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Final Report

Evaluation of 2010-2011 *Energized Guyz* Elementary and Middle School Programs

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ES EXECUTIVE SUMMARY

The National Theatre for Children (NTC) has developed in-school energy literacy curricula to teach elementary and middle school students about energy production, conservation and water conservation. NTC has delivered its energy efficiency module, entitled *The Energized Guyz*, to elementary schools in the Tennessee Valley Authority (TVA) service territory since the 2008-09 school year, and added a curriculum for middle schools starting with the 2010-11 schools year. In the most recent academic year, the programs were delivered in 800 elementary schools and 300 middle schools.

In 2010, The NTC Research Foundation contracted with Research Into Action, Inc., to conduct an independent evaluation of the elementary and middle school programs in TVA's five-state service territory. The goal of the evaluation was to assess whether the programs help students learn key energy- and water-related concepts. Curriculum developers were also interested in how knowledge affected student attitudes toward conservation and self-reported conservation behaviors.

This report presents initial findings based on the first nine months of the planned three-year evaluation. The first-round evaluation examined whether students at schools where the curriculum was delivered (intervention group) showed improvement on a test of energy- and water-related factual knowledge. The evaluation also seeks to reveal changes in pro-conservation attitudes and self-reported behaviors among students exposed to the curriculum versus those students that did not receive the curriculum (control group).

Students were tested at the beginning the 2010-11 school year and near the end of the spring term; students at half of the intervention schools were also tested shortly after the curriculum was delivered (in the fall term). Analyses controlled for differences among schools in demographics (urban or rural, percent minority), grade level, previous school exposure to the program, and home language other than English. The curriculum differed for elementary and middle schools, as did the test. Although the program was presented to all grade levels in each school, the evaluation included only upper elementary grades (grades 3, 4, and 5) and grades 6, 7, and 8 in middle schools.

In elementary schools, *The Energized Guyz* curriculum increased knowledge for third graders, especially those who took the fall post-test. Researchers found that students in grades 4 and 5 scored so high on pre-test energy knowledge that there was little room for improvement of baseline knowledge. To address this issue, the research team recommends more challenging pre- and post-test standards in the 2011-12 academic year that will lead to a more robust test of curriculum effects.

In middle school grades, the NTC program curriculum increased knowledge of both energy-related and water-related factual knowledge. The program effect showed statistical significance among all grade 7 and grade 8 students who received the intervention. While grade 6 students also showed knowledge improvement, the effect for this age group missed statistical significance.

At pre-test, students at both intervention and control elementary schools showed very high levels of agreement that saving energy was important. These data indicate that student awareness of energy issues is quite high and suggests that this student population may be predisposed to changing attitudes about energy consumption and may be receptive to take positive steps. Additional testing and analysis (in future school years) will help establish the relative strength of this link.

Overall, the analysis showed the curriculum effect increased factual knowledge – especially relating to water conservation – and students appeared to show short-term increases in both energy- and water-related pro-conservation behavioral intentions.

In upcoming school years, the research team intends to examine the long-term intentions of students, and establish differences between intervention and control students. These questions will assess pro-conservation attitudes and self-reported behaviors – areas of the study that may further connect the curriculum's impact on factual knowledge.

1 METHODS

RESEARCH DESIGN

The general research design was a test-retest comparison with a control condition. The details of the design were somewhat complicated. We assessed elementary students (grades 3, 4, and 5) and middle school students (grades 6, 7, and 8) at all intervention schools before the program (pre-test) and at the end of the school year (spring post-test). To reduce variability in the intervals between the pre-test and the program and between the program and the spring post-test, we selected only schools where programs were performed in the middle of the fall term. We included a set of control schools, matched on demographic characteristics to the intervention schools, from the areas contiguous with the TVA territory. Students at the control schools were assessed early in the fall term and at the end of the following spring term.

In addition, in half of the intervention schools, we included an assessment shortly after the program in the fall term (fall post-test). Including a fall post-test in half the schools allowed us to examine three things: 1) whether the program appeared to produce an immediate knowledge gain even if the spring post-test did not show a gain; 2) whether any immediate knowledge gain decreased over time; and 3) whether the fall post-test itself improved knowledge gain. Table 1 summarizes the overall design.

Table 1: Basic Research Design

	Pre-test	Program	Fall Post-test	Spring Post-test
Intervention	x	◆	x	x
	x	◆		x
Control	o			o

The 800 elementary and 350 middle schools that received the program varied demographically – by location (rural or urban) and student composition (e.g., percent minority). We attempted to control for any possible influence of such demographic factors on the assessment results. To ensure that the sample was varied demographically, we stratified the sample on urbanization and minority composition. Examination of the school population indicated that urban schools were more heterogeneous in terms of minority composition than rural schools, so we established three

strata: rural, urban-high minority, and urban-low minority[1]. We included that stratification also in our sample of control schools.

A final factor that we opted to examine was whether or not the program had been presented previously at the school. This was an issue only for elementary schools, as 2010/2011 was the first year in which the program had been offered in middle schools, and it was not an issue for control schools. Therefore, among the elementary intervention schools, an additional stratification was prior or no prior program; this stratification was crossed with the demographic stratification.

SAMPLE DESIGN

Table 2 shows the resulting sample design. To draw the sample of intervention schools, we randomly selected two schools from the intervention population within each cell of the design. Although it would have been desirable to sample several schools within each cell, the resulting sample of dozens of schools would have made it prohibitively expensive to print, distribute, collect, and carry out data entry on the test instruments for each student.

Table 2: Sample Design

Group		Rural	Urban-High Minority	Urban-Low Minority	Total
Elementary					
Intervention	Prior program	2	2	2	5
	No prior program	2	2	2	6
Subtotal		4	3	4	12
Control		2	2	2	6
Elementary School Total		6	6	6	18
Middle					
Intervention		2	2	2	6
Control		2	2	2	6
Middle School Total		4	4	4	12

1 Generally speaking, “high minority” was defined as the top one-third of each group in terms of percent minority and “low minority” was defined as the bottom one-third. Note that we treated minority composition as a continuous variable in all analyses; therefore, it does not matter that the definition of high- and low-minority varied somewhat from group to group.

Of the two schools within each cell of the intervention sample, one was randomly selected to have the additional fall post-test.

In drawing the sample of control schools, we also selected randomly within each cell of the sample design. However, we attempted to match each cell within the control group as closely as possible on minority student composition to the corresponding cell in the intervention group. Therefore, after randomly drawing the schools within a given cell, if the mean minority student composition differed by more than 15 percentage points from the corresponding intervention school cell, we re-randomized the control population from that cell and drew again.

INSTRUMENT DESIGN

We interviewed NTC staff and reviewed program scripts to identify the program goals and key learning objectives. Based on these sources, we developed separate, age-appropriate assessments for elementary and middle school students. Within each school level, the same assessment was used for the pre-test and post-tests.

At both school levels, the assessments included questions testing energy-related (elementary and middle school) and water-related (middle school only) factual knowledge as well as questions assessing energy- and water-related attitudes and self-reported behaviors.[2] In addition, the elementary school test contained three questions asking whether students spoke a language other than English with their families and whether they had seen the program and completed the workbook in school. These three questions were omitted from the middle school versions of the assessment. This was done to make room for more factual material; we reasoned that non-English home languages would have less impact on results in older students.[3]

The elementary school assessment had nine factual knowledge items. These addressed the following topics:

- Identifying whether energy is used to operate DVD players and computers.
- Understanding of the term "appliance."
- Identifying energy resources, renewable resources, and hydro power.
- Understanding of the concept of renewable resources.

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[2] Prior to the 2010-2011 school year, NTC revised the elementary school script to include water-related messages as well as energy-related messages. However, the revised script was not available at the time the test instrument was being developed. The energy-related message did not change substantively between script versions.

[3] As indicated below, we found that it was not necessary to control for home language at any age.

- Identifying energy saving activities.

The middle school assessment had 16 such items, addressing the following topics:

- Identifying energy resources, renewable resources, and hydro power.
- Understanding how electricity is generated at power plants.
- Understanding how greenhouse gasses are created.
- Water use and conservation.
- Identifying energy saving activities.

In addition, the assessments contained several items (six for elementary students, four for middle school students) on self-reported behaviors, behavioral intentions, and attitudes:

- How often they leave lights or water on when not in use.
- Whether or not they have asked their family to buy CFLs.
- Whether or not they have asked their family to buy a water savings showerhead (elementary school) or to take shorter showers (middle school).
- Whether or not they think saving water and energy is important (elementary school only).

Copies of the test instruments are included in the appendix.

DELIVERY OF THE ASSESSMENT

Staff of the NTC delivered packets of tests to each school, with a request to distribute one packet to each teacher. Each packet included a written set of instructions on test administration. These instructions included a personal letter to teachers outlining the evaluation, and instructions for students about answering each question once, in black or blue pen or a pencil, avoiding stray marks, and filling out the blanks at the top of the test.

Each test instrument covered both sides of a single sheet of paper. For intervention schools, the pre-test was administered approximately one week before the live show. For those intervention schools randomly selected to take the fall post-test, that assessment was administered within two weeks after the show. For all intervention schools, the spring post-test was administered in May of 2011. For control schools, the two assessments were administered at about the time that the pre-test and spring post-test were administered in the intervention schools.

RESEARCH QUESTIONS

Our research objective was to determine whether the *Energized Guyz* program had an effect on learning of the program's factual content as well as on intentions, attitude, and self-reported behaviors. To meet this objective, we based our analysis on three main research questions:

1. Compared to students who did not see the program, did students who saw the program show a greater increase in knowledge about energy- and water-related concepts (or pro-conservation intentions, attitudes, and self-reported behaviors) between the pre-test and the spring post-test?
2. Did taking the fall post-test affect the level of learning or intentions, attitudes, and self-reported behaviors assessed with the spring post-test?
3. Among students who took both the fall post-test and the spring post-test, was there a loss of learning between the fall post-test and spring post-test?

ANALYSIS METHODS

We chose an Analysis of Covariance (ANCOVA) approach to assess learning of factual content and regression to assess behavioral changes. Both analysis methodologies allowed us to control for the potential confounding effects of demographic and other secondary variables, thus maximizing our ability to detect any program effects.

Because we asked different questions of middle and elementary school students and because they saw different program versions, we analyzed elementary and middle school tests separately, using the same methods.

Analysis of Factual Content Learning

Variables

We created a pseudo-continuous dependent variable, *sum_correct*, to reflect the number of correct responses to those questions of factual content. Each correct response contributed one point to the value of the dependent variable. We counted unanswered questions as incorrect responses (tests with entirely blank sides had been excluded previously). Therefore, the dependent variable for the elementary school analyses had a possible range of values of zero to nine; the dependent variable for the middle school analyses had a possible range of values of zero to 16.

For the middle-school analyses, we created two additional pseudo-continuous dependent variables: *sum_correct_energy* represented the number of correct responses to energy-related factual questions; *sum_correct_water* represented the number of correct responses to water-related factual questions. The energy-related variable had a possible range of values of zero to 10, and the water-related variable had a possible range from zero to six.

We operationalized our independent variables in the following way. We used a three-level variable for *condition*:

1. Intervention with spring post-test only (one post-test)
2. Intervention with fall and spring post-tests (two post-tests)
3. Control

We also used a three-level variable for *test*:

1. Fall pre-test
2. fall post-test
3. spring post-test

Additionally, we controlled for the following covariates:

1. *Grade*
2. *Location* (Rural or Urban)
3. *Minority* (Percent minority)
4. *Prior* (Program has appeared at school before – elementary only)
5. *Language* (Student speaks a language besides English at home - elementary only)

We treated *grade* as an ordinal variable, *minority* as a continuous variable, and *location*, *prior*, and *language* as dummy variables. We coded *prior* and *language* as 0 = no and 1 = yes and *location* as 0 = urban and 1 = rural.

Models

We developed six ANCOVA models to operationalize our research questions. Note that *prior* and *language* are covariates only in the elementary school models.

RQ1. Does the change from pretest to post-test2 differ for Intervention and Control?

Model 1: *Sum_correct = test (1, 3) x condition (1+2, 3) with prior, grade, location, minority, and language*

Model 2: *Sum_correct = test* (1, 3) x *condition* (2, 3) with *prior*, *grade*, *location*, *minority*, and *language*.

Model 3: *Sum_correct = test (1, 3) x condition (1, 3) with prior, grade, location, minority, and language.*

RQ2. Does the change from pretest to post-test2 differ for Intervention 1 and Intervention 2?

Model 4: *Sum_correct = test (1, 3) x condition (1, 2) with prior, grade, location, minority, and language*

RQ3. Are post-test2 scores lower than post-test1 scores for Intervention 2?

Model 5: *Sum_correct = test (2, 3) with prior, grade, location, minority, and language.*

For models 1 through 4, our primary interest was whether the interaction term (*test* x *condition*) was statistically significant: we wanted to know whether the effect of *test* on the mean number of correct responses differed significantly across the levels of *condition*. For model 5, our interest was in the main effect of test: whether the mean number of correct responses was significantly different across tests.

To assess whether, in middle school, the program effect differed for the energy-related and water-related content, we repeated the first three models, addressing the primary research question, separately with *sum_correct_energy* and *sum_correct_water*.

Effects of Grade, Demographics, Prior Program Exposure, and Language

Although our primary interest was in the effect of the program on concept learning, we were also interested in whether the amount students learned from the program was influenced by the other variables that made up the research design or by whether students spoke a language other than English at home. To test the effects of these secondary variables on the relationship between test and condition, we designed five ANCOVA models, each treating a separate variable as an additional primary independent variable, while controlling for the rest:

- *Sum_correct = grade (3, 4, 5)* x *test (1, 3)* x *condition (1, 2, 3)* with *prior, location, minority,* and *language*.
- *Sum_correct = location (1, 2)* x *test (1, 3)* x *condition (1, 2, 3)* with *prior, grade, minority,* and *language*.
- *Sum_correct = demographics (1, 2, 3)* x *test (1, 3)* x *condition (1, 2, 3)* with *prior, grade,* and *language*.[4]
- *Sum_correct = language (1, 2)* x *test (1, 3)* x *condition (1, 2, 3)* with *prior, grade, location, and minority.*
- *Sum_correct = prior (1, 2)* x *test (1, 3)* x *condition (1, 2)* with *grade, location, minority,* and *language.*

[4] Because of our research design, *Demographics* was actually a three-level variable encompassing both the Location and Minority variables (levels: urban – low minority, urban – high minority, and rural). As such, *Location* was not included as a covariate in this model.

Note that only an intervention school could have had prior exposure to the program – none of the control schools had ever hosted the program. Therefore, we could analyze the effect of prior program exposure among intervention schools only.

For middle school, we used only the first of the above three models, omitting *prior* and *language* as covariates.

Our primary interest was in the three-way interaction terms: we wanted to know whether the relationship between test and condition differed significantly across the levels of grade.

Analysis of Intentions, Behaviors, and Attitudes

Because the questions assessing self-reported behaviors used varying scales and question types, and because there were not enough to create a pseudo-continuous variable, we analyzed each of these questions separately. For the two questions with four-point scales (1 - never, 2 - sometimes, 3 - most of the time, 4 - always), we used ordinal regression to assess whether the odds of providing a higher response on the scale (a less energy-efficient rating) were lower after seeing the program, relative to the control group. We controlled for the same demographic variables as above.

Significance Tests

All significance tests were conducted at $\alpha = 0.05$; although we report results of $\alpha < 0.10$ as "marginally significant," these results should be interpreted with extreme caution.

2 RESULTS

Table 3 shows the number of completed tests returned. We excluded tests for which the students did not complete one or both of the sides of the test instrument.

Table 3: Number of Completed Tests by Condition

Group	Pre-test	Fall Post-test	Spring Post-test	Total
Elementary				
Intervention	1757	695	1821	4273
Control	1793	0	1859	3652
Elementary School Total	3550	695	3680	7925
Group	**Pre-test**	**Fall Post-test**	**Spring Post-test**	**Total**
Middle				
Intervention	1359	777	1244	3380
Control	2361	0	2316	4677
Middle School Total	3720	777	3560	8057

The following results are organized into three main groups: analyses relating to factual content questions; analyses relating to attitudes, intentions, and behaviors; and item-by-item analyses.

FACTUAL CONTENT

In this section, we discuss the program's effect on knowledge of the factual content taught, as indicated by changes in the mean number of correct responses to fact-based test questions. We first present the results for the elementary school sample, followed by results for the middle school sample. Our analyses also produced estimated marginal means (EMMs) at each level of *condition* and *test* (the estimated mean number of correct responses for each intervention group at each test, controlling for the effects of the covariates.)[5]

[5] ANCOVA calculates the effects of primary independent variables while holding the effects of covariates constant. The EMMs are estimates of the mean of the dependent variable at each level of the primary independent variable(s), calculated the covariates held constant at their mean values.

Elementary School

As described above, we analyzed the program's effect on knowledge of energy concepts across all students, controlling for grade, demographics, prior program exposure, and whether or not English is spoken at home. We also analyzed how each of those additional variables affected the program's effect.

Effect of Program across All Elementary Students

Table 4 presents an overview of our findings by research question. Overall, when all intervention students are included (RQ1, Model 1), the interaction between test and condition was marginally significant ($p = .10$). However, the program effect is related to whether or not students took the fall post-test: when only those intervention students who took the fall post-test are compared to control school students (RQ1, Model 2), the interaction is statistically significant ($p < .01$), while that effect does not even approach significance when comparing intervention students who did not take a fall post-test with control students (RQ1, Model 3; $p = .85$).

Table 4: Significance Results of ANCOVA Models by Research Question (Elementary School)

Model (with *Prior*, *Grade, Location, Minority,* and *Language* covariates)	Term	*F*	*p*
Research Question 1			
1: *Sum_correct = Test (1, 3) x Condition (1+2, 3)*	Test x Condition	2.70	0.10
2: *Sum_correct = Test (1, 3) x Condition (2, 3)*	Test x Condition	6.34	0.01
3: *Sum_correct = Test (1, 3) x Condition (1, 3)*	Test x Condition	0.03	0.85
Research Question 2			
4: *Sum_correct = Test (1, 3) x Condition (1, 2)*	Test x Condition	5.46	0.02
Research Question 3			
5: *Sum_correct = Test (2, 3) (Subset: Two-test intervention condition only)*	Test	0.53	0.47

Table 5 shows the estimated mean number of correct responses, controlling for location, minority, grade, previous program, and language spoken at home. Intervention students with a fall post-test showed a nearly 0.8-point mean improvement from pre-test to spring post-test, compared to about a half-point gain by the control students and intervention students with no fall post-test.[6]

[6] Because the six ANCOVA models we used had different samples of interest, the means of the covariates differed across models. Therefore, the various models produce slightly different EMMs.

Table 5: Estimated Marginal Means of Number of Correct Responses by Test and Condition (Elementary School)

Condition	Pre-test		Fall Post-test		Spring Post-test	
	Mean[1]	SEM	Mean	SEM	Mean	SEM
Intervention (One Post-test)	6.23	0.05	-	-	6.73	0.05
Intervention (Two Post-tests)	6.22	0.06	6.92[2]	0.06	7.00	0.06
Control	6.64	0.04	-	-	7.16	0.04

[1] The mean number is the estimated marginal mean (EMM) produced by the ANCOVA; the EMM is an estimated mean that controls for the effects of the covariates.

[2] This estimated marginal mean and associated standard error of the mean come from a model of the Two Post-test intervention condition only.

We also found evidence that concept learning was maintained from the fall to the spring among students who took both fall and spring post-tests. As the second data row in the above table shows, the difference between the mean fall and spring post-test scores was not statistically significant (RQ 3, Model 5).

As noted above, the control school students scored higher on both the pre-test and post-test than either intervention group. It could be argued that the initial pre-test scores of the control school students may have limited the amount of improvement that could be seen in this group and that, therefore, the appearance of a program effect is artifactual. However, the fact that intervention students who took the fall post-test had higher scores at the spring post-test than those who did not take the fall post-test does suggest a program effect.

Also note that the pre-test means for the two intervention groups were lower than for the control group. To address the possibility that the program effect seen in Model 2 was influenced by statistical regression, we repeated Models 1 through 5, entering each school's mean pre-test score as a covariate.[7] The results were highly similar to the results of the original models, suggesting that the results were not influenced by statistical regression. We therefore present the results from models that did not control for differences in pre-test means.

[7] Statistical regression is the tendency for groups with extreme scores to have less extreme scores in repeated testing. This occurs when there is an element of random variation in the scores. Under the assumption that the students in the intervention and control schools were similar on average, the pre-test means should have been similar. Under the hypothesis of statistical regression, random variation in test performance may have produced lower test scores in the intervention groups. Upon retest, the intervention groups would be expected to have higher scores even if there were no actual program effect.

Effect of Grade on Program Effects

As Table 6 shows, there was a statistically significant three-way interaction between *grade*, *test* (pre-test, spring post-test), and *condition* (intervention or control). This indicates that the program's effect differed by grade level.

Table 6: ANCOVA Model Results Summary – Grade (Elementary School)[1]

Term	*F*	*p*
*Test * Condition * Grade*	6.68	< .001
*Test * Condition*	5.10	.006
*Condition * Grade*	.70	.588
*Test * Grade*	26.71	< .001
Grade	207.40	< .001

[1] Model = *Sum_correct = Grade (3, 4, 5) x Test (1, 3) x Condition (1, 2, 3) with Prior, Location, Minority, and Language.*

Because our analyses showed that the effect of *condition* on *test* varied across grade level, we analyzed the effects of *condition* and number of post-tests separately for each grade. Among all comparisons, only one showed a significantly greater gain for intervention than control students. Third-graders in the intervention schools who took the fall post-test showed greater improvement between the pre-test and the spring post-test than third-graders in the control schools. The intervention schools did not show a statistically significant effect in any other elementary school group.

The above finding suggests that the fall post-test may have been effective only for the youngest students in cementing concept learning, but it also may suggest a ceiling effect in the higher grades: some of the questions may have been too easy for fourth and fifth graders.

Table 7: Pre-Post Mean Number of Correct Responses by Condition and Grade (Elementary School)[1]

	Intervention (One Post-test)			Intervention (Two Post-tests)			Control		
Grade	Pre-test	Spring Post-test	Delta	Pre-test	Spring Post-test	Delta	Pre-test	Spring Post-test	Delta
3rd	5.70	6.29	0.59	5.19	6.83	1.64	5.96	6.78	0.81
4th	6.30	6.79	0.49	6.48	6.89	0.41	6.88	7.28	0.40
5th	6.69	7.18	0.49	6.83	7.18	0.35	7.18	7.48	0.30

[1] The mean number is the estimated marginal mean (EMM) produced by the ANCOVA; the EMM is an estimated mean that controls for the effects of the covariates.

Demographics (Rural, Urban-High Minority, Urban-Low Minority)

Because the location variable is essentially included in the *demographics* variable, we discuss only the results of the *demographics* variable in detail. As Table 8 shows, the three-way interaction effect shows that demographics appear to have a statistically significant effect on the amount students learn from the *Energized Guyz* program.

Table 8: ANCOVA Model Results Summary – Demographics (Elementary School)[1]

Term	*F*	*p*
*Test * Condition * Demographics*	6.845	< .001
*Test * Condition*	3.724	.024
*Condition * Demographics*	19.267	< .001
*Test * Demographics*	1.273	.280
Demographics	118.060	< .001

[1] Model = *Sum_correct = Demographics (1, 2, 3) x Test (1, 3) x Condition (1, 2, 3) with Prior, Grade, and Language.*

However, the pattern of results is not entirely clear. While high-minority urban schools have the lowest mean scores (Table 9), the differences between pre- and post- test scores did not differ across demographic groups in a consistent manner.

Table 9: Pre-Post Mean Number of Correct Responses by Condition and Minority Level[1]

	Intervention (One Post-test)			Intervention (Two Post-tests)			Control		
Level	Pre-test	Spring Post-test	Delta	Pre-test	Spring Post-test	Delta	Pre-test	Spring Post-test	Delta
High	5.96	6.26	0.30	5.67	6.29	0.62	6.13	6.80	0.67
Low	6.56	6.84	0.27	6.52	7.50	0.98	7.05	7.45	0.40
Rural	6.66	7.61	0.95	6.18	6.86	0.68	6.53	6.93	0.40

[1] The mean number is the estimated marginal mean (EMM) produced by the ANCOVA; the EMM is an estimated mean that controls for the effects of the covariates.

Prior Intervention and Language

In elementary schools, neither prior intervention nor speaking a language outside the home had a significant effect on the relationship between *test* and *condition*. This finding validates the decision not to capture home language in the middle school sample, as there is no need to control for it in analyzing the effect of condition on test scores. Moreover, prior intervention did not have an overall effect on test scores – students at schools where the program had been performed

the previous year did not in general score better on the tests than students at schools where the program was being performed for the first time.

Middle School

Effect of Program

Among middle school students, the *Energized Guyz* program also showed evidence of increased factual content knowledge. Unlike the elementary school findings, in middle schools, evidence of increased energy knowledge was seen among all students who saw the program, regardless of whether or not they took the fall post-test. As shown in Table 10, with *sum_correct* as the dependent variable, the interaction between test and condition was significant when all intervention students are included (RQ1, Model 1; $p < .001$) as well as when each intervention group is separately compared with controls (Models 2 and 3, $p < .001$ in both models).

Table 10: Significance Results of ANCOVA Models by Research Question

Model (with Grade, Location, and Minority as covariates)	Term	*F*	*p*
Research Question 1			
Sum_correct = Test (1, 3) x *Condition (1+2, 3)*	Test x Condition	15.39	< .001
Sum_correct = Test (1, 3) x *Condition (2, 3)*	Test x Condition	11.37	< .001
Sum_correct = Test (1, 3) x *Condition (1, 3)*	Test x Condition	10.24	< .001
Research Question 2			
Sum_correct = Test (1, 3) x *Condition (1, 2)*	Test x Condition	< 0.001	.998
Research Question 3			
Sum_correct = Test (2, 3) (Subset: Two-test intervention condition only)	Test	24.39	< .001

Table 11 shows an overview of the estimated mean number of correct responses, controlling for location, minority, grade, previous program, and language spoken at home. This shows that students who saw the *Energized Guyz* program showed about a 0.8-point improvement from pre-test to spring post-test, regardless of whether or not they took the fall post-test, compared to about one-quarter of a point improvement for the control students (RQ 1, model 1; $p < .05$).

Table 11: Estimated Mean Number of Correct Responses by Test and Condition[1]

Condition	Pre-test		Fall Post-test		Spring Post-test	
	Mean	SEM	Mean	SEM	Mean	SEM
Intervention (One Post-test)	9.79	0.12	-	-	10.62	0.13
Intervention (Two Post-tests)	8.45	0.12	10.10[2]	0.11	9.26	0.12
Control	9.55	0.06	-	-	9.79	0.06

[1] The mean number is the estimated marginal mean (EMM) produced by the ANCOVA; the EMM is an estimated mean that controls for the effects of the covariates.

[2] EMM and associated SEM come from a separate model.

The knowledge gain from the pre-test to the spring post-test did not differ significantly between those students who had the fall post-test and those students who did not (RQ 2; $p > .05$). Among those students who had both fall and spring post-tests, there was a small but statistically significant loss of knowledge gain between the two post-tests (RQ 3; a 0.88 point decrease, $p < .05$). Thus, taking a fall post-test does not appear to have increased the long-term energy concept knowledge of middle school students who saw the program.

Note that the intervention school students who took only the spring post-test scored higher on both the pre-test and post-test than the control group. Therefore, it cannot be argued that the intervention effect is an artifact of a limit on the possible amount of improvement in the control group.

When we repeated the analyses for RQ1 with *sum_correct_energy* and *sum_correct_water* as the dependent variables, we found the same results. In all cases, the interaction between test and condition was significant when all intervention students are included as well as when each intervention group was separately compared with controls. This indicates the program effect was similar for the energy-related content and the water-related content.

Effect of Grade on Program Effects

Table 12 shows that the three-way *grade* by *test* by *condition* interaction was not statistically significant, indicating that the effect of the intervention did not differ by grade level.

Table 12: ANCOVA Model Results Summary – Grade (Middle School)[1]

Term	*F*	*p*
*Test * Condition * Grade*	0.51	0.73
*Test * Condition*	10.17	< .001
*Condition * Grade*	18.39	< .001
*Test * Grade*	10.17	< .001
Grade	1.41	0.24

[1] Model = *Sum_correct = grade (6, 7, 8) x test (1, 3) x condition (1, 2, 3) with demographics and language.*

Because of the significant two-way *condition* by *grade* and *test* by *grade* interactions, we also tested the effect of *condition* on *test* separately for each grade level. We found that seventh and eighth graders in the intervention conditions showed significantly more improvement from pre-test to spring post-test than those in the control condition ($p < .05$). Sixth graders in the intervention condition showed more improvement than students in the control condition, but this difference was only marginally statistically significant ($p < .10$). Table 13 shows the estimated mean number of correct responses on the pre-test and spring post-test, by grade and by condition.

Table 13: Pre-Post Mean Number of Correct Responses by Condition and Grade[1]

	Intervention (One Post-test)			Intervention (Two Post-tests)			Control		
Grade	Pre-test	Spring Post-test	Delta	Pre-test	Spring Post-test	Delta	Pre-test	Spring Post-test	Delta
6th	9.12	10.30	1.18	8.29	9.54	1.25	9.70	10.54	0.85
7th	10.16	10.77	0.62	8.85	9.28	0.43	9.51	9.24	-0.27
8th	10.40	11.17	0.77	8.30	9.06	0.77	9.75	9.80	0.05

[1] The mean number is the estimated marginal mean (EMM) produced by the ANCOVA; the EMM is an estimated mean that controls for the effects of the covariates.

Demographics (Rural, Urban-High Minority, Urban-Low Minority)

Table 14 shows that the three-way *demographics* by *test* by *condition* interaction did not reach statistical significance. Therefore, we cannot conclude that the effect of the intervention differed by demographic group.

Table 14: ANCOVA Model Results Summary – Demographics (Middle School)[1]

Term	*F*	*p*
*Test * Condition * Demographics*	2.51	.06
*Test * Condition*	7.764	< .001
*Condition * Demographics*	14.96	< .01
*Test * Demographics*	2.13	0.12
Demographics	13.278	< .001

[1] Model = *Sum_correct = Demographics (1, 2, 3) x Test (1, 3) x Condition (1, 2, 3) with Prior, Grade, and Language.*

There was a statistically significant main effect for *demographics*, indicating that, overall scores differed among the demographic groups. Students from rural schools had the highest overall mean tests scores ($M = 9.9$), followed closely by urban-low minority students ($M = 9.5$) and urban-high minority ($M = 8.9$). The statistically significant *condition* by *demographics* interaction reflects the fact that the difference among the demographic groups varied among the

intervention and control groups. As Table 15 shows, there was no consistent and easily interpretable pattern.

Table 15: Pre-Post Mean Number of Correct Responses by Condition and Minority Level[1]

Level	Intervention (One Post-test)			Intervention (Two Post-tests)			Control		
	Pre-test	Spring Post-test	Delta	Pre-test	Spring Post-test	Delta	Pre-test	Spring Post-test	Delta
High	9.34	10.37	1.03	7.87	8.89	1.02	-	-	-
Low	10.30	10.99	0.69	7.93	8.74	0.80	9.80	9.46	-0.34
Rural	9.59	10.44	0.85	9.18	9.89	0.71	9.71	10.29	0.58

[1] The mean number is the estimated marginal mean (EMM) produced by the ANCOVA; the EMM is an estimated mean that controls for the effects of the covariates.

INTENTIONS, BEHAVIORS, AND ATTITUDES

In addition to factual information, the assessments administered to students also included questions about energy- and water- related behaviors, intentions, and for elementary school students, attitudes. Pre-test levels of most of these behaviors and intentions indicated high pro-conservation attitudes.

Table 16: Percent of Students Giving Pro-Conservation Responses at Pre-test, by Group

Item	Group		
	Intervention: One Post-test	Intervention: Two Post-tests	Control
Elementary School			
Saving energy is important (True)	95%	98%	97%
Saving water is not important (False)	79%	81%	87%
How often leave the light on when nobody is in room? (Never or Sometimes)	82%	85%	83%
How often leave the water on while brushing teeth? (Never or Sometimes)	81%	82%	85%
Asked family to buy CFLs? (Yes or Already Have)	50%	55%	40%
Asked family to buy low-flow showerhead? (Yes or Already Have)	34%	35%	29%
Middle School			
How often leave the light on (Never or Sometimes)	78%	79%	79%
How often leave the water on (Never or Sometimes)	75%	68%	74%
Ask family to buy CFLs (Yes or Already Have)	56%	48%	47%
Asked family to take shorter showers (Yes or Already Do)	41%	41%	34%

Saving Energy

We asked students a few questions about their energy-saving behaviors at home. We asked students how often they leave the light on when no one is in the room. Among both elementary and middle school students, while students who saw the program showed increases in pro-conservation behavioral intentions immediately afterwards (fall post-test, $p < .05$), overall students who saw the program did not show a significantly greater increase in pro-conservation behaviors from the pre-test to the spring post-test than students who did not see the program ($p > .05$).

We also asked elementary (but not middle school) students whether they thought saving energy is important. An overwhelming majority of students in both the intervention and control schools indicated that saving energy was important (96.5%); therefore, there was little room for a program effect.

We asked students about whether they had asked their parents to buy CFLs. Response options were yes, no, or they already had them. We found an increase between the pre-test and the fall post-test in both the percentage of intervention students who said they had asked their parents to buy CFLs and the percentage who reported that their families had already performed the action. As it was unlikely that a large percentage of families had installed CFLs between those two tests, we hypothesized two possible causes for this reported increase: a) students gave the socially desirable response after having seen the program; b) some students were not familiar with CFLs or low-flow showerheads before the program and responded "no" to the question even though their family had purchased these items, but they answered "already bought them" after the program, once they realized what they were. We determined that we could not draw reliable conclusions from the responses to this question. We will eliminate it from future evaluations of this program and replace it with a question that will allow a clearer interpretation.

Saving Water

We also asked students about their water-saving behaviors and intentions. First, we asked students how often they leave the water on while brushing their teeth.

Controlling for *grade*, *minority*, and *demographic* variables, we found a statistically significant increase in the proportion of both elementary and middle school students who reported water conservation behavior between the pre-test and the fall post-test ($p < .05$). However, by the time of the spring post-test, student were no less likely to report water conservation than they were at the pre-test, and the difference between the pre-test and spring post-test was not different for intervention students than for control students ($p > .05$).

We asked elementary (but not middle school) students about whether they thought saving water was important. We found evidence that intervention students showed a significantly greater increase, from the pretest to the spring post-test, in agreement that that saving water is important, compared to students who did not see the program ($p < .05$).

Finally, we asked students about whether they had asked their families to conserve water – by purchasing a low-flow showerhead in the case of elementary students or by taking shorter showers in the case of middle schools students. Responses options were yes, no, and they already had bought the showerheads or were taking short showers. As was the case with the question about CFLs, responses to this question did not allow clear interpretations about program effects. We will eliminate this question from future evaluations of this program and replace it with a question that will allow a clearer interpretation.

ITEM-BY-ITEM ANALYSIS

We found evidence that some items showed little variation between pre-test and post-test. In some cases, a very high percentage of students at pre-test gave the same correct response on concept knowledge items or the same pro-conservation response on attitude, intention, or behavior items. On these items, there was little room for program-related change. In other cases, there was adequate room for change, but we nevertheless found no change while we did find change in other items. Those cases may indicate areas where the program did not deliver the intended message as well as it might.

For each item in the elementary and middle school tests, we examined whether the change from pre-test to fall and spring post-tests was statistically significant. For the pre-test to fall post-test changes, we naturally included only those students who took the fall post-test. For the pre-test to spring post-test changes, we included all intervention students.

Elementary School

In the elementary school test, there were five items that did not show statistically significant increases in correct responses in at least one post-test for two or more grade levels. For two of those items, at least 90% of fourth- and fifth-graders gave correct responses in the pre-test, leaving little room for improvement. These items were (correct response is underlined):

- When you watch a DVD, the DVD player uses energy – <u>true</u> or false?
- Which of these things can you do to help save energy? (Take longer showers, study harder for school, <u>turn off the lights when nobody is in the room</u>, keep the refrigerator door open while you pour a glass of milk)

Another item that had a high initial rate of correct responses – but not so high that improvement could not reasonably be expected – was:

- When you are using a computer, the computer does *not* use energy – true or <u>false</u>?

For that item, 84% of fourth-graders and 88% of fifth-graders answered the question correctly in the pre-test. The negative wording of this question may have accounted for the overall lower pre-test scores compared to the DVD question, but it does not account for the lack of improvement in fourth- and fifth-graders. Fewer third-graders (79%) answered this question correctly at pre-test,

but the percentage of correct responses showed statistically significant increases at the fall and spring post-tests for the third-grade group.

Another item that showed post-test improvement among third-graders but not older elementary students was:

- Which two things are both appliances? (a desk and a washing machine, a book and a phone, a washing machine and a refrigerator, a book and a desk)

At pre-test 62% of among third-graders answered this question correctly compared to 78% and 79% of fourth- and fifth-graders, respectively. Again, there was more room for improvement at third grade and at the older grade levels. Note that the point of this item was to test students' understanding of the word appliance. Understanding that term was not explicitly a learning goal of the program, but the program script used the term without defining it, and so it appeared to assume that elementary school students understood the term. If some children do not understand the term, however, they then may not learn concepts being taught using it.

Finally, one item showed no improvement at any grade level at the fall post-test, but showed statistically significant improvement at all grade levels at the spring post-test:

- Which two things are both resources? (Coal and rainbows, rainbows and cars, coal and water)

The percentage of correct responses at pre-test ranged from 73% for third-graders to 89% for fifth-graders, and the percent increase in correct responses ranged from 4% for fifth-graders to 13% for third-graders.

Although the findings for this last question indicate that it was possible to see a statistically significant increase in correct responding even when the pre-test level approached 90%, in general these results suggest that the items in question were not challenging enough for fourth- and fifth-graders. Even third-graders answered correctly at pre-test from 62% to 88% of the time. We will review these items to attempt to create more challenging questions to assess the relevant teaching goals in the next round of this evaluation.

Middle School

In the middle school test, 11 items failed to show statistically significant increases in correct responses in at least one post-test for two or more grade levels. In the majority of these, however, the pre-test percentages of correct responses were below 70% for most grade levels. Those with correct pre-test response percentages below 70% were:

- Which of the following is *not* used in making electricity at power plants? (coal, water, turbines, the wind)
- What is another term for renewable resources (green energy, pollution, greenhouse gasses, all of the above)

- Which uses more water? (a bath, a five-minute shower, they both use the same amount)
- Which of the following is a non-renewable resource? (water, coal, wind, the sun)
- Which of the following are *all* resources that power plants burn to make electricity? (coal, oil, water; coal, oil, natural gas; oil, water, natural gas; natural gas, wood, water)
- Which of the following is a renewable resource? (coal, oil, natural gas, wind)
- Which of the following is true about power companies? (use only nonrenewable resources, use only renewable resources, combine renewable and nonrenewable resources, use neither renewable nor nonrenewable resources)

In the first four of the above seven items, only one comparison out of 24 (three grades times two comparisons per grade times four items) showed a statistically significant change from pre-test to one of the post-tests. The lack of improvement from relatively low pre-test levels in those four items suggests an opportunity for improving the program's overall effect by providing more thorough coverage of the topics they address.

The same conclusion could apply to a lesser extent to the last three of the above items. Those items also showed relatively low pre-test scores, with inconsistent increases from pre-test to post-test.

Finally, four items had pre-test scores that exceeded 70% correct for all grade levels – and in several cases approached or exceeded 80% – but showed inconsistent improvements at the post-tests. Those items were:

- How can you help save energy? (switch to compact fluorescent bulbs, leave your computer on all the time, turn off lights you are not using, a and c, a, b, and c)
- Which uses less water when you wash your bike or the family car? (a hose, a bucket of soapy water, they both use the same amount)
- Wasting water in our homes has no impact on hydroelectric dams – true or false?
- Renewable resources produce energy over and over – true or false?

We will review those items to determine whether some may be too easy for older students and should be replaced with more challenging items. In addition, however, program staff should review those items to identify teaching objectives that could be addressed more effectively in the program.

3 SUMMARY AND CONCLUSIONS

SUMMARY

Factual Content

The Energized Guyz curriculum increased energy-related knowledge for third graders who took the fall post-test. Demographic variables affected results for the elementary school students, validating the decision to control for these factors in examining program effects. However, the pattern of results for the demographic variables is not clear; therefore, we cannot draw any definitive conclusions about the effect of demographics on program effects. Neither prior intervention nor speaking a language outside the home had a significant effect on the relationship between test and condition.

In the middle school grades, we found evidence that *The Energized Guyz* curriculum increased learning for both energy- and water-related content. Unlike the third-grade data, the increased learning was not dependent on whether students took the fall post-test.

Attitudes and Behavior

Nearly all elementary students in the intervention and control schools indicated at the pre-test that saving energy was important, leaving little room for a program effect. In both elementary and middle school students, the program appeared to show short-term increases in pro-conservation behavioral intentions, but the behavior intentions of intervention and control students did not differ at the end-of-year assessment. The research team will continue to study long-term attitude differences and self-reported behavioral changes in both elementary and middle schools as the study moves forward in the 2011-12 school year.

At pre-test, elementary students were less aware of the importance of saving water as they were of the importance of saving energy. Results indicated that the program increased the level of agreement that saving water is important, between pre-test and the spring post-test. As with energy-saving intentions, we found changes in self-reported water conservation behavior among intervention students in the short term, but the intervention and control students did not differ at the end-of-year assessment. The research team will continue to investigate possible self-reported behavioral changes in the 2011-12 school year.

CONCLUSIONS

The initial results of this first-round analysis show a program effect on energy concept learning among third-, seventh-, and eighth-graders. Lack of statistical significance in fourth- and fifth-

graders is likely due to (1) a too-easy test for these grade levels, and/or (2) pre-existing high student awareness of energy issues in fourth and fifth grade students.

Program effects on attitudes, intentions, and self-reported behaviors were less clear, although there was evidence for a program effect on the perceived importance of saving water and some evidence for short-term gains in pro-conservation intentions. Changes in behavior are notoriously difficult to maintain, and these results may indicate the need for incorporating follow-on teaching activities, such as increased number of homework assignments, continuous online interaction, as well as, in-class exercises, to cement changes initiated in the curriculum.

RECOMMENDATIONS

In upcoming school years, the research team recommends a deeper analysis of the long-term intentions of students.

➡ **Recommendation:** Develop questions to assess pro-conservation attitudes and self-reported behaviors that will explore the relationship with the curriculum's impact on factual knowledge.

Item-by-item analyses indicated high pre-test levels of correct responses for many of the elementary school test items, suggesting that many of those items were not challenging for elementary school students, particularly in the higher grades. Replacing those items with more challenging ones may show greater program effects by providing more room for improvement from pre-test to post-test. Looking at younger grade levels (grades 1 & 2) may also show greater program effects by providing more room for improvement from pre-test to post-test.

➡ **Recommendation:** Audit terminology used in the curriculum and assure that all vocabulary is properly defined, such as the use of the word "appliance" in the elementary school program.

By contrast, the item-by-item analyses of the middle school tests indicated that meeting some of the program's teaching objectives might benefit by additional repetition (or other teaching tools) throughout the curriculum. We recommend that the program developers compare content with the pertinent teaching objectives. As with the elementary school test, some items on the test may be insufficiently challenging. We will review the testing and create more challenging questions that analyze content and objectives for the upcoming 2011-12 school year.

➡ **Recommendation:** Revise the middle school program to put greater focus on teaching the difference between renewable and non-renewable resources, how power plants use resources to generate electricity, and how water is wasted.

A APPENDIX A: TEST INSTRUMENTS

ELEMENTARY SCHOOL, GRADES 3-5

We are trying to find out what kids your age know about energy and electricity. Read each question and pick one answer that you think is correct. Use your pencil to fill in the correct circle on the answer sheet.

1. How often do you leave the light on when nobody is in the room?
   - ○ Never
   - ○ Sometimes
   - ○ Most of the time
   - ○ Always
2. How often do you leave the water running while you brush your teeth?
   - ○ Never
   - ○ Sometimes
   - ○ Most of the time
   - ○ Always
3. Have you asked your family to buy compact fluorescent light bulbs, also called CFLs?
   - ○ Yes
   - ○ No
   - ○ They already have bought CFLs
4. Have you asked your family to buy a showerhead that uses less water?
   - ○ Yes
   - ○ No
   - ○ They already bought one
5. When you watch a DVD, the DVD player uses energy – true or false?
   - ○ True
   - ○ False
6. When you are using a computer, the computer does not use energy – true or false?
   - ○ True
   - ○ False

7. Which two things are both appliances?
   - ○ A desk and a washing machine
   - ○ A book and a phone
   - ○ A washing machine and a refrigerator
   - ○ A book and a desk

8. Which two things are both resources?
   - ○ Coal and rainbows
   - ○ Rainbows and cars
   - ○ Coal and water

9. Which two things are both renewable resources?
   - ○ Coal and water
   - ○ Water and wind
   - ○ Wind and oil
   - ○ The sun and natural gas

10. Only one of the following sentences is true. Which one?
    - ○ Renewable resources come back again and again
    - ○ Renewable resources get used up quickly
    - ○ Renewable resources have to be made out of other things

11. What do you call the kind of power that is created from fast moving water?
    - ○ solar power
    - ○ hydro power
    - ○ hyper power

12. You can help save energy. Which of these things can you do to help save energy?
    - ○ Take longer showers
    - ○ Study harder for school
    - ○ Turn off the lights when nobody is in the room
    - ○ Keep the refrigerator door open while you pour a glass of milk

13. Which of these things would not help save energy?
    - ○ Turning down the water heater temperature
    - ○ Turning down the thermostat in winter
    - ○ Using a compact fluorescent light bulb or CFL
    - ○ Getting a cell phone

14. Saving water is not important – true or false?
    - ○ True
    - ○ False

15. Saving energy is important – true or false?
    - ○ True
    - ○ False

16. Do you speak a language other than English with your family?
    - ○ Yes
    - ○ No

QUESTIONS 17 AND 18 – INTERVENTION SCHOOLS ONLY:

17. Did you see the program called *Energized Guyz* at your school?
    - ○ Yes
    - ○ No

18. Did you do the *Energized Guyz* workbook in your class?
    - ○ Yes
    - ○ No

MIDDLE SCHOOL, GRADES 6-8

The company that provides electricity to your home is trying to find out what kids your age know about energy and electricity. Read each question and pick one answer that you think is correct. Use your pencil to fill in the correct circle on the answer sheet.

1. How often do you leave the light on when nobody is in the room?
   - ○ Never
   - ○ Sometimes
   - ○ Most of the time
   - ○ Always
2. How often do you leave the water running while you brush your teeth?
   - ○ Never
   - ○ Sometimes
   - ○ Most of the time
   - ○ Always
3. Have you asked your family to buy compact fluorescent light bulbs or CFLs?
   - ○ Yes
   - ○ No
   - ○ They already have bought them
4. Have you asked your family to take shorter showers?
   - ○ Yes
   - ○ No
   - ○ They already take short showers
5. Which of the following are <u>all</u> resources that power plants burn to make electricity?
   - ○ Coal, oil, water
   - ○ Coal, oil, natural gas
   - ○ Oil, water, natural gas
   - ○ Natural gas, wood, water
6. Which of the following is <u>not</u> used in making electricity at power plants?
   - ○ Coal
   - ○ Water
   - ○ Turbines
   - ○ The wind

7. Which of the following statements is correct?
   - ○ There are equal amounts of all energy resources
   - ○ Non-renewable resources will run out eventually
   - ○ Renewable resources are always available
   - ○ All resources are unlimited
8. Which of the following is a non-renewable resource?
   - ○ Water
   - ○ Coal
   - ○ Wind
   - ○ The sun
9. Which of the following is a renewable resource?
   - ○ Coal
   - ○ Oil
   - ○ Natural gas
   - ○ Wind
10. Which of the following is an impact of burning non-renewable resources?
   - ○ Creating greenhouse gasses
   - ○ Reducing energy use
   - ○ Creating solar power
   - ○ None of the above
11. What is another term for renewable resources?
   - ○ Green Energy
   - ○ Pollution
   - ○ Greenhouse gasses
   - ○ All of the above
12. Renewable resources produce energy over and over – true or false?
   - ○ True
   - ○ False

13. Which of the following statements is true?
    - ○ We will never run out of fresh water
    - ○ There is more fresh water than salt water
    - ○ The amount of fresh water is limited
    - ○ The amount of fresh water is increasing

14. How much water can you save every day by shutting off the water when you brush your teeth?
    - ○ 1 to 5 cups
    - ○ 1 to 5 pints
    - ○ 1 to 5 quarts
    - ○ 1 to 5 gallons

15. Which uses more water?
    - ○ A bath
    - ○ A five-minute shower
    - ○ They both use the same amount

16. Which uses less water when you wash your bike or the family car?
    - ○ A hose
    - ○ A bucket of soapy water
    - ○ They both use the same amount

17. Wasting water in our homes has no impact on hydroelectric dams – true or false?
    - ○ True
    - ○ False

18. Which of the following is true about power companies?
    - ○ Power companies use only nonrenewable resources
    - ○ Power companies use only renewable resources
    - ○ Power companies combine renewable and nonrenewable resources
    - ○ Power companies use neither renewable nor nonrenewable resources

19. How can you help save energy?
    - ○ Switch to compact fluorescent bulbs
    - ○ Leave your computer on all the time
    - ○ Turn off lights you are not using
    - ○ a and c
    - ○ a, b, and c

20. Which of these things would not help save water?
    - ○ Fix leaky faucets
    - ○ Use a bucket instead of a hose to wash the car
    - ○ Turn off the water when you are brushing your teeth
    - ○ Take baths in cold water

QUESTIONS 21 AND 22 – INTERVENTION SCHOOLS ONLY:

21. Did you see the program called *Con-serving Up Comedy* at your school?
    - ○ Yes
    - ○ No

22. Did you do the *Con-serving Up Comedy* workbook in your class?
    - ○ Yes
    - ○ No