: 0813513. Concord, MA: Concord Evaluation Group, LLC.

Support for this Study

This research was performed on behalf of WGBH, with funding from the National Science Foundation (NSF 0813513).

Contacts

For questions or more information about the **evaluation study**, please contact:

Christine Andrews Paulsen, Ph.D.

Owner and Principal Research Scientist

Concord Evaluation Group, LLC

PO Box 694

Concord, MA 01742

978.369.3519

cpaulsen@concordevaluation.com

For questions or more information about ***FETCH!* with Ruff Ruffman**, please contact:

Susan Buckey

Outreach Project Director

WGBH

One Guest Street

Boston, MA 02135

617.300.3958

susan_buckey@wgbh.org

Table of Contents

Background

Objectives

In the spring of 2010, WGBH Boston (wgbh.org) delivered twenty new episodes for the television series *FETCH! with Ruff Ruffman* (pbskids.org/*FETCH!*/). These episodes, developed for *FETCH!*'s fifth season, reflected a broadening of *FETCH!*'s stem content to include more mathematics. Rather than focusing exclusively on science and engineering, as *FETCH!* had done in the first four seasons, Season 5 episodes also highlighted age-appropriate math skills and concepts.

Figure 1. The *FETCH!* home page.

WGBH was interested in assessing the extent to which kids learned math concepts and skills from these episodes. WGBH hired Concord Evaluation Group (CEG) to evaluate the effectiveness of a selection of four episodes from the *FETCH!* Season 5 lineup. *CEG's main study objective was to test the hypothesis that kids who watched the episodes would demonstrate significantly greater learning about math concepts and skills than kids who did not watch the episodes.*

Study Design

This study took place in the summer and early fall of 2010, and the sample included summer camps, Girl Scout troops, and afterschool programs. We used a randomized block design. Of the 16 sites in our sample, eight were randomly assigned to the treatment condition and eight were randomly assigned to the control condition. The study design is illustrated below:

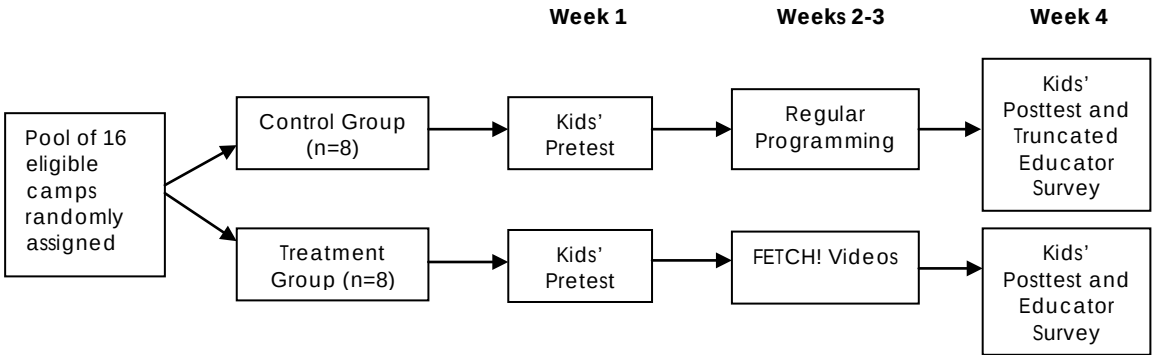


Figure 2. Randomized block design.

As illustrated in Figure 2, kids in both groups completed a pretest survey at the start of the study. After receiving the completed surveys, we mailed DVDs containing the four episodes to the treatment group sites. Treatment group sites (camp leaders/educators) were instructed to show the episodes to the same group of kids over a period of two to three weeks. Control group sites were instructed not to do anything differently than their normal programming. After all treatment group sites completed watching the episodes, kids in both groups (treatment and control) completed a posttest survey. In addition, the treatment group educators also completed a survey to gather their opinions about the effectiveness of the episodes.

As an incentive to participate, all sites received a donation of $100. Additionally, after completing the posttest surveys, control group sites were allowed to keep the DVDs with the four episodes as a token of appreciation.

Participants

To recruit participants for the study, WGBH sent notices about the study to national-level contacts at organizations such as the National Afterschool Association, Girl Scouts, Boys & Girls Clubs, and library associations. Sites that were interested in participating in the study were screened for eligibility.

Sixteen sites were selected into the study in order to maximize diversity across geographic regions, urbanicity, aggregate income level of the program participants, and race/ethnicity distribution of the participants.

We created matched pairs of sites (matched with respect to geographic location, 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.

Despite recruiting 16 sites, several sites dropped out of the study and were replaced with other, similar sites. The final sample included eight control group sites and seven treatment group sites. The sample characteristics are summarized in Table 1. The overall sample contained

slightly more females than males. The sample mirrored fairly closely, the racial and ethnic breakdown of the general US population. However, kids in the treatment group sample were significantly less likely to report that they were African-American and more likely to report they were Hispanic. Kids in the treatment group were significantly older than the kids in the control group, and were more likely to report that they were Asian. We controlled for these differences in our analyses.

The sample was relatively evenly split between low and moderate income families. There were very few high income families in the sample. Most were located in urban settings. According to the educators, they expected the kids to be receptive to learning about math at camp.

Despite our explicit instructions to sites to only include kids between the ages of 8 and 10 in the study, most sites included kids outside (in some cases, well outside) of the prescribed age range. Among the 329 kids in the sample, the kids' ages ranged from 5 to 16 years old. Sites explained that in informal settings, like summer camps, it was often difficult or impossible to prevent the kids outside the prescribed age range from participating. *For analytic purposes, we have removed the kids who are younger than 8 or older than 10.* This resulted in a total sample size of 255 kids.

Table 1:

Kids' Characteristics

Characteristic	Treatment Group (n = 92)	Control Group (n = 163)	TOTAL (N = 255)
Gender			
Male	35 (38.0%)	54 (33.1%)	89 (34.9%)
Female	57 (62.0%)	109 (66.9%)	166 (65.1%)
Race / ethnicity			
White	55 (59.8%)	83 (50.9%)	138 (54.1%)
Black or African-American	12 (13.0%)	55 (33.7%)	67 (26.3%)**
Hispanic, Latino or Spanish origin	19 (20.7%)	16 (9.8%)	35 (13.7%)*
Asian	12 (13.0%)	6 (3.7%)	18 (7.1%)**
American Indian, Alaskan Native, Native Hawaiian or Other Pacific Islanders	3 (3.3%)	6 (3.7%)	9 (3.5%)
Aggregate family income (according to the educators)			
Average proportion of families that are low income	44%	46%	45%

Characteristic	Treatment Group (n = 92)	Control Group (n = 163)	TOTAL (N = 255)
Average proportion of families that are middle income	49%	48%	48%
Average proportion of families that are high income	7%	7%	7%
Location (by site, not by child)			
Urban	5 (62.5%)	3 (42.9%)	8 (53.3%)
Suburban	2 (25.0%)	3 (42.9%)	5 (33.3%)
Rural	1 (12.5%)	1 (12.3%)	2 (13.3%)
Perceived interest in learning about math at camp (according to the educators)			
Average interest level (scale of 1 "Not at all" to 5 "Very interested") and standard deviation	3.57 (.369)	3.75 (.366)	3.67 (.976)
Age (in years)			
Average age (standard deviation)	9.37 (.794)	8.82 (.769)	9.02 (.820)**

Note: Participants could choose more than one race / ethnicity.
* Difference between the groups is significant at the p < .05 level.
** Difference between the groups is significant at the p < .01 level.

The educators' demographic and background characteristics are summarized in Table 2. All of the educators were female. Most of the educators were white (73%) or Black (27%). Six of the 15 educators reported they had earned a high school diploma or a two-year degree, four reported they had a four-year degree, and four indicated they had advanced degrees. All of the educators reported having experience leading math activities with kids.

Table 2:

Educators' Demographic and Background Characteristics

Characteristic	Treatment Group (n = 7)	Control Group (n = 8)	TOTAL (N = 15)
Gender			
Female	7 (100%)	8 (100%)	15 (100%)
Race / ethnicity			
White	4 (57.1%)	7 (87.5%)	11 (73.3%)
Black or African-American	1 (14.3%)	3 (37.5%)	4 (26.6%)
Hispanic, Latino, or Spanish origin	1 (14.3%)	0 (0.0%)	1 (6.7%)
Asian	1 (14.3%)	0 (0.0%)	1 (6.7%)
Education level (n = 14)			
High school diploma or GED	1 (14.3%)	3 (42.9%)	4 (26.7%)
Associate's degree	1 (14.3%)	1 (12.5%)	2 (13.3%)
Bachelor's degree	4 (57.1%)	0 (0.0%)	4 (26.7%)
Master's degree	0 (0.0%)	3 (42.9%)	3 (20.0%)
Doctoral degree	1 (14.3%)	0 (0.0%)	1 (6.7%)
Missing	1 (14.3%)	0 (0.0%)	1 (6.7%)
Experience leading math activities with kids			
Yes	7 (100%)	8 (100%)	15 (100%)
Number of years working with kids			
Average (standard deviation)	12.13 (8.202)	14.00 (7.047)	13 (7.474)

Note: Participants could choose more than one race / ethnicity.

We asked educators to self-report on their own attitudes toward math on a scale of 1 "Strongly disagree" to 5 "Strongly agree." Educators reported very positive attitudes toward math. Their responses are summarized in Table 3 below.

Table 3:

Educators' Attitudes toward Math

	Treatment Group	Control Group	Total
I am good at math.	3.75 (.453)	4.29 (.286)	4.00 (1.069)
Math is important in everyday life.	4.63 (.183)	4.71 (.184)	4.67 (.488)
I enjoy using math.	4.00 (.378)	4.43 (.297)	4.20 (.941)
Math can be fun.	4.13 (.350)	4.57 (.202)	4.33 (.816)
Total average (standard deviation)	**16.50 (1.239)**	**18.00 (.817)**	**17.20 (2.956)**

Findings

Attitudes toward Math

We asked kids to report their level of agreement with a series of statements about math on a scale of 1 (strongly disagree) to 5 (strongly agree). Most kids in both groups reported fairly positive attitudes toward math. Average ratings for each of the statements, by group, are summarized in Table 4.

Table 4:

Kids' Attitudes toward Math

Attitudes	Control Group Averages (Standard Deviation) (n = 140)		Treatment Group Averages (Standard Deviation) (n = 88)	
	Pretest	Posttest	Pretest	Posttest
I am good at math.	4.17 (1.064)	4.08 (1.083)	3.86 (1.116)	4.01 (1.105)
Math is important in everyday life.	4.16 (1.056)	4.24 (0.916)	4.38 (0.983)	4.54 (0.913)
I enjoy using math.	3.99 (1.192)	3.94 (1.048)	3.91 (0.892)	4.00 (0.821)
Math can be fun.	4.11 (1.016)	4.03 (1.200)	4.00 (1.112)	4.08 (1.059)
Average (standard deviation)	**4.14 (.079)**	**4.07 (.081)**	**4.04 (.081)**	**4.17 (.073)**

To explore differences between the two groups with respect to attitudes, we performed a hierarchical linear model analysis. We included the 4-item overall attitude score[1] as the dependent variable, with time (pretest and posttest) as the repeated measure and group assignment (treatment versus control), group assignment as the fixed effect, plus the interaction term (group assignment by time).[2] The repeated measures were modeled with a compound symmetry covariance structure, which means that the residual variation in student scores within the same sites are considered independent for different kids, but correlated across the two time points for each kid. This accounts for the fact that some kids, both pre- and posttest scores are higher than for other kids, even within the same site and treatment condition.

[1] The four items together yielded an internal reliability coefficient (alpha) of .69. Alpha speaks to the reliability of the instrument or scale. The higher the coefficient, the more reliable the scale.

[2] Single-item constructs are more generally not as reliable as constructs that are measured with multiple items. See Gliem, J.A. & R.R. Gliem (2003). Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales. Paper presented at the 2003 Midwest Research to Practice Conference in Adult, Continuing, and Community Education.

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

For Time *k* for Kid *i* in Site *j*

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

Likewise, because kids were nested within sites in the design, we needed to account for the fact that within site, the scores were likely to be more similar than they would be if kids came from different classes (measured by the intraclass correlation). To do this, we separately estimated the variation among kids' scores who have the same educator (σ^2) and the variation in scores between educators (τ_{00}) (even within the same group assignment). In this case, the ICC accounted for approximately 8.7% of the variance in kids' attitude scores. That is, 8.7% of residual variation in kids' scores comes from being from the same site.

Table 5:

Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	17.090	2314.333	.000
Time	1	202.926	.164	.686
Group Assignment	1	17.090	.014	.906
Time by Group Assignment	1	202.926	4.355	.038

As shown in Table 5, the interaction term was significant ($F_{(1, 202.296)} = 4.355$, $p = 0.038$). Although most kids in both groups reported fairly positive attitudes toward math from the start, the treatment group demonstrated significantly greater gains in attitude scores than did the control group. The control group kids' scores decreased from 4.14 to 4.07, while the treatment group kids' scores increased from 4.04 to 4.17.

As demonstrated in Figure 3, however, the computed effect size suggests that while the difference between the groups was statistically significant, the difference between the groups as still fairly small ($d = .08$).

Recognizing that the treatment group sample differed in some key ways from the control group sample, we also ran a model that controlled for age as well as models that controlled for whether students were African-American, Hispanic, or Asian. We wanted to be sure that the significant difference between the groups was attributable to the intervention and not age or ethnic differences.

We found that age was not a key factor in the changes in attitudes between the groups. In other words, controlling for age, we found the treatment group still had significantly better attitudes toward math at posttest than did the control group ($F_{(1,202.805)} = 4.340$, $p = .038$). We also found

that differences in race/ethnicity between the groups were not key factors. Controlling for ethnicity (specifically, African-American) we found the treatment group still had significantly better attitudes toward math than the control group at posttest ($F_{(1,202.805)} = 4.340$, $p = .038$). Likewise, controlling for Hispanic and Asian identification, we found that the treatment group still had better attitudes at posttest than did the control group ($F_{(1,202.347)} = 4.572$, $p = .034$; $F_{(1,202.887)} = 4.391$, $p = .037$, respectively).

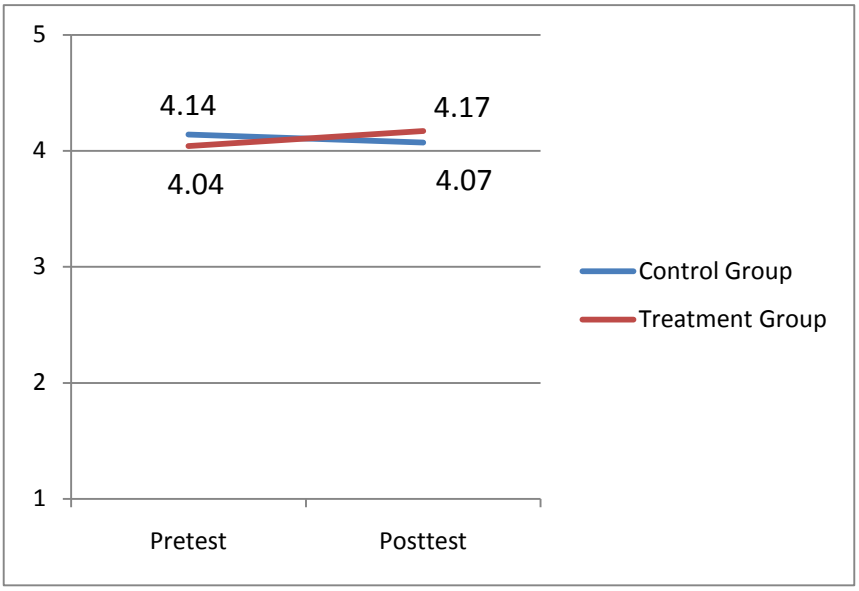


Figure 3. Pretest and posttest average attitude scores for both groups (Effect size *d* = .08).

Thus, we are confident in stating that there is evidence that the *FETCH!* episodes were able to enhance kids' attitudes toward math. Although, given the small effect size, it is likely that there are other factors related to attitudes that we haven't considered—such as, for example, parental attitudes or peer attitudes. These variables were not included in this study, but might be considered in future studies of this type.

Learning Math and Science

To measure learning, we administered a set of eight questions (see items 1, 3-9 in the Student Survey in Appendix A) that were a mix of math and science content and procedural knowledge questions.[3] Kids could earn total test scores between 0 and 18 points.[4]

We performed a hierarchical linear model analysis, as described above, to explore differences between the two groups with respect to learning. We included the test score as the dependent

[3] Even though the new episodes were designed to place a greater emphasis on math, some science constructs are still covered in the episodes.
[4] Internal consistency coefficient (alpha) = .63.

variable, with time (pretest and posttest) as the repeated measure and group assignment (treatment versus control), group assignment as the fixed effect, plus the interaction term (group assignment by time).[5]

Table 6:

Type III Tests of Fixed Effects

Parameter	Numerator df	Denominator df	F	Sig.
Intercept	1	18.368	814.338	.000
Time	1	211.606	18.173	.000
Group Assignment	1	18.368	5.098	.036
Time by Group Assignment	1	211.606	4.883	.028

The treatment group demonstrated greater gains in test scores than did the control group; scores for kids in the control group rose from 8.72 on the pretest to 9.10 on the posttest, while for kids in the treatment group, scores increased from 9.21 to 11.28 ($F_{(1, 211.606)} = 4.883$, $p = 0.028$). This relationship is also summarized in Figure 4 below. As we found with our attitudes analysis, the computed effect size suggests that while the difference in test scores between the groups was statistically significant, the difference between the groups were actually relatively small ($d = .10$).

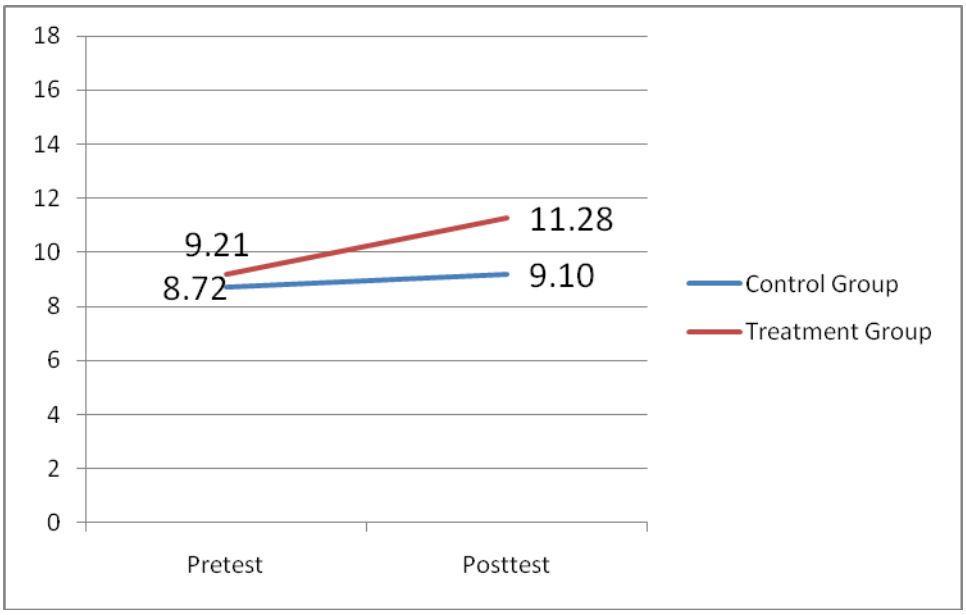


Figure 4. Pretest and posttest average test scores for both groups (Effect size *d* = .10).

[5] The intraclass correlation = 13.24%

As with our analysis of the attitude data, we found that the group differences in age was not a key factor in explaining the different test scores between the groups. In other words, controlling for age, we found the treatment group still outperformed the control group ($F_{(1,213.837)} = 5.027$, $p = .026$). We also found that the difference in the proportion of African-American kids between the groups was not a key factor. Controlling for ethnicity (specifically, African-American) we found the treatment group still had significantly better attitudes toward math than the control group ($F_{(1,211.889)} = 4.909$, $p = .028$). Nor was Hispanic or Asian identity a factor: Controlling for Hispanic and Asian identification, we found that the treatment group still outperformed the control group ($F_{(1,212.340)} = 5.008$, $p = .026$; $F_{(1,212.458)} = 5.076$, $p = .025$, respectively).

Thus, we are confident in stating that there is evidence that the *FETCH!* episodes were able to successfully teach kids some basic math and science concepts.

Episodes' Appeal

We also asked the kids in the treatment group to rate the degree to which they liked the episodes on a scale from 1 ("I didn't like them at all") to 5 ("I liked them a lot"). Most kids reported that they liked the episodes (76.1%). The average rating was 4.10 (sd = 1.179) out of 5.

Finally, we asked treatment group kids to tell us what they learned about math or science from watching the episodes. They said:[6]

Math is fun and useful (n = 23)

- *Math cna be fun.*
- *Math helps a lot.*
- *Math is ALWAYS useful.*
- *Math is cool.*
- *Math is useful.*
- *Math is very useful for anything.*
- *That it can be fun.*
- *That it is fun if do FETCH! for math.*
- *That it's helpful.*
- *That its useful.*
- *That math and science can be useful.*
- *That math can always be fun in many ways! :)*
- *That math can be fun.*
- *That math can be fun if you try.*
- *That math helps alot in life and mostly everything has to do with math.*
- *That math is useful.*
- *That math is very inportent.*
- *That math, science can be fun.*
- *You can ues it fore allmoistt avriting.*

[6] We have included the kids' responses verbatim – even when they contained typographical errors.

- *That you can use math in many different and fun ways.*
- *Math can help you with many things.*
- *We learned math can be used for alot of things and so can science.*
- *What I learned about math or science from watching FETCH! is that they are fun to learn.*

New methods for estimation and measurement (n = 12)

- *How they estamate the measurement.*
- *Different strategies and new words.*
- *How to use math even better than you did before.*
- *I learned how to find something with measurments from two places.*
- *I learned that math and science can used in ways that I had not known before.*
- *I learned that you have to try different things to get the right answer.*
- *I learned you can use other objects rather than daily used objects.*
- *Mesurment.*
- *That you can meserstuff to find things.*
- *That you can use any surroundings to help you.*
- *You can measure 60 feet and 3 feet with a rope.*
- *How the FETCH!ers use the rope with knots to measure distance.*

Animals (n = 12)

- *About the number of animals in yellow stone.*
- *How much one animal can change places.*
- *How they caught and keep track of animal population.*
- *I learnd about wolevs.*
- *I learned about bird.*
- *I learned about birds.*
- *Mother birds and no feathers on their stomach so she can keep her baby's warm.*
- *Probably then they were teaching us about the wildlife.*
- *That birds need to be megerd befor you let them go.*
- *That wolfs can help erth.*
- *You can put nets out that is called a packets. Then the bird gets out in the net. You can also put a collar on a wolf and trak them down.*
- *The birds sing for mating calls and other spacific things.*

Concepts of density and buoyancy (n = 11)

- *Density and Bouncy.*
- *I didn't know what the density was until I watched the FETCH! video.*
- *I learned about density and boyency.*
- *I learned that in science, denser means it will sink to the bottom.*
- *I learned that salt water is heavier then fresh water.*

- *Boyonce.*
- *Probly boyence.*
- *That if you put corn syup with fresh water salt water corn oil, corn syup is never then the rest.*
- *That some liquids are denser than others.*
- *That vegetable oil has the least density.*
- *The most important thing about science with Ruff is flouting and solid things float.*

How to use a compass (n = 6)

- *How to use a compass.*
- *How to use a compass.*
- *How to use a compass and add things up with it.*
- *How to find yourself on a map by using a compass.*
- *I learned how a compass works I didn't know how it worked before.*
- *I learned in math, that the compass points to the gravetatiatal poles.*

How math and science could be used in your daily life (n = 3)

- *How math and sience could be used in your daily life.*
- *I leard that you can use alot of math and science in real life.*
- *I learned that you use math like in nature and solving mystries.*

Other (n = 2)

- *To think outside the box.*
- *The most important thing I learned is to never give up.*

Educators' Opinions

We asked the treatment group educators to comment on the *FETCH!* episodes at the end of the study. First, we asked them to comment on the effectiveness of the episodes in teaching the kids about math. Four out of seven educators reported that the episodes were "effective." One educator reported that the episodes were "very effective." Two educators remained neutral about their effectiveness. They told us:

- *All students were involved in the video, they watched it with interest and were sad when the video was over.*
- *I think the younger children enjoyed the videos immensely. I think it would be nice to have activities using the math discussed in the video to do with the children after, so as to solidify what they learned.*
- *My studious kids were able to watch the show and really pull out the math points. Others just wanted to watch the show.*

- *Some episodes are better at teaching math ... for example, the ghost town episode does math reasoning better than the pirate episode which demonstrates scientific principles better.*
- *While the children enjoyed the episodes, many knew a lot of the information.*
- *Some of the older kids (teenagers) did not want to watch the videos as they thought it was for "kids". The younger kids enjoyed them though.*
- *While the activities (watching the episodes) were fun, camp was not the right setting for these activities.*

We asked the educators whether the kids liked the episodes. Five out of seven reported that the kids liked the episodes "a lot." They told us:

- *All students were paying attention. They showed disappointment when the videos were over.*
- *All were excited to watch the "FETCH!" videos because most of them have seen "FETCH!" on TV before and were very familiar with the characters. Those that hadn't seen "FETCH!" before were told all about it by those that had.*
- *Most of the kids are familiar with FETCH! already and are fans.*
- *Most of the kids seemed to enjoy the videos, laughed and shouted out the answers. A couple of the girls are "wise beyond their years" and thought the shows were too young for them.*
- *The children enjoyed watching the episodes.*

Two others reported that the kids liked the episodes "a little." They told us:

- *Camp was not the proper setting.*
- *The older kids did not enjoy them (teenagers).*[7]

All of the educators reported that they planned to use the episodes again to teach kids at their sites about math:

- *I think a hands on practice after watching the video would help make the concepts more real to them. A lot of the activities are easy to recreate.*
- *I think these videos should be offered to elementary teachers, as well as "kits" to actually do some of the activities with students after watching them.*
- *I would only to extend from the program … so, for example, I would add elementary but formal algebra to the calculations.*
- *The videos were excellent.*
- *To younger youth (K-5).*
- *When I am teaching a concept that is in one of the videos, I will show it. They are highly interesting to all students.*
- *Yes, I think they were very entertaining.*

[7] Recall that kids older than 10 were not supposed to view the episodes, but some educators chose to show them to older kids anyway.

All but one of the educators reported that they would recommend the episodes to other camps.

- *I enjoyed the activity.*
- *I enjoyed them myself.*
- *I have already encouraged others in our (Parks and Recreation) department to take part....the videos are entertaining and educational.*
- *I think most students would be motivated to watch the videos.*
- *I would recommend the episodes.*
- *Kids who watch only PBS programs are very different in outlook and attitudes towards learning. If you do this at a bigger camp, you will be able to introduce more kids to FETCH! and that PBS programming is more than cool!*
- *Should be used in a troop setting (as opposed to a camp setting).*

Summary

Based on this summative study, we feel confident reporting that *FETCH!* episodes can positively impacts kids' learning and attitudes towards math. Below, we highlight the report findings:

Watching the *FETCH!* episodes enhanced kids' attitudes toward math.

Although most kids in both groups reported fairly positive attitudes toward math from the start, the treatment group demonstrated significantly greater gains in attitude scores than did the control group. The control group kids' scores decreased from 4.14 to 4.07, while the treatment group kids' scores increased from 4.04 to 4.17 ($F_{(1, 202.296)} = 4.355$, $p = 0.038$).

Watching the *FETCH!* episodes enhanced kids' knowledge of math and science (content and procedural knowledge).

The treatment group demonstrated greater gains in test scores than did the control group; scores for kids in the control group rose from 8.72 on the pretest to 9.10 on the posttest, while for kids in the treatment group, scores increased from 9.21 to 11.28 ($F(1, 211.606) = 4.883$, $p = 0.028$).

I learned that math and science can be used in ways that I had not known before.

-8 year old

The *FETCH!* episodes had universal appeal across all ethnic, age, and gender groups.

Math is cool!

-8 year old

On a scale of 1 ("I didn't like them at all") to 5 ("I liked them a lot"), kids reported that they liked the episodes (average = 4.10). These findings were universal across both genders and all age, and racial/ethnic groups.

Kids told us that the *FETCH!* episodes helped them learn that "math is fun and useful" and that they learned new measurement skills and science concepts from watching the episodes.

We asked kids to tell us, in their own words, what they learned about math or science from watching the episodes. Many reported that "math is fun and useful", that they learned new ways

of using math, and that they learned some new science concepts from watching the episodes. Some illustrative comments are included below:

- *Math helps a lot.*
- *Math is ALWAYS useful.*
- *Math is cool.*
- *Math is very useful for anything.*
- *Math can always be fun in many ways! :)*
- *Math can be fun if you try.*
- *Math helps a lot in life and mostly everything has to do with math.*
- *Math is very important.*
- *Math and science can be fun.*
- *You can use it for almost everything.*
- *You can use math in many different and fun ways.*
- *Math can help you with many things.*
- *We learned math can be used for a lot of things and so can science.*
- *What I learned about math or science from watching FETCH is that they are fun to learn.*
- *I learned that you use math like in nature and solving mysteries.*
- *I learned how to find something with measurements from two places.*
- *I learned that math and science can be used in ways that I had not known before.*
- *I learned that you have to try different things to get the right answer.*
- *I learned you can use other objects rather than daily used objects.*
- *I learned that you can use any surroundings to help you.*
- *I learned how a compass works--I didn't know how it worked before.*
- *I didn't know what the density was until I watched the Fetch video.*
- *I learned about density and buoyancy.*
- *I learned that in science, denser means it will sink to the bottom.*
- *I learned that salt water is heavier then fresh water.*
- *That some liquids are denser than others.*
- *That vegetable oil has the least density.*

> *I have already encouraged others in our (Parks and Recreation) department to take part....the videos are entertaining and educational.*
>
> *-Informal educator*

The majority of after-school and camp educators were enthusiastic about the *FETCH!* episodes and the episodes' ability to teach kids about math and science.

Five out of seven educators reported that the episodes were "effective" or "very effective." All of the educators reported that they planned to use the episodes again to teach kids at their sites about math. All but one of the educators reported that they would recommend the episodes to other camps. Several educators expressed an interest in using a set of hands-on activities along with the episodes to

teach kids about math and science. CEG and WGBH will be testing a Camp Curriculum Guide (including hands-on activities) in the spring and summer of 2011.

Some illustrative comments follow:

- *The videos were excellent.*
- *I think it would be nice to have activities using the math discussed in the video to do with the children after, so as to solidify what they learned.*
- *I think a hands-on practice after watching the video would help make the concepts more real to them. A lot of the activities are easy to recreate.*
- *I think these videos should be offered to elementary teachers, as well as "kits" to actually do some of the activities with students after watching them.*
- *Watching the episodes was fun.*
- *All students were paying attention. They showed disappointment when the videos were over.*
- *The children enjoyed watching the episodes.*
- *I would only extend from the program … so, for example, I would add elementary but formal algebra to the calculations.*
- *When I am teaching a concept that is in one of the videos, I will show it. They are highly interesting to all students.*
- *I have already encouraged others in our (Parks and Recreation) department to take part....the videos are entertaining and educational.*

When I am teaching a concept that is in one of the videos, I will show it. They are highly interesting to all students.

-Informal educator

Appendix A: Kids' Pretest and Posttest Questions

Name _____

FETCH! With Ruff Ruffman

Student Survey

Can Ruff Ruffman make learning math even more fun?!

Help us find out!

Please answer these questions as carefully as you can.

Thank you for your help!

Ruff Ruffman needs your help!

1. Ruff is trying to explain to Blossom what math is. Can you help him? Please circle the sentences that are true:

   Math helps you to…

   a) Measure things
   b) Add things up
   c) Make a graph
   d) Use a compass
   e) Read a map
   f) Answer science questions
   g) Find patterns in nature
   h) All of these are true
   i) None of these are true

2. Ruff wants to know what kids think about math. Please circle the choices that tell us how you feel about math:

I like math.	I Agree Very Much	I Agree	I Am Not Sure	I Don't Agree	I Don't Agree At All

Math is useful.	I Agree Very Much	I Agree	I Am Not Sure	I Don't Agree	I Don't Agree At All

I am good at math.	I Agree Very Much	I Agree	I Am Not Sure	I Don't Agree	I Don't Agree At All

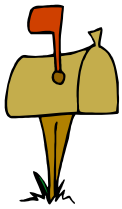
Math can be fun.	I Agree Very Much	I Agree	I Am Not Sure	I Don't Agree	I Don't Agree At All

3.

Ruff has buried a special toy 12 inches from his mailbox, but he can't remember where he put it!

Can you mark all the places where the toy might be?

Note: 12 inches is about this big

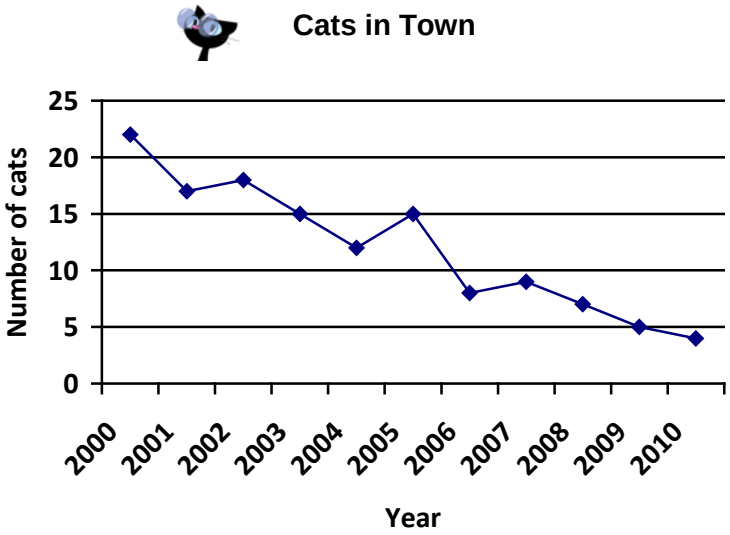


4. Now Ruff needs your help with something else!

Ruff wants to ride on a roller coaster. He needs to be 40 inches tall to ride, but he doesn't have a ruler.

He knows that his toy hedgehog is 10 inches tall. Explain how he can use his hedgehog to measure himself.

5. Ruff wants to keep track of the number of cats moving into his town.



Using the chart above, what would you tell Ruff?

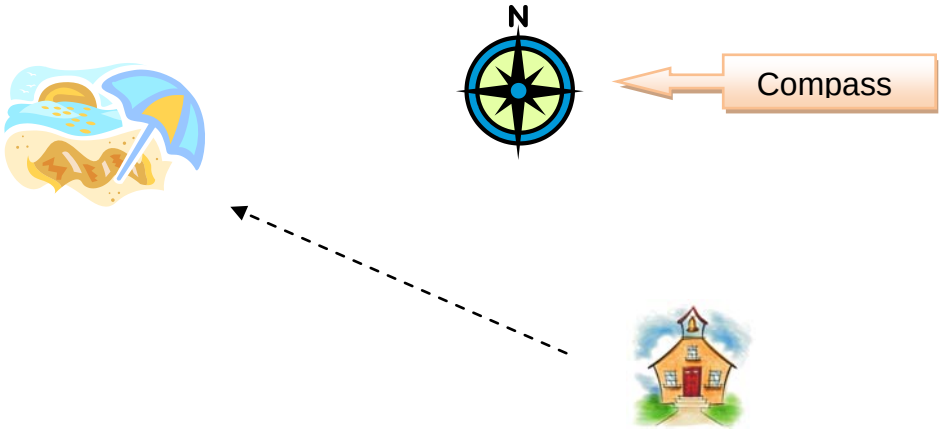
a. The number of cats in town has stayed the same since 2000.
b. The number of cats in town has decreased since 2000.
c. The number of cats in town has increased since 2000.

6. In Ruff's town, coyotes eat rabbits and rabbits eat clover.

If more coyotes moved in, what would probably happen to the amount of clover?

a) Go up
b) Stay the same
c) Go down

7. Use the compass to tell Ruff what direction he should walk to get from the school to the beach.



a) Northeast
b) Northwest
c) South
d) West

8. If you pour all three of the following liquids together in a glass, which one will sink to the bottom?

a) Vegetable oil
b) Fresh water
c) Salt water

9. True or false: A ball that is solid will float better than a ball that is full of air.

a) True
b) False

10. What is the most important thing you learned about math or science from watching FETCH? *(Treatment group only)*

11. On a scale of 1 to 5, how much did you like the FETCH! shows that you watched? *(Treatment group only)*

    1) I didn't like them at all
    2) I didn't like them very much
    3) I don't know
    4) I liked them
    5) I liked them a lot

12. Are you a boy or a girl?

    a) Boy
    b) Girl

13. How old are you? _____

14. How would you describe yourself?

    a) White
    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

THANK YOU!

Appendix B: Educators' Posttest Questions

Camp Counselor Survey (Post-Test Only)

1. How much do you agree with each of the following statements? (Scale of 1 to 5; 1 = Strongly Disagree to 5 = Strongly Agree)

    1) I am good at math.
    2) Math is important in everyday life.
    3) I enjoy using math.
    4) I am confident that I can teach kids about math.

2. How interested do you think your kids are to learn about math while at camp?

    1) Not interested at all
    2) Not very interested
    3) Not sure
    4) A little interested
    5) Very interested

3. How effective do you think the episodes were at teaching kids about math? *(Treatment group only)*

    1) Not effective at all
    2) Not very effective
    3) Not sure
    4) A little effective
    5) Very effective

Please explain:

4. Did your kids enjoy the episodes? *(Treatment group only)*

    1) Not at all
    2) Not very much
    3) Not sure
    4) A little
    5) Very much

Please explain:

5. Would you use these episodes again in the future to teach kids about math? *(Treatment group only)*

    a) Yes
    b) No

Please explain:

6. Would you recommend the episodes to other camps? *(Treatment group only)*

    a) Yes
    b) No

Please explain:

Please tell us a little bit about yourself:

7. Are you male or female?

    a) Male
    b) Female

8. How would you describe yourself?

    a) White
    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

9. For how many years have you been working with kids? _____

10. What is the highest educational level you have achieved?

    a. Some high school
    b. High school diploma or GED
    c. Trade school certificate
    d. Some college
    e. Associate's degree (major) _____
    f. Bachelor's degree (major) _____
    g. Master's degree (major) _____
    h. Doctorate or other professional degree (major) _____

THANK YOU!