



ANNUAL REPORT
2016
*Presented by the Colorado River Alliance
June 2015 - June 2016*



Texas Colorado River Rolling Exhibit Annual Report
Colorado River Alliance
2015 - 2016

Introduction

The mission of the Colorado River Alliance (Alliance) is to secure the vitality of the Texas Colorado River through education and advocacy for all generations. The Alliance and Austin Water have been working collaboratively since fall 2012 to design and develop the Texas Colorado River Rolling Exhibit (Mobile River) and its corresponding classroom curriculum. Both are designed to meet specific program goals and objectives, as well as to support educators in meeting Texas state science standards (TEKS). The Mobile River is an interactive, water-science center housed inside a 42-foot gooseneck trailer. It visits middle school campuses and teaches students about the Colorado River, its watershed, and human interaction with local water sources. The program also delivers four customized lesson plans that are administered inside the classroom. This system allows educators to build core science knowledge and skills relative to watersheds and provide a sound educational experience to youth.

Program Goals & Objectives

This program's goal is to reach 8,000- 10,000 people (6,000 7th graders and 4,000 community members) each year. The Alliance is implementing this project by collaborating with both Austin Water and the Austin Independent School District (AISD), integrating both informal and formal education curriculum and building on preexisting middle school programs provided by all three entities.

Short-term target outcomes include:

- Student participants show statistically significant increases in water conservation and water quality knowledge, and knowledge of related STEM concepts taught in classrooms.
- Students show statistically significant increases in pledges to adopt personal water-conservation habits, resulting in 10 million gallons of water conserved annually through pledges.
- Students show statistically significant increases in interest in STEM professions.

Long-term intended impacts include:

- A workforce of professionals in STEM fields who are knowledgeable about water quality and water-conservation needs for a sustainable water supply
- A healthier Colorado River watershed
- Reduction in water use within the Colorado River watershed

Program Structure

The Mobile River program delivers a powerful educational experience for 7th grade students. Students spend one 45 minute class period interacting with exhibits, guided by staff and interns inside the trailer. In the classroom they complete up to four lesson plans on water conservation, Texas ecoregions and weathering, watershed precipitation and runoff, and watershed pollution. Before the Mobile River deploys to a school campus, 7th grade science teachers undertake up to four hours of training on classroom curriculum, and Alliance staff construct a customized curriculum delivery schedule to ensure all 7th grade science classes receive the same educational experience. Campus visits last one–two weeks, depending on the size and number of 7th grade science classes. Student knowledge gains are assessed by administering identical pre-visit and post-visit knowledge questionnaires. Alliance staff also collect feedback from teachers after the program completes campus visits. The Alliance launched the Mobile River program on April 28th, 2015, and this report includes operations through the end of June 2016.

Program Participation Statistics

Table 1: Program Operating Statistics through June 2016

Program Dimension	Metric	Apr-Jun 2016	Jun 2015-Jun 2016	Program To-Date (Since April 2015)
Staff Involvement	Total Staff Operating Hours	635	2143	2448
	Executive Director	30	92	128
	Program Director	100	580	860
	Development Director	25	34	43
	Program Coordinator	480	1437	1437
School and Community Engagement	Total Mobile River Events	62	268	315
	Private Events	6	12	18
	Public Events	3	12	15
	Class Field Trips	53 (5 school visits)	244 (24 school visits)	285 (27 school visits**)
	Total Individuals Served	1843	8821	10664
	General Public (<i>all ages</i>)	611	3250	3546
	Public School 7 th Graders	1212	5201	6132
	Title I	306	2541	2769
	Non-Title I	906	2660	3338
	Adult Events	20	370	986
	Private-event Attendees	20	370	768
	Public-event Attendees	0	0	218
	Student Ethnicity			
	Caucasian	49.67%	34.72%	37.06%
	Hispanic	40.43%	52.43%	50.43%
	African American	4.62%	8.83%	8.14%
	African	0.08%	0.23%	0.20%
Middle Eastern	1.73%	1.60%	1.51%	
Asian	3.05%	2.10%	2.59%	
Other	0%	0%	0%	
Classroom Curriculum Impact	Total # Lessons Delivered*	1211	8686	11846
	Total # Educators Served**	11	55	76
	Teacher Prof. Dev. Hours***	10	116	148
Volunteer Engagement	Total Volunteer Hours	212	704	704

* Not all teachers and classes complete all four lesson plans as part of a Campus Visit.

** Includes repeat visits to teachers and schools across program years.

*** Teacher Professional Development training is not repeated for the same teachers across program years unless requested.

Student Knowledge Impacts

We compared the pre-visit and post-visit questionnaire scores from 690 AISD 7th grade students, all of which completed Mobile River trailer visits and all four of our program’s classroom lesson plans. To compute student knowledge scores, we scored ten out of twelve questions on the pre-visit and post-visit knowledge questionnaire (see Figure A, Appendix), which cover curriculum delivered in the Mobile River trailer, and through our program’s four classroom lesson plans. Our curriculum directly supports the 7th grade Curriculum Road Map (CRM) followed by AISD schools and the Texas Essential Knowledge and Skills (TEKS). Student performance within individual water science and conservation topic areas is further explored in the Discussion section of this report.

Our student knowledge assessment was performed by using a repeated-measures Analysis of Variance (ANOVA) which included students’ school Title I Status as a factor. 218 students were from Title I schools (those serving children from predominantly low-income households) and 472 students were from Non-Title I schools (serving children from middle-class and affluent households).

- Students from both Title I and Non-Title I schools scored significantly higher on post-visit knowledge questionnaires than pre-visit questionnaires (See Table 2 below, and Exhibit B, Appendix).
- Students from Non-Title I schools showed significantly larger increases in post-visit questionnaire scores than students from Title-I schools.
- Non-Title I students also scored higher than Title I students on both pre-visit and post-visit questionnaires.
- All mean score comparisons were statistically significant with p-values less than .05:

Table 2: Mean student pre-visit and post-visit questionnaire scores for water science and conservation knowledge (18 total points possible)

	Mean Student Pre-Visit Score	Mean Student Post-Visit Score	Percent Change in Score	# Students Assessed
Non-Title 1	9.31	12.24	+ 31.5%	472
Title 1	6.63	8.47	+ 27.8	218
Total	8.46	11.05	+ 30.6	690

Student Water Conservation Habits and STEM Interest Assessment

The remaining two questions assessed student interest in STEM (Science, Technology, Engineering, and Math) careers (Question #4, Exhibit A; Appendix) and willingness adopt various water conservation habits (Question #10, Exhibit A; Appendix). Student scores from both questions were assessed by using a repeated-measures Analysis of Variance (ANOVA) which included students’ school Title I Status as a factor.

Student Interest in STEM Careers:

- The mean student scores from both pre and post-visit questionnaires indicate they have a neutral interest level in STEM careers.
- Students from both Title I and Non-Title I schools scored significantly higher on post-visit questionnaires than pre-visit questionnaires (See Table 3 below, and Exhibit E, Appendix).

- Students from Title I schools showed significantly larger increases in post-visit questionnaire scores than students from Non-Title-I schools.
- Non-Title I students scored significantly higher than Title I students on both pre-visit and post-visit questionnaires.
- Mean score comparisons were statistically significant with p-values less than .05:

Table 3: Mean student pre-visit and post-visit questionnaire scores for STEM career interest (5 points possible, 1 = “Not at all interested,” 3 = “Neutral,” 5 = “Very Interested”)

	Mean Student Pre-Visit Score	Mean Student Post-Visit Score	Percent Change in Score
Non-Title 1	3.19	3.29	+ 3.1%
Title 1	2.83	3.02	+ 6.7%
Total	3.06	3.19	+ 4.2%

Water Conservation Habit Adoption:

- Students from both Title I and Non-Title I schools scored significantly higher on post-visit questionnaires than pre-visit questionnaires (See Table 4 below, and Exhibit F, Appendix).
- Students from Non-Title I schools showed significantly larger increases in post-visit questionnaire scores than students from Title-I schools.
- Non-Title I students scored significantly higher than Title I students on both pre-visit and post-visit questionnaires.
- All mean score comparisons were statistically significant with p-values less than .05:

Table 4: Mean student pre-visit and post-visit questionnaire scores for water conservation habit adoption (4 points possible)

	Mean Student Pre-Visit Score	Mean Student Post-Visit Score	Percent Change in Score
Non-Title 1	2.15	2.58	+ 20%
Title 1	1.64	1.94	+ 18.3%
Total	1.96	2.35	+ 19.9%

Table 5: Water conservation estimate for Program Year 2, assuming students adopt conservation habits they selected on Question 10 (see Appendix, Exhibit A)

Conservation Pledge Action	# of Pledges	% of Pledges	# of Gallons Saved per Action	# of Actions per Year	# of Gallons Saved in one Year
Taking short showers (5 minutes)	1755	30.1	25	312	13,689,000
Running full loads of laundry	1037	17.8	20.5	52	1,105,442
Turning off the faucet running while brushing your teeth	1966	33.7	3.5	365	2,511,565
Running full loads in the dishwasher	971	16.6	3	52	151,476
I don't know	103	1.8	0	0	0

Discussion

Student Learning Impacts

Students completing all of the Mobile River's curriculum averaged a 2-3 point increase in water science and conservation knowledge questionnaire scores, out of a total of 18 possible points. This knowledge increase was statistically significant, regardless of whether students attended Title-I or Non-Title-I schools. Overall student knowledge gains were driven by increases in several program content areas (see Exhibit C, Appendix); most notably including:

- 1) **Knowledge of drinking water source** (Question # 1; taught during trailer visits by Alliance staff):
- 2) **Water conservation knowledge** (Question # 5; taught by teachers administering the Water Conservation lesson plan in classrooms)
- 3) **Watershed precipitation and runoff knowledge** (Question # 7; taught by teachers administering the Watershed Precipitation and Runoff lesson plan in classrooms):

Students from affluent backgrounds (attending Non-Title I schools) scored significantly higher on both pre-visit and post visit questionnaires, and they made larger gains in post-visit questionnaire scores than students from underserved and underrepresented backgrounds (attending Title-I schools). These performance differences may be partly attributable to language barriers; students attending Title I schools have a much larger percentage of Hispanic students, many of which are learning English as a second language. Feedback from teacher surveys indicated that students attending Title I schools could have used more time to complete classroom lesson plans because they encountered new vocabulary and needed extra support following instructions.

Important learning differences between these two groups of students were also observed across the five major water science and conservation topic areas for which students were assessed (see Exhibits D and E, Appendix). Knowledge gains made by more affluent students (attending Non-Title I schools) were made in topic areas that spanning three out of four classroom lesson plans and much of the Mobile River Trailer's curriculum. These gains are noted by the italicized text below:

- 1) **Knowledge of drinking water source** (Question #1; taught during trailer visits by Alliance staff): *A larger percentage of Non-Title I students showed knowledge gains on this question than Title I students.*
- 2) **Water conservation knowledge** (Question #s 2,5,11; taught during trailer visits by Alliance staff, and Question # 5; taught by teachers administering the Water Conservation lesson plan in classrooms): *A larger percentage of Non-Title I students answered these questions correctly than Non-Title I students on both pre-visit and post visit questionnaires. A larger percentage of Non-Title I students showed knowledge gains on Question #5 than Title-I students.*
- 3) **Watershed pollution knowledge** (Question #s 3,9; taught during trailer visits by Alliance staff, and by teachers administering the Watershed Pollution lesson plan in classrooms): *A greater percentage of Non-Title I students answered correctly on Question #3 than Title I students on both pre and post-visit questionnaires. Both groups of students showed similar degrees knowledge gains between pre-visit and post-visit questionnaires. A greater percentage of Non-Title I students showed knowledge gains on Question #9 than Title I students.*
- 4) **Watershed precipitation and runoff knowledge** (Question #s 6,7; taught by teachers administering the Watershed Precipitation and Runoff lesson plan in classrooms): *A larger percentage of Non-Title I students answered these questions correctly than Non-Title I students on both pre-visit and post visit questionnaires. Both groups of students showed similar degrees knowledge gains between pre-visit and post-visit questionnaires.*
- 5) **Ecoregions and weathering knowledge** (Question #s 8,11; taught by teachers administering the Ecoregions and Weathering lesson plan in classrooms): *A larger percentage of Non-Title I students showed knowledge gains on Question #8 than Title-I students. A greater percentage of Non-Title I students correctly answered Question #11 than Title I students on both pre-visit and post-visit questionnaires. A greater percentage of Title I students showed knowledge gains on Question #11 than Non-Title I students.*

Student Interest in STEM Careers

Students from comparably affluent backgrounds (attending Non-Title I schools) make more knowledge gains in our program than students from underserved and underrepresented backgrounds (attending Title I schools). These gains are made in topic areas that spanning three out of four classroom lesson plans and much of the Mobile River Trailer's curriculum as well. However, student knowledge gains were not uniformly disparate between these two student groups across all questionnaire items for a given topic. This pattern suggests that within most of the science and conservation topics our program focuses on, students from underserved and underrepresented backgrounds had trouble with certain learning points within that topic, but not others. As a result, Alliance staff must review sections of lesson plans and trailer curriculum that directly pertain to questionnaire items that Title I students are having trouble with, and revise the language, instructions, and teacher training supporting this curriculum to be clearer to someone who may be learning English as a second language.

Students from comparably affluent backgrounds showed greater interest in STEM careers than students from underserved and underrepresented backgrounds on both pre-visit and post-visit questionnaires. Students from disadvantaged backgrounds showed a greater increase in STEM interest scores than more affluent students, however the de-facto difference in STEM interest scores from both groups of students (see Table 3) is so small that the Alliance urges caution in assigning too much importance to the fact that they are significantly different as determined by a statistical test.

Student Interest in Water Conservation

Students who pledged to adopt water conservation habits on post-visit questionnaires will save 17,457,483 gallons (53.6 acre-feet) if they enact these habits over a one year period (see Table 5). A similar (but not identical) score pattern to STEM interest scores exists for student water conservation habit adoption when comparing pre-visit and post-visit questionnaire scores (see Table 4). Students from more affluent backgrounds pledged to adopt more water conservation habits on both pre-visit and post-visit questionnaires than students from underrepresented and underserved backgrounds. Comparably affluent students also showed greater increases in conservation habit adoption on post-visit questionnaires than underrepresented and underserved students, however the difference in pre-visit and post visit questionnaire means is very small, despite being statistically significant. Clearly, further work must be done to achieve more meaningful increases in STEM interest and water conservation among students participating in our program.

Tactical Improvements for the 2016-2017 School Year

Based on our operating experience during the 2015-2016 school year, the Alliance has implemented a number of tactical improvements to the Mobile River program's logistics and resources:

- 1) Challenge: During the 2015-2016 school year, teachers at 10 out of 22 AISD middle schools only undertook trailer visits and did not complete any classroom lesson plans. Teachers at other campuses completed one to three of the four lesson plans that accompany the trailer during campus visits, however teachers at only 4 AISD middle schools completed all four classroom lesson plans with their students.

Improvement 1: Alliance staff has increased efforts towards lesson plan adoption by teachers by promoting the importance of the lesson plans during teacher training in advance of campus visits. *The Alliance's goal is to have 50% (11 schools) of AISD middle school teachers complete all four classroom lesson plans with their students during the 2016-2017 school year.*

Improvement 2: The Alliance will have all AISD students complete pre-visit and post-visit questionnaires, including those who do not complete in-classroom lesson plans. We will compare knowledge increases between students who complete classroom lesson plans to those who do not, thereby providing a direct measure of the value of classroom lesson plans relative to trailer visits.

- 2) Challenge: During the 2015-2016 school year, teacher feedback surveys indicated that students attending Title I schools needed more time to complete classroom lesson plans to overcome language barriers encountered by Hispanic students.

Improvement 1: The Alliance constructed an additional set of classroom curriculum materials (e.g., hands-on models and demonstrations) and adjusted program scheduling to permit students attending Title I schools to have up to two weeks to complete classroom lesson plans

instead of one week. This extra set of classroom materials can be left behind after the Trailer leaves for the next school campus, and picked up at a later date.

Improvement 2: The Alliance is revising teacher training and environmental educator intern training to clarify instruction and curriculum delivery support pertaining to questionnaire items that Title I students struggled with (namely Questions # 1, 5, 8, and 9). *The Alliance's goal is to implement instructional improvements that result in a four point score increase on post-visit questionnaires for both Title I and Non-Title I students during the 2016-2017 school year.*

- 3) Challenge: Students show marginal increases in STEM career interest and water conservation habit adoption scores on post-visit questionnaires.

Improvement: The Alliance will adjust environmental educator intern training to help them emphasize their choice of STEM majors in college to middle school students, and to highlight how professionals in STEM help solve important environmental and social problems, regardless of racial or socio-economic background. In addition, interns will be trained to ensure that all students visiting the Mobile River trailer complete the Daily Water Use Calculator. *The Alliance's goal is to achieve a 1 point increase in post-visit questionnaire scores on questions pertaining to STEM interest and water conservation habit adoption during the 2016-2017 school year.*

- 4) Challenge: The Alliance lost significant amounts of pre/post visit questionnaire data because students failed to legibly write their Student ID on answer sheets.

Improvement: The Alliance's Program Coordinator re-designed the administration of these questionnaires so students must record answers to both pre-visit and post-visit questionnaires on one sheet of paper, eliminating mismatched Student ID numbers.

- 5) Challenge: The Mobile River Trailer encountered chronic mechanical issues such as spontaneous generator shutdowns, electrical wiring shorts, battery drainage, exhibit damage from vibration and heat, trailer wrap damage from heat and weather exposure, and visitor wear to Exhibit Unit 2 ("Who Gets the Water?"). One-time damage occurred from towing mishaps and student altercations. Repairs and upgrades from these issues cost \$3,600, in addition to \$1,800 from routine trailer and generator maintenance, and \$5,000 from trailer transportation costs outside of the service area that Austin Water staff cover.

Improvement: The Alliance has budgeted \$10,000 for annual maintenance, repair, and contracted transportation services. An additional \$3750 will be budgeted annually to plan for a trailer wrap replacement in four years.

Strategic Initiatives for the 2016-2017 School Year

The Alliance is constantly evaluating and evolving the focus of its educational programs to respond to emerging needs of students and families in the Texas Colorado River Watershed, as well as input from the Alliance Board of Directors:

- 1) Emerging need: One out of every four of the 2.1 million people in the Texas Colorado River Basin speak Spanish.

Strategic Initiative: The Alliance's Mobile River Program Coordinator will take Spanish lessons

during Summer 2017, identify two public events in Fall 2017 that cater to Hispanic populations, and send the Mobile River to attend them. *The Alliance's goal is to engage with 750 Spanish-speakers at public events, provide bilingual interactions with them during the 2016-2017 year. In addition, one bi-lingual intern has been recruited for the Fall 2016 season, and two will be recruited for Spring 2017.*

- 2) Alliance Board of Directors Input: The Alliance's education programs currently focus primarily on the Austin area, and we need to extend further to communities across the Texas Colorado River Basin.

Strategic Initiative: In the coming year, the Mobile River program will increase efforts to reach students, teachers, and members of the public in upstream and downstream communities by visiting schools and public events in Matagorda, Colorado, Bastrop, San Saba, and Tom Green Counties. *The Alliance's goal is to engage 500 students outside of the Austin Area, and 1000 people at public events outside of Austin during the 2016-2017 year (see Exhibits G and H, Appendix).*

Appendix:

**Exhibit A:
Mobile River Pre-Visit/Post-Visit Student Questionnaire**

Greetings Students! These questions take 10 minutes. They are not for a grade, and we will never know your name. Please circle the answer you think is correct. *If you don't know, circle "I don't know".*

1. Where do people in Austin get their drinking water from?
 - a. The Edwards Aquifer underground
 - b. The Texas Colorado River
 - c. The Colorado River in Arizona
 - d. The Gulf of Mexico
 - e. I don't know

2. Circle **ALL** of the home habits below that will save water:
 - a. Taking short showers (5 minutes)
 - b. Running full loads of laundry
 - c. Turning the faucet off while brushing your teeth
 - d. Running full loads in the dishwasher
 - e. I don't know

3. Circle **ALL** of the **sources** of pollution in our river:
 - a. Nutrients from fertilizer
 - b. Animal waste (poop)
 - c. Dirt and sediment washed in from construction sites
 - d. Algae
 - e. Trash such as empty plastic bottles
 - f. I don't know

4. Are you interested in using math, science, or engineering at your job when you grow up?
 - a. I'm very interested
 - b. I'm somewhat interested
 - c. I feel neutral about it
 - d. I'm not very interested
 - e. I'm not *at all* interested
 - f. I don't know

5) On average, who uses the most water each day?

- a. People from Kenya
- b. People from India
- c. People from Texas
- d. People from England
- e. I don't know

6) When it rains, which of the following landscapes would allow the most rain to infiltrate and become groundwater?

- a. A shopping center parking lot
- b. A field with trees, grass, and shrubs
- c. A neighborhood with houses, driveways, and yards
- d. A city street with buildings and parking garages
- e. I don't know

7) When it rains, which of the following landscapes would cause the most rain to run off the ground surface into streams and rivers?

- a. A grassy field with soaking wet soil from recent rain
- b. A grassy field with soft soil
- c. I don't know

8) Circle all of the following environmental processes that occur in the Texas Colorado River?

- a. Weathering
- b. Erosion
- c. Deposition
- d. Subduction
- e. Induction
- f. I don't know

9) Once pollution is introduced to the environment by humans, what is the biggest way it winds up in our rivers and lakes?

- a. It gets blown by the wind
- b. It gets dumped by people
- c. It is washed in by runoff from rain

- d. It gets left behind by animals
- e. I don't know

10) Circle each of the home water saving habits you pledge to adopt into your daily routine:

- a. Taking short showers (5 minutes)
- b. Running full loads of laundry
- c. Turning off the faucet running while brushing your teeth
- d. Running full loads in the dishwasher
- e. I don't know

11) On average, which Texas city among the four answer options below gets the most rainfall?



- a. Austin, TX
- b. El Paso, TX
- c. Dallas, TX
- d. Houston, TX
- e. I don't know

12) How much **liquid** freshwater exists on Earth?

- a. 100%
- b. 3%
- c. 1%
- d. .003% (so less than 1%)
- e. I don't know

Exhibit B: Overall Student Knowledge Gains on Environmental Science and Water Conservation Concepts, 2015-2016

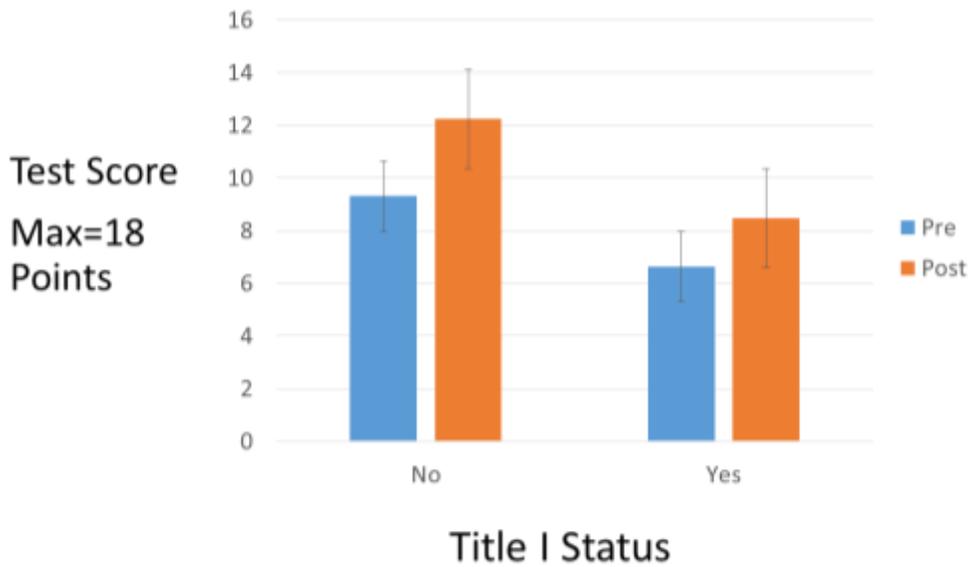


Exhibit C: Knowledge Gains on Environmental Science and Water Conservation Concepts by all Students, 2015-2016 (see Exhibit A to reference each Test Question Number)

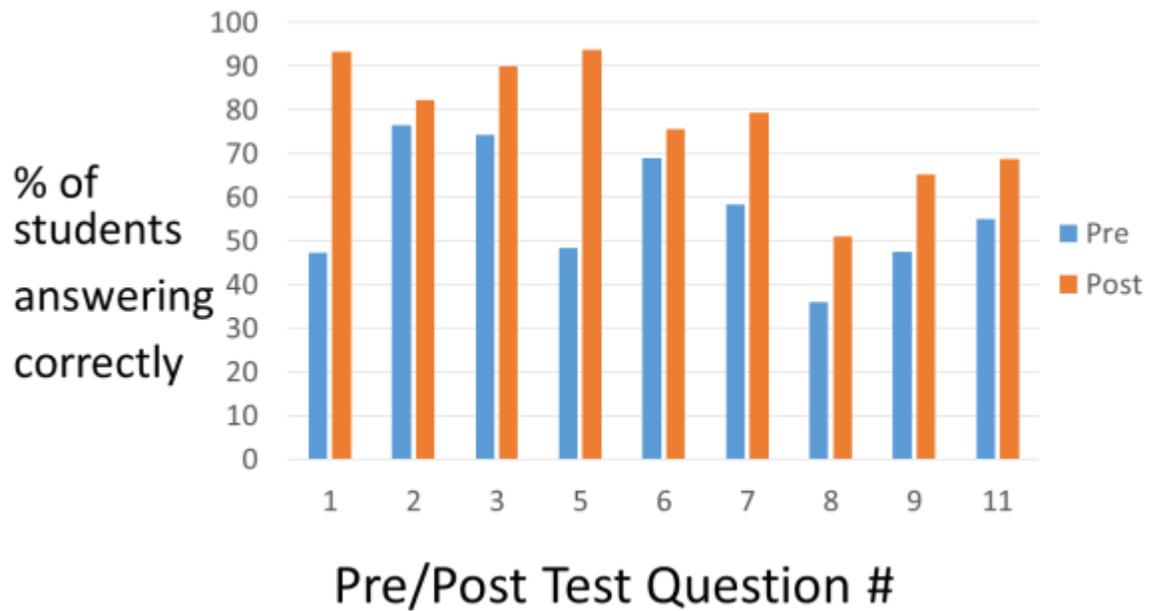


Exhibit D:
Knowledge Gains on Environmental Science and Water Conservation Concepts by Students Attending Title I Schools, 2015-2016 (see Exhibit A to reference each Test Question Number)

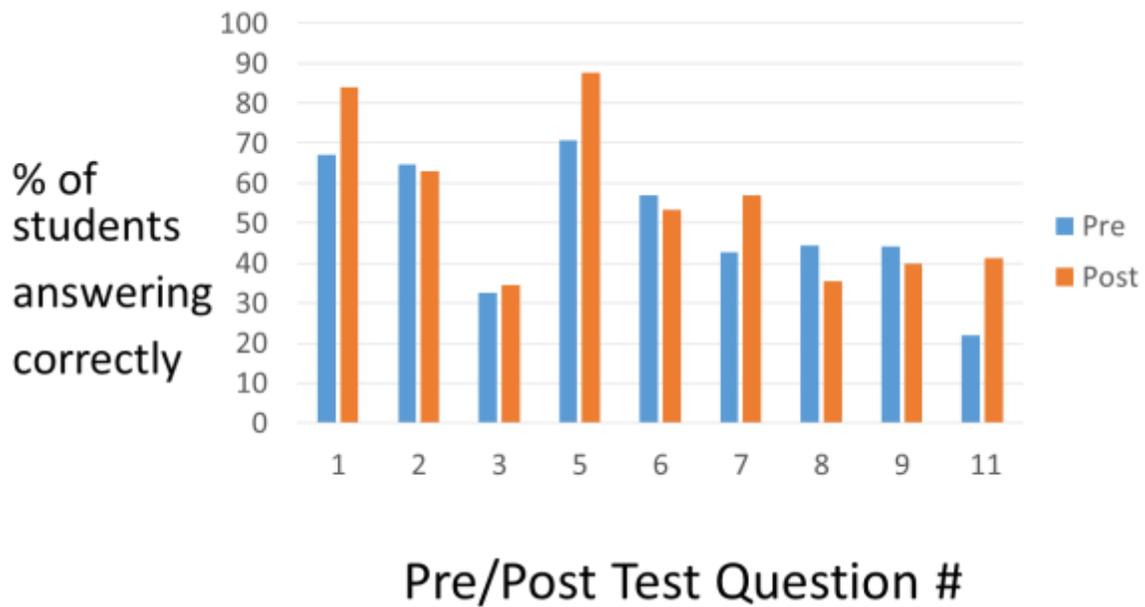


Exhibit E:
Knowledge Gains on Environmental Science and Water Conservation Concepts by Students Attending Non-Title I Schools, 2015-2016* (see Exhibit A to reference each Test Question Number)



*Question # 12 was excluded from the analysis of overall student questionnaire scores because an insufficient number of Title I students successfully completed this question.

Exhibit E:

Student ratings of STEM Career Interest, 2015-2016 (see Exhibit A to reference Question #4)

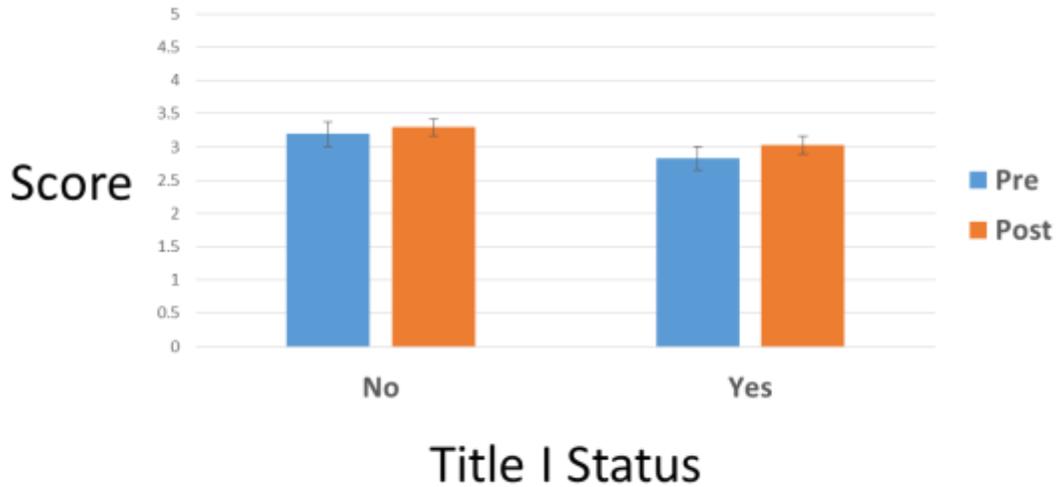


Exhibit F:

Student Conservation Pledge Scores, 2015-2016 (see Exhibit A to reference Question #10)

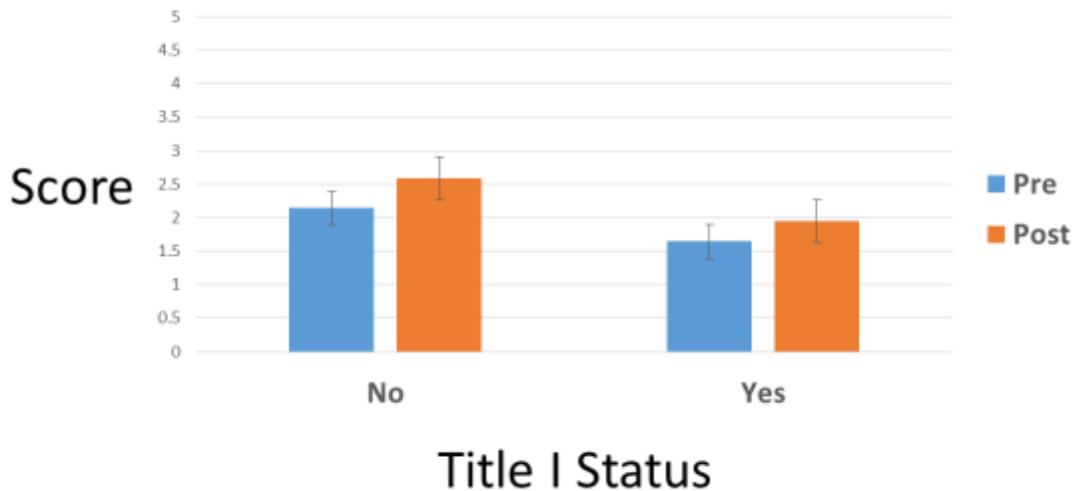


Exhibit G: 2015-2016 Public Events

Date	Event	Location	# Visitors
2/13/2016	San Marcos STEM Fair	San Marcos, TX	109
2/27/2016	Girl Day at UT-Austin – Women in Engineering Program	Austin, TX	1,565
3/16/2016	Barton Springs “Under the Springs” Celebration (2 days)	Austin, TX	400
4/2/2016	Zilker Garden Festival (2 days)	Austin, TX	522
4/23/2016	Earth Day Austin	Austin, TX	70
6/25/2016	Colorado River Ramble	Austin, TX	10

Exhibit H: 2016-2017 Public Events and School Visits outside Austin

Date	Event	Location	# Visitors
7/2/2016	Bastrop Patriotic Festival (2 days)	Bastrop, TX	755
7/26/2016	McKinney Roughs Wild for Water Camp	Cedar Creek, TX	90
8/4/2016	Bastrop Rodeo and Homecoming (3 days)	Bastrop, TX	187
8/20/2016	Austin Bat Festival	Austin, TX	79
9/20/2016	Colorado County Fair	Columbus, TX	
11/7/2016 - 11/21/2016	Bay City ISD, Tidehaven ISD, Matagorda Bay Nature Center	Bay City, TX	
1/9/2016 – 1/20/2016	San Angelo ISD, San Saba ISD	San Angelo & San Saba TX	