The following is a final report detailing the successful completion of the USEPA/Texas A&M University-Corpus Christi environmental education project Reaching Further: Redefining Environmental Education. The project was very successful and met or exceeded all goals identified in the original proposal. The following is an itemized response to each of the items identified in the contract for the final project report.

Expenditures

The project is complete and $43,437.68 of the original $43,795 has been drawn on the project. A no-cost extension from May 30, 2008 to July 30, 2008 was granted which allowed an extra series of summer camps to be conducted in summer 2008. A revised budget has been submitted and is included in appendix A along with a summary of project matching contributions. Texas A&M University-Corpus Christi (A&M-CC) project staff contributed additional time to the project resulting in a savings of $4,090.46 in salaries and $1,066.25 in indirect. These funds were used to provide five additional summer camps in 2008 for children and youth from the Coastal Bend Boys & Girls Club, the Homeschool Association of South Texas, and the South Texas Women’s Shelter.

Activities Performed

The original agreement called for four Summer Sea Camps, two Teacher Workshops, ten Teacher/Student Field Experiences, five Seniors’ Expeditions, and three community events. Five Summer Sea Camps were completed in the summer of 2007 with an additional five Camps in the summer of 2008. Project staff partnered with the College of Education to offer two teacher workshops, Teaching Environmental Science I & II, in the summer of 2007. Twelve Teacher/Student Field Experiences were completed in spring 2007. Five Seniors’ Expeditions were completed in the spring of 2007. Community events included the Spring Adopt-A-Beach cleanup on Mustang & Padre Islands in 2007 and 2008, Fall Adopt-A-Beach Cleanup in 2007, and SeaFair in Rockport in fall 2006 and 2007. Six special offerings were also completed in 2007 and 2008, consisting of one-day kayaking experiences for special groups including Audrey’s Day at the Beach, an event for families with children who have Down’s syndrome, at-risk youth from the National Youth Sports Program, and various student and teacher groups. All of these activities will be described in more detail along with numbers of participants later in the report.

New/Innovative

This project is new and innovative in two respects. First, the project provides a unique, field-based environmental education experience that emphasizes taking the participants out into the environment. By using kayaks and the Wetland Explorer floating classroom, participants get to explore locations that are only accessible by boat. Once in the field, participants get to use field methods and equipment under the supervision of environmental educators to really understand coastal ecology and particularly their role in helping preserve and protect our valuable natural resources. The second way that the project is new and innovative is the target audience. This
The project provides environmental education experiences to many diverse groups outside mainstream middle and high school science students. The focus on extending environmental education to underserved constituents is demonstrated by who those participants were. They include teachers and students from rural schools, urban minority youth, at-risk youth, abused women and children, seniors, children with disabilities and their families, and the general public. While environmental education was the primary goal of the project, many individuals gained much more including overcoming fear of water and boats, building self-esteem and confidence, learning to work together, and having a really unique adventure.

EPA Priorities

The project addressed *Education Reform* by delivering field-based, experiential learning to develop higher level thinking skills in response to the new Texas Science standards and by assisting the Rural Systemic Initiative with their science education reforms, *Community Issues* and *Health* by raising awareness of important environmental and health issues among a large and diverse group of citizens, *Teaching Skills* through graduate level teacher training and science class field trips, and *Career Development* through all components involving youth. These priorities were established in the original proposal in response to the EPA Solicitation Notice and remained key considerations throughout the course of the project.

Problems Encountered

Two primary problems were encountered during the project. The first problem was the disappearance of Warm Springs Rehabilitation Hospital. One of the project activities was to be an adaptive kayaking experience for patients from Warm Springs. Shortly after project award, staff attempted to contact Warm Springs to plan the activity. Unfortunately, Warm Springs no longer existed in Corpus Christi. It is unknown whether they relocated or simply went out of business. A replacement group was found in a non-profit organization named “Audrey’s Day at the Beach”. This organization serves families with children with Down’s syndrome. Jay Tarkington and volunteers successfully provided an outdoor environmental education experience for 130 children and family members using kayaks and the Wetland Explorer floating classroom.

The second problem was weather. Because most of the activities were outside and on the water, weather was a critical element. Bad weather through the winter of 2006 delayed the project’s initial activities until early 2007. During the summer of 2007 there was an exceptional amount of bad weather which threatened to disrupt summer camp activities. Somehow, there always seemed to be a window in the bad weather which allowed every camp to be successfully completed. In the summer of 2008 Hurricane Dolly brought severe weather to the Coastal Bend resulting in the cancellation of outdoor activities for two days during one summer camp. The lesson learned is to have some “weather resistant” activities lined up in case of inclement weather. These included field trips to the Texas State Aquarium, Texas Parks & Wildlife Fish Hatchery, and Padre Island National Seashore.

Audience and Application

The audience for the project is best described by reviewing the target audience for each activity. There were 151 participants for the summer camps in 2007 and 2008. They were youth from the Boys & Girls Club, children and moms from the Women’s Shelter, and homeschool children from the Homeschool Association. These groups were chosen based on two criteria. First they are groups that are not normally provided with these type opportunities. Second, the partner organizations committed to recruiting and preparing participants for the project.
The second activity was the Teaching Environmental Science I & II teacher workshops. These two groups included a diverse collection of 27 teachers from beginning to experienced, from urban to rural, and from primary to secondary. Participating teachers came from the Coastal Bend and South Texas.

The Teacher/Student Field Experiences recruited primarily rural teachers from all over South Texas. Project staff partnered with the South Texas Rural Systemic Initiative (STRSI) to recruit rural science teachers and their students for a full-day field experience. Participating schools came from Gregory-Portland, Ingleside, Woodsboro, Runge, Jourdanton, Rockport-Fulton, Refugio, with one group from Kansas. A total of 268 teachers and students participated.

The audience for the Seniors’ Expeditions consisted of 160 seniors who were recruited from around the region. This group included seniors from the Coastal Bend area as well as “Winter Texans” who are seniors who winter in Texas from their homes across the Midwest and Northern United States.

Community events including SeaFair and the Adopt-A-Beach cleanups brought in people from all over. Participants in both events came from the Coastal Bend and South Texas with some coming from various locations in Central Texas including Waco, Austin, San Antonio, Brenham, and other cities.

In addition to the planned activities, there were several special one-day events. We conducted two field science days for a total of 83 STRSI teachers from all over South Texas. We provided a field experience for 13 undergraduate students involved in three summer science programs at A&M-CC. These students came mainly from across Texas, but included students from Oklahoma, California, and Puerto Rico. Additional special events included field trips for 18 at-risk youth from the National Youth Sports Program and 19 teens from Central Texas participating in a SeaCamp. Also included were 130 family members from Audrey’s Day at the Beach. This event served children with Down’s syndrome and their parents and siblings.

Benefits & Dissemination

Other programs involved in outdoor, recreation, and environmental education programming can benefit from the project by looking at the activities we provide and the methods and equipment that we use. We have seen other youth programs in the region begin using kayaks in their outdoor activities and have been contacted by others seeking this experience for their groups (see special events). This combined with the information on our website and good coverage by the media contributes to the awareness of environmental education programming in our region.

Plans for the immediate future include finding funding to continue the activities developed and offered under this project. A grant has already been obtained for summer camps in 2009 for a special group of participants focusing on at-risk, urban, disadvantaged, female youth. We plan to continue participation in community events including the 2008 Fall Adopt-A-Beach Cleanup in September and the 2008 SeaFair in October. University student volunteers are being recruited for both events. Jay Tarkington is currently seeking funding to continue offering Teacher/Student Field Experiences and Seniors’ Expeditions. We will both continue to partner with the College of Education on the Teaching Environmental Science I & II teacher training courses.
It has been a goal of A&M-CC to expand the program to additional participants from a broader geographical region beyond South Texas. This will require substantial additional funding. A source for this funding has not been identified as of yet.

**Environmental Outcomes**

The goal of this project was to raise environmental awareness and create environmental stewards. The five project components: summer camps for youth, environmental education training for teachers, field trips for rural teachers and their students, environmental expeditions for senior citizens, and environmental education at community events reached a large and diverse audience. Participants of all ages and walks of life gained a science-based understanding of environmental issues relevant to this region. Learning objectives included science of the local environment, awareness of specific environmental issues, objectivity, and teamwork accomplished through experiential learning. The project successfully increased participants’ knowledge and awareness of the environment. Project activities were evaluated to determine success. The results of project evaluation are contained in appendix B.

**Project Activities & Conclusion**

I. Summer Camps

We conducted five summer camps in 2007 and five in 2008 with additional one-day trips for special groups. Participants included children and mothers from the Women’s Shelter, youth from the Boys & Girls Club, and children and youth from the Homeschool Association. Special one-day events were provided for at-risk youth from the National Youth Sports Program, children with Down’s Syndrome and their families from Audrey’s Day at the Beach, and others as described previously. Each camp included field instruction, science activities, kayaking, and visits to special sites. Special sites included the Texas State Aquarium, the Texas Parks & Wildlife/Coastal Conservation Association Fish Hatchery, Padre Island National Seashore, and the A&M-CC Aquatic Education Program research & teaching vessel “Wetland Explorer”. One camp was interrupted for two days by Hurricane Dolly. Otherwise, all camps were completed as planned with a total of 151 young people participating.
II. Teacher Environmental Education Training

In June and July of 2007, we conducted two environmental education programs for area teachers. Teaching Environmental Science I & II (TES I & II) offered primary and secondary teachers in-depth instruction, field activities, site visits and guest speaker presentations during each of the two-week, graduate level courses. A total of 27 teachers participated in the courses. Teachers were provided curricula, supplies, contacts, and additional support during and following the program. This program was cosponsored with the A&M-CC College of Education.

III. Teacher & Student Field Experiences
The work plan and schedule called for ten teacher/student field experiences. In spring 2007 we completed twelve of these offerings with 268 teachers and students participating. This activity consisted of two parts, kayak exploration and a “hands-on” science lesson aboard the Wetland Explorer. Activities included a mud grab, otter trawl, examination of marine life, use of field instruments & equipment, bird identification, and discussion of human impacts on coastal waters.

Many lessons were learned by students and their teachers, as well as program staff. The evaluator found that the goal of increasing environmental knowledge and awareness was achieved in all of the offerings.

IV. Seniors’ Expeditions

Eight senior or “Winter Texan” field trips were planned for each winter. In each winter of 2002 and 2003, eight of these field trips were successfully completed. A total of 276 seniors participated. Trips consisted of bus tours around Corpus Christi Bay with lectures on the different ecosystems of the Coastal Bend region of Texas and kayak excursions when the weather permitted. Ten groups were able to do the kayaking program. This activity was very popular and we have received requests from area museums and civic groups to offer this experience for their constituents. With a free, propane “clean” bus provided at no expense by the Port of Corpus Christi, we saved substantial transportation costs while demonstrating an environmentally friendly mode of transportation.
Community events included annual Spring and Fall Beach Cleanups and the Rockport Sea Fair. The Beach Cleanups are part of a statewide Adopt-A-Beach program operated by the Texas General Land Office. The Texas program participates in the Ocean Conservancy’s International Coastal Cleanup. The Cleanups were cosponsored with Padre Island Kiwanis Club.

Over 500 volunteers participated in the Beach Cleanups. The Cleanups were promoted through schools, youth programs, area businesses, general media, and the University. Each of the three cleanups saw volunteers collecting an average of 4 1/2 tons of trash from eleven miles of beach.
A large number of volunteers from Padre Island Kiwanis Club provided lunch and refreshments for everyone involved. Groups came from as far away as San Antonio, Austin, and Dallas.

In fall of 2007 we participated in the annual SeaFair festival in Rockport. We partnered with students from the A&M-CC Wildlife Conservation and Rehabilitation Club to provide a kayaking and environmental exploration activity for festival guests. Club members served as kayak instructors and nature guides, teaching participants how to kayak while providing an interpretive tour of Little Bay in Rockport. Guests saw dolphins and a number of birds including multiple species of herons, egrets, gulls, and pelicans. In addition to kayaking, guests were provided trips aboard the University’s floating classroom, the Wetland Explorer. Captain Jay Tarkington took visitors out for viewing of the bird sanctuary on the islands in Little Bay. This event was especially popular among families as there was no charge to participate, making it one of the few activities at the festival that was free. We estimate more than 600 people participated in 2007.

Conclusion

The program was a great success providing environmental education opportunities for nearly 2000 children, youth, students, teachers, adults, and seniors. Students learned about the natural environment of the Gulf Coast. Teachers learned how to be effective environmental educators. Seniors, most of who are visiting “Winter Texans” learned about this area and its different ecosystems. Summer campers learned about kayaking, sea turtles, fish and the fish hatchery, marine life, wetland plants and animals, human impacts, and many other topics. The public learned about stormwater runoff and what they can do to prevent pollution. Most of all, the people we reached all gained from the program whether through knowledge from the instruction or through confidence from the activities. We will continue to seek to sustain this program and sincerely appreciate the invaluable support EPA has provided for these last two years.
Appendix A: Final Project Budget
## Itemized Budget for 8/19/2008

**Description** | **Itemized Budget**
--- | ---
**Salaries & Wages** |  
Laura Heil (Teacher in Residence) | $2,000.00  
James Needham | $3,578.80  
Joseph Miller | $4,988.74  
Vincent Guercio | $140.00  
Austin Carter | $810.00  
Mary Shelton | $680.00  
**Total S&W** | $12,197.54

**Fringe Benefits** |  
Laura Heil (Teacher in Residence) | $166.00  
James Needham | $717.28  
Joseph Miller | $1,577.82  
Vincent Guercio | $7.67  
Austin Carter | $66.44  
Mary Shelton | $28.61  
**Total FB** | $2,563.82

**Travel** | $5,638.19

**Contractual** |  
Dr. Bilaye Benibo  
Salary | $2,000.00  
Fringe | $295.60  
**Total Contractual** | $2,295.60

**Other/Supplies** | $13,505.62

**Subtotal** | $36,200.77

**Indirect** |  
51% of $14,197.54 | $7,240.75

**TOTAL BUDGET REQUEST** | **$43,441.52**
## Itemized Cost Share for 8/19/2008

<table>
<thead>
<tr>
<th>Description</th>
<th>Subtotal</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Salaries and Wages</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jim Needham</td>
<td></td>
<td>$14,525</td>
</tr>
<tr>
<td>Jay Tarkington</td>
<td></td>
<td>6,854</td>
</tr>
<tr>
<td>Joe Miller</td>
<td></td>
<td>764</td>
</tr>
<tr>
<td><strong>Total S&amp;W</strong></td>
<td></td>
<td>$22,143</td>
</tr>
<tr>
<td><strong>Fringe Benefits</strong></td>
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<td>$4,865</td>
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<tr>
<td><strong>Volunteers</strong></td>
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</tr>
<tr>
<td><strong>Port Bus (with fuel)</strong></td>
<td></td>
<td>$2,760</td>
</tr>
<tr>
<td><strong>Wetland Explorer</strong></td>
<td></td>
<td>$750</td>
</tr>
<tr>
<td><strong>Kayaks</strong></td>
<td></td>
<td>$6,750</td>
</tr>
<tr>
<td><strong>Indirect (51% of salaries and wages)</strong></td>
<td></td>
<td>$11,293</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>$50,681</td>
</tr>
</tbody>
</table>

REACHING FURTHER; REDEFINING ENVIRONMENTAL EDUCATION
USEPA Assistance Agreement Number NE-96642201-0
Itemized Cost Share for 8/19/2008
Appendix B: Project Evaluation
Reaching Further: Redefining Environmental Education Program
(2007)

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(A U.S.E.P.A.-SPONSORED PROJECT)
EXECUTIVE SUMMARY

Overall, 286 students from the Coastal Bend area completed the program. Most (207) of the participants were from the area middle and high schools and participated in the science field trips. The other 79 students are either from the Corpus Christi Boys and Girls Club, Women’s Shelter or Home Schools and participated in summer camps. Approximately 53% and 47% of these 79 students identified themselves as male and females respectively. African, Hispanic and White - Americans and “Others” of the same group of students comprised 14.9%, 36.5%, 44.6% and 4.1% respectively of the participating students.

There was a statistically significant improvement in students’ knowledge of wetlands/aquatic systems in the Gulf Coast as a result of participating in the program, overall. This improvement remained consistent across all sex and racial/ethnic categories of participating students.

Participants, regardless of their sex, rated their experience of the program and their awareness of their environment positively. There were, however, some significant racial/ethnic differences: Hispanic and African American students rated their experience of the program and awareness of their environments more positively than their White counterparts.

** Commendations
1. There is more racial diversity among participants this year than previous years.
2. A very effective instructional strategy.

** Recommendations:
1. Increase total number future participants.
2. Encourage all participants to complete the data collection instrument,
Introduction

This project is designed to “deliver environmental education to a large and diverse group citizens and to raise their awareness of the environment.” The long-term goal of this project, however, is to reduce the endangerment of the 3,178 marine plants and animals, and the 494 species of birds in the Gulf Coast. The accomplishment of this goal requires, ultimately, environmentally-friendly changes in our industrial discharge practices, farming and fishing techniques, urban development philosophies, as well as personal consumption habits and waste disposal policies. Obviously, the eventual attainment of this long-term goal requires *inter alia* relevant educational programs at all levels of our society for an extended period of time. The present project focuses on that level of our society where education on environmental issues promises considerable profit. The target population of this project is high school students in the Corpus Christi area. The purpose of this evaluation is to assess the short-term effectiveness of this summer project.

Methodology:
Participants: Overall, 286 students from the Coastal Bend area completed the program. Most (207) of the participants were from the area middle and high schools. The other 79 students are either from the Corpus Christi Boys and Girls Club, Women’s Shelter or Home Schools. Approximately 53% and 47% of these 79 students identified themselves as male and females respectively. African, Hispanic and White - Americans and “Others” of the same group of students comprised 14.9%, 36.5%, 44.6% and 4.1% respectively of the participating students.

Participation was based on voluntary completion of the relevant intent forms and actually showing up for the trips. With the exception of a few cases, participants converged at the designated place and time at the university and were transported in the institution’s buses to the sights where the trips to the wetlands and aquatic systems actually began. Participants could (and some did) drop out of the program by simply failing to show up. The duration of each trip varied from a couple of hours to eight hours. Breakfast and lunch were provided for participants during field trips.

Data Collection:
Survey questionnaires were designed to assess participants’ (1.) knowledge of wetland and aquatic systems in the Gulf of Mexico, (2.) awareness of their environment and (3.) overall experience of the program.

Field observation was also undertaken by the evaluator to assess the overall climate of a major field trip to wetlands in the coastal bend area.

Measurement of Key Survey Variables:
1. *Knowledge of Wetlands and aquatic systems.* Fourteen multiple choice questions, weighted 2-points each were given to participants before and at the end of the program.

2. *Awareness of Environmental issues.* Scaled response (1= Not at all aware; 5= Very aware) to survey question: “How would you rate your awareness of environmental issues?” This question was administered only after the program.

3. *Respondent’s Assessment of Program.* Scaled response (1= Terrible; 5= Great) to survey question: “How would you rate your experience.” was administered only at the end of program.

4. *Sex* This variable was self-identified: 1. male and 2. female

5. *Race/Ethnicity* This variable was self-identified: 1 African American, 2. Hispanic American, 3. White American, 4. Other.

Data Analysis:
Analyses of survey data involve six steps: (1.) Data description, showing aggregate responses to survey questions; (2) T-test, comparing knowledge of wetlands and aquatic systems before and after the program for all participants; (3) T-tests, comparing knowledge of wetlands and aquatic systems before and after the program for sub-samples of male and female participants; (4) t-tests, comparing pretest and posttest
knowledge of wetlands and aquatic systems before and after participating in the program for (a) African Americans, (b) Hispanic Americans and (c) White Americans, and (5) t-test (independent samples) analysis to determine sex and racial/ethnic differences in participants’ rating of their awareness of environmental issues and their experience of the program as a whole. Regrettably, more detailed analyses cannot be conducted for the 207 middle and high school participants because individual level demographic data were inadvertently omitted during the data collection procedure. Step 6 therefore is a t-test comparing pretest and posttest scores on knowledge of wetlands and aquatic systems for all the 207 high and middle school students.

Step 1:
The demographic breakdown as indicated above for the 74 Boys and Girls Club, Women’s Shelter and Home School students show that 53% and 47% of participants who completed the questionnaire are males and females respectively. African, Hispanic and White - Americans and “Others” comprised 14.9%, 36.5%, 44.6% and 4.1% respectively of the participating students.

-Table 1-
<table>
<thead>
<tr>
<th>Variable</th>
<th>N=74</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex: Male</td>
<td>39</td>
<td>52.7</td>
</tr>
<tr>
<td>Female</td>
<td>35</td>
<td>47.3</td>
</tr>
<tr>
<td>Race/Ethnicity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>11</td>
<td>14.9</td>
</tr>
<tr>
<td>Hispanic American</td>
<td>27</td>
<td>36.5</td>
</tr>
<tr>
<td>White American</td>
<td>33</td>
<td>44.6</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>4.1</td>
</tr>
</tbody>
</table>

Step 2:
T-test (matched samples) statistic, was undertaken to determine whether there was a statistically significant difference between pretest and posttest scores. The test revealed a 4.2 (15.29-11.27) difference between the two tests was statistically significant (p<.01).

-Table 2-
<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>N***</th>
<th>SD</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of wetlands:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>5.05</td>
<td>63</td>
<td>1.67</td>
<td>-11.50</td>
<td>0.000**</td>
</tr>
<tr>
<td>Posttest</td>
<td>8.05</td>
<td>63</td>
<td>1.92</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05; **p<0.01; *** Respondents who completed both pre and post program questionnaires

The above table suggests that participation in the program had a positive effect on students’ knowledge of wetland biology and aquatic systems. In short, the program accomplished its main objective.

Step 3:
The program was effective for the entire body of participating students, but would this finding hold true for both sexes and the three racial groups (African, White and Hispanic - Americans). Specifically, the following analyses investigate possible sex and racial/ethnic differences in the effectiveness of the
program. This involved separate t-tests for male and female participants (see Tables 3a and 3b), and for African, White and Hispanic Americans (see Table 4a, 4b and 4c). Tables 3a and 3b below show that female and male participants learned significantly more about the coastal bend wetlands as a result of their participation in the program.

**-Table 3a-
T-test: Knowledge of Wetlands
Sex-Males Only**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean***</th>
<th>N</th>
<th>SD</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of wetlands: Pretest</td>
<td>4.91</td>
<td>33</td>
<td>1.89</td>
<td>-9.40</td>
<td>0.000**</td>
</tr>
<tr>
<td></td>
<td>8.09</td>
<td>33</td>
<td>1.91</td>
<td></td>
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</tr>
</tbody>
</table>

*p<0.05; **p<0.01; ***Respondents who completed both pre and post program questionnaires.

**-Table 3b-
T-test: Knowledge of Wetlands
Sex-Females Only**

<table>
<thead>
<tr>
<th>Variables</th>
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<th>SD</th>
<th>t</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
<td>Knowledge of wetlands: Pretest</td>
<td>5.20</td>
<td>30</td>
<td>1.40</td>
<td>-6.91</td>
<td>0.000**</td>
</tr>
<tr>
<td></td>
<td>8.00</td>
<td>30</td>
<td>1.96</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05; **p<0.01; ***Respondents who completed both pre and post program questionnaires.

**Step 4:**

A similar analysis on African, Hispanic and White-American participants found that the program was significantly beneficial to each of the racial/ethnic categories, in terms of improvement in participants’ knowledge of wetlands (see Tables 4a, 4b and 4c below).

**-Table 4a-
T-test: Knowledge of Wetlands
Race-African Americans**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>N***</th>
<th>SD</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of wetlands: Pretest</td>
<td>4.89</td>
<td>9</td>
<td>1.05</td>
<td>-12.57</td>
<td>0.000**</td>
</tr>
<tr>
<td></td>
<td>9.78</td>
<td>9</td>
<td>0.44</td>
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*p<0.05; **p<0.01; ***Respondents who completed both pre and post program questionnaires.

**-Table 4b-
T-test: Knowledge of Wetlands
Race-Hispanic Americans**

<table>
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<tr>
<th>Variables</th>
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<th>SD</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of wetlands: Pretest</td>
<td>5.39</td>
<td>18</td>
<td>1.50</td>
<td>-6.32</td>
<td>0.000**</td>
</tr>
<tr>
<td></td>
<td>8.28</td>
<td>18</td>
<td>1.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05; **p<0.01; ***Respondents who completed both pre and post program questionnaires.
**Table 4c**

<table>
<thead>
<tr>
<th>Variables</th>
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<th>N***</th>
<th>SD</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of wetlands: Pretest</td>
<td>5.15</td>
<td>33</td>
<td>1.75</td>
<td>-7.52</td>
<td>0.000**</td>
</tr>
<tr>
<td>Posttest</td>
<td>7.42</td>
<td>33</td>
<td>1.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05; **p<0.01; ***Respondents who completed both pre and post program questionnaires

Viewed together, tables 4a, 4b and 4c reveal that although all three racial categories became significantly more knowledgeable about wetlands in the coastal bend area, the mean difference (posttest score-pretest scores) was highest for African Americans (4.89), followed by Hispanic Americans (2.88) and then White Americans (2.27). This suggests that African American participants benefited significantly more than their Hispanic and White counterparts. The pretest scores show that African American participants were less knowledgeable of wetlands in the coastal bend area before the program than White and Hispanic Americans. The scores were 4.89, 5.15, and 5.39 respectively. The posttest scores were, however, surprising: African Americans averaged 9.78 compared to 8.28 and 7.42 for Hispanic and White Americans respectively.

**Step 5:**

The analysis here, however, is focused on sex and racial differences in participants’ rating of the program. Since this question was asked only at the end of the program, the test statistics employed was t-test for independent samples (for sex) and Analysis of Variance (for race/ethnicity). The present data do not reveal any significant difference between the sexes, in terms of their experience and awareness of the program. There were, however, statistically significant differences among African, Hispanic, and White Americans, in terms of their ratings of their awareness of environmental issues and experience of the program (p<0.01).

**Table 5a**

<table>
<thead>
<tr>
<th>Variables</th>
<th>N*</th>
<th>Mean</th>
<th>t</th>
<th>SD</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex: Male</td>
<td>34</td>
<td>4.09</td>
<td>0.07</td>
<td>1.05</td>
<td>0.94</td>
</tr>
<tr>
<td>Female</td>
<td>29</td>
<td>4.07</td>
<td>1.07</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Only those who completed the program

**Table 5b**

<table>
<thead>
<tr>
<th>Variables</th>
<th>N*</th>
<th>Mean</th>
<th>t</th>
<th>SD</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex: Male</td>
<td>34</td>
<td>3.97</td>
<td>0.25</td>
<td>0.94</td>
<td>0.80</td>
</tr>
<tr>
<td>Female</td>
<td>29</td>
<td>4.03</td>
<td>1.05</td>
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</tr>
</tbody>
</table>

* Only those who completed the program
Table 5c
ANOVA: Racial Differences in Respondents’ Experience of the Program

<table>
<thead>
<tr>
<th>Variable</th>
<th>SS</th>
<th>df</th>
<th>MSS</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience Between Groups</td>
<td>16.72</td>
<td>3</td>
<td>5.57</td>
<td>6.34</td>
<td>0.001*</td>
</tr>
<tr>
<td>Within Groups</td>
<td>51.88</td>
<td>59</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>68.60</td>
<td>62</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>SS</th>
<th>df</th>
<th>MSS</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness: Between Groups</td>
<td>20.71</td>
<td>3</td>
<td>6.90</td>
<td>6.34</td>
<td>0.000*</td>
</tr>
<tr>
<td>Within Groups</td>
<td>39.29</td>
<td>59</td>
<td>0.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>60.00</td>
<td>62</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** p<0.01
* Only those who completed the program

Step 6

Table 6
T-test: Knowledge of Wetlands
Middle and High School Students Only

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean***</th>
<th>N</th>
<th>SD</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of wetlands: Pretest</td>
<td>2.97</td>
<td>207</td>
<td>1.19</td>
<td>-63.9</td>
<td>0.000**</td>
</tr>
<tr>
<td>Posttest</td>
<td>8.30</td>
<td>207</td>
<td>1.32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05; **p<0.01 *** Respondents who completed both pre and post program questionnaires.

Conclusion:
Overall, this project accomplished its primary objective. Participation in the program significantly improved students’ knowledge of environmental, economic, social and cultural factors that negatively affect the water quality of our wetlands, rivers, bays and estuaries. Among students from the Boys and Girls Club, Women’s Shelter and Home Schools African American students learned the most from this program and also expressed a significantly higher level of satisfaction with the program than their White counterparts. There were no statistically significant sex differences in any of the outcome measures examined in this evaluation.

Recommendation:
Greater effort to recruit and retain Asian American and Native Americans in the future is strongly recommended. It is also important to reduce the number of students who leave the project prematurely. Furthermore, in order to ensure a more valid evaluation in the future, participants should be encouraged to complete and return all questionnaires.
Teaching Environmental Science I & II
Evaluation

Twenty (20) teachers throughout South Texas participated in Teaching Environmental Science Summer 2007. These 20 teachers served over 280 K-12 students. 72% of those 280 students were Hispanic and of low-income.

Post comments of the Teaching Environmental Science course included:

- “Of all the courses I have taken to become a teacher, this is by far the best course I have ever had.”
- “This will change the way I teach Science from now on in my classroom.”
- “I plan on starting my own Environmental Science Club at school next year.”
- “Myself and another teacher at Schanen Estates have already put together our proposal for an HEB environmental grant for our school to hold an Environmental Science Fair. We intend on making this an annual event for our school.”

Pre / Post Test Results Comparing Percentage with Correct Answers

<table>
<thead>
<tr>
<th>Question #</th>
<th>% Correct – Pre</th>
<th>% Correct – Post</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42.86</td>
<td>97.68</td>
<td>+ 54.82</td>
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<tr>
<td>2</td>
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<td>+0</td>
</tr>
<tr>
<td></td>
<td>Succession</td>
<td>87.5</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>75.0</td>
<td>100</td>
<td>+ 25</td>
</tr>
<tr>
<td>4</td>
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<tr>
<td>5</td>
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<tr>
<td>6</td>
<td>71.43</td>
<td>100</td>
<td>+28.57</td>
</tr>
<tr>
<td>7</td>
<td>85.71</td>
<td>100</td>
<td>+ 14.29</td>
</tr>
<tr>
<td>8</td>
<td>28.57</td>
<td>62.75</td>
<td>+34.18</td>
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<td>9</td>
<td>14.29</td>
<td>75</td>
<td>+ 60.71</td>
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<td>10</td>
<td>57.14</td>
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<td>11</td>
<td>100</td>
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<td>+0</td>
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<tr>
<td>12</td>
<td>Chlorination</td>
<td>100</td>
<td>+0</td>
</tr>
<tr>
<td>13</td>
<td>Filtration Bed</td>
<td>100</td>
<td>+0</td>
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<tr>
<td>14</td>
<td>Backwash</td>
<td>100</td>
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</tr>
<tr>
<td>16</td>
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<td>17</td>
<td>28.57</td>
<td>42.75</td>
<td>+ 14.18</td>
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<td>85.71</td>
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<tr>
<td>19</td>
<td>57.14</td>
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<td>+ 18.43</td>
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<td>+ 28.57</td>
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<td>+ 7.44</td>
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<td>28.57</td>
<td>100</td>
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<tr>
<td>23</td>
<td>71.43</td>
<td>100</td>
<td>+ 28.57</td>
</tr>
<tr>
<td></td>
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<td>24</td>
<td></td>
<td>57.14</td>
<td>100</td>
</tr>
<tr>
<td>25</td>
<td>Reduce</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Reuse</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
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<td>Recycle</td>
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<td>100</td>
</tr>
<tr>
<td></td>
<td>Rebuy</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
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<td>86.13</td>
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<tr>
<td>30</td>
<td></td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>31</td>
<td>Ground Ozone</td>
<td>85.7</td>
<td>93.17</td>
</tr>
<tr>
<td></td>
<td>Parti. Matter</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Acid Rain</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Nitro. Oxides</td>
<td>85.7</td>
<td>93.17</td>
</tr>
<tr>
<td></td>
<td>Stratos. Ozone</td>
<td>85.7</td>
<td>93.17</td>
</tr>
<tr>
<td>32</td>
<td></td>
<td>28.57</td>
<td>57.14</td>
</tr>
</tbody>
</table>
Pre-test for Teaching Environmental Sciences

The following results were achieved by your class for the pre-test. The percentage after each answer indicate the percentage of teachers who chose that answer.

1) Unless the exhaust gas is actually tested, there is no way to even have a rough idea of how much pollution your vehicle makes.
   ___ True
   ___ False
   Correct answer: T
   T – 42.86%
   F – 57.14%

2) Match each term below to its best meaning in environmental science:
   ___ Pollution
   ___ Succession
   ___ Estuary
   ___ Riparian zone
   ___ Biome
   A) The area along the edge of a stream or lake.
   B) A material present above its natural level causing harm to the environment.
   C) A broad ecological unit characterized by the distinctive climax species.
   D) The change of species and populations in an area over time.
   E) An area where fresh and saltwater mix, creating diverse ecological niches.

   Pollution – correct answer = B
   A – 0%
   B – 100%
   C – 0%
   D – 0%
   E – 0%

   Succession – correct answer = D
   A – 0%
   B – 0%
   C – 0%
   D – 87.5%
   E – 12.5%

   Estuary – correct answer = E
   A – 12.5%
   B – 0%
   C – 12.5%
   D – 0%
   E – 75%

   Riparian zone – correct answer = A
   A – 75%
   B – 0%
   C – 0%
   D – 0%
   E – 25%

   Biome – correct answer = C
   A – 12.5%
   B – 0%
   C – 87.5%
   D – 0%
   E – 0%

3) Plants must take in oxygen to survive.
4) Most waste is disposed of by burying it in landfills. Which of the following are effective in reducing the amount of waste going to landfills?
A) Not creating waste: reusing or reselling things, more efficient manufacturing, informed purchasing (only amounts that will be used; only items with limited packaging; preferring recycled), and using wastes as a resource (like composting)
B) Recycling used materials into new products.
C) Buying products that are made from recycled materials.
D) All of the above.
E) None of the above. Although these are popular and make people feel like they are doing something good, none of these actually has a significant impact on the amount of waste going to landfills.
Correct answer = D

5) When a lake becomes eutrophic, excessive nutrients cause algae to grow explosively. What is the MOST significant impact on the ecology of the lake?
A) The water turns green and smells bad, ruining people's enjoyment of the area.
B) During daytime, there is plenty of oxygen, but at night the algae consumes almost all of the oxygen causing fish and other animals to suffocate.
C) The large amount of algae causes a huge growth of bacteria, which can cause disease to the fish and other water life and to animals when they drink the water.
D) There really is not an impact on the water body. The algae is food for the water life, so more and larger fish grow in the lake.
Correct answer = B

6) A septic tank is completely different than a sewage treatment plant. A septic tank does not actually treat sewage, but isolates it from water sources.

___ True ___ False
Correct answer = F

7) What is a species?
A) A group of organisms that all look pretty much the same, like a breed of dogs.
B) A group of animals that can interbreed and produce fertile offspring.
C) A family of organisms that share many characteristics, like beetles.
Correct answer = B

8) Water treatment may require several steps to make water safe for drinking. Match each term below with the definition that best describes its meaning.
___ Chlorination
Filtration bed
A) Pushing clean water backwards through a system to remove contaminants from filters and membranes.
B) Adding a chemical to drinking water to kill pathogens.
C) A layer or multiple layers of sand, coal, or other inert materials that remove particles from water as it flows through the layer(s).
Chlorination - correct answer = B
A – 0%
B – 100%
C – 0%
Filtration bed - correct answer = C
A – 0%
B – 0%
C – 100%
Backwash - correct answer = A
A – 100%
B – 0%
C – 0%

9) The only TEKS standards that can be successfully covered through teaching about environmental science are those for science and math.
   ___ True   ___ False
Correct answer = F
T – 0%
F – 100%

10) What is pH?
A) A measure of how much salt or other dissolved solids are in water.
B) A measure of how acid or alkaline a solution in water is.
C) A measure of how much bacteria is in water.
Correct answer = B
A – 0%
B – 85.71%
C – 14.29%

11) The federal Resource Conservation and Recovery Act (RCRA), which regulates hazardous waste, applies to all wastes that can harm the environment.
   ___ True   ___ False
Correct answer = F
T – 100%
F – 0%

12) Match the following terms to the proper definition for air quality issues.
   ___ Carbon monoxide
   ___ Solar radiation
   ___ Carbon dioxide
   ___ Lead
   ___ Catalytic converter
A) A greenhouse gas that may be a cause of global warming.
B) A poisonous gas that forms when fuels are burned very quickly, as in a gasoline engine.
C) A heavy metal that can be emitted as an air pollutant by certain types of facilities.
D) An emission control device on gasoline-powered vehicles and some wood stoves that removes some nitrogen oxides, volatile organic compounds and carbon monoxide from the exhaust.
E) Sunlight, some of which can cause reactions that lead to ozone formation.
Carbon monoxide – correct answer = B
A – 0%
13) What is meant by the term “endangered species?”
   A) An individual animal is in danger of being killed because of development, pollution, or other problems in its habitat.
   B) This type of animal is dangerous to other animals and people who live in the same area.
   C) This type of animal has been listed by the federal government as being in danger of becoming extinct.
   D) None of the above.
   Correct answer = C

14) During the 1980’s, Ronald Reagan was criticized by some people for stating that trees cause pollution. However, this statement is accurate.
   ___ True  ___ False
   Correct answer = T

15) What laws and regulations cover hazardous wastes generated by schools?
   A) School policies are all that apply to hazardous wastes generated at schools.
   B) Schools are subject to the same laws for hazardous wastes as any other facility.
   C) Schools are specifically exempted from hazardous waste laws and regulations.
   D) A and C only.
   Correct answer = B
16) When rain enters a storm drain, it is treated before being released. You must not pour oil down these because it overloads the treatment plant.

___ True  ___ False

Correct answer = F

T – 57.14%
F – 42.86%

17) Why is the level of fecal coliform bacteria measured in water to be used for drinking?
A) To determine how healthy the body of water is. Since these bacteria only come from sewage, they can show if the water has been contaminated.
B) These organisms are indicators species that can show when pathogens are likely to be present.
C) These bacteria are found in the intestines of animals, so they are only found in water that is contaminated with fecal matter. This means that these bacteria will make you sick if you drink the water.
D) A and C only.

Correct answer = B

A – 14.29%
B – 28.57%
C – 0%
D – 57.14%

18) Which of the following is NOT a benefit from wetlands?
A) Wetlands filter water entering streams and aquifers, improving water quality.
B) Wetlands can provide habitat for a variety of species.
C) Wetlands are the primary sources of drinking water for many communities.
D) Wetlands protect against flooding by slowing down runoff entering streams.

Correct answer = C

A – 0%
B – 14.29%
C – 85.71%
D – 0%

19) About 3/4 of the Earth’s surface is covered with water (seas, freshwater, and glaciers). How much of this water is readily available for drinking?
A) About half.
B) About a third.
C) 10%.
D) Less than 1%.

Correct answer = D

A – 0%
B – 14.29%
C – 28.57%
D – 57.14%

20) Removing grass clippings is best for your lawn. Leaving them in place can smother the grass, and rotted clippings can give disease to the grass.

___ True  ___ False

Correct answer = F

T – 28.57%
F – 71.43%

21) Old computers, cell phones, and electronic devices cause greater environmental problems than most consumer goods if not recycled or disposed properly.

___ True  ___ False
22) Why are children more susceptible to ground-level ozone than adults? Mark all answers that are correct.
A___ Since children are usually shorter than adults, they are closer to the ground and breathe in higher concentrations of ozone.
B___ Children have developing organs and longer life expectancies, both of which may increase the chances of their developing cancer later in life.
C___ Children tend to be outside more during the ozone season and tend to be more active than adults. Breathing more air exposes them to more ozone compared to their body size.
D___ Because adults breathe more air than children, adults, not children are the most susceptible to ozone.
Correct answers – B and C (must get both and only these for answer to be correct)
A only – 0%
B only – 14.29%
C only – 42.86%
D only – 0%
A and B – 0%
A and C – 0%
A and D – 0%
B and C – 28.57%
B and D – 0%
C and D – 0%
A, B and C – 14.29%
A, B and D – 0%
B, C and D – 0%
A, B, C, and D – 0%

23) What NATURAL events can affect the amount of ozone in the stratosphere?
A) Volcanoes injecting nitrogen oxides into the stratosphere.
B) Trees releasing hydrocarbons into the air.
C) The release of Freon into the air.
D) Second and third answers only.
Correct answer = A
A – 71.43%
B – 14.29%
C – 0%
D – 14.29%

24) New landfills are required to have a liner, which is a layer at the bottom of each landfill cell that water cannot penetrate. What is its purpose?
A) It prevents rain water from entering the landfill so the decomposition of wastes and generation of odors can be better controlled.
B) It prevents rain water and other liquids from leaving the landfill because they could pollute groundwater.
C) It prevents groundwater from coming up into the landfill during wet weather.
D) There is no such layer required for any landfill.
Correct answer = B
A – 0%
B – 57.14%
C – 14.29%
D – 28.57%

25) Match the following terms relating to pollution prevention and recycling to the correct definition below:
Reduce
A) Using an item again for the same or another purpose instead of disposing of it.
B) Taking steps to not generate waste in the first place.
C) Buying by preference items that are made from recycled materials.
D) Diverting wastes that can be used again to a manufacturing process rather than to a landfill.
Reduce – correct answer = B
A – 0%
B – 100%
C – 0%
D – 0%

Reuse
A – 100%
B – 0%
C – 0%
D – 0%
Reuse – correct answer = A
A – 100%
B – 0%
C – 0%
D – 0%

Recycle
A – 0%
B – 0%
C – 0%
D – 100%
Recycle – correct answer = D
A – 0%
B – 0%
C – 0%
D – 100%

Rebuy
A – 0%
B – 0%
C – 100%
D – 0%
Rebuy – correct answer = C
A – 0%
B – 0%
C – 100%
D – 0%

26) The U.S. Environmental Protection Agency tells the Texas Commission on Environmental Quality directly what to put into state regulations.
___ True
___ False
Correct answer = F
T – 57.14%
F – 42.86%

27) The Texas Commission on Environmental Quality issues permits that allow businesses to release pollutants.
___ True
___ False
Correct answer = T
T – 71.43%
F – 28.57%

28) The only way that someone can really have a positive impact on the environment is by joining a big group and working together to make changes.
___ True
___ False
Correct answer = F
T – 0%
F – 100%

29) The issues related to air pollution, water contamination, and waste disposal are completely separate from each other.
___ True
___ False
Correct answer = F
T – 0%
F – 100%
30) To protect groundwater and public health, what types of protection must gas stations have for their tanks?
A) The tanks must be located above ground so that any gasoline or diesel spilled evaporates.
B) No special protection is needed. Since gasoline and diesel float on top of water, they do not present any real hazard to groundwater.
C) The tanks must be double-walled or must have a special system installed to prevent the tanks from rusting.
D) Any spills must be cleaned up immediately, but the tanks are not a concern because they are made of fiberglass.
Correct answer = C

A – 0%
B – 0%
C – 100%
D – 0%

31) Match the following terms to the proper definition for air quality issues.

___ Ground-level ozone
___ Particulate matter
___ Acid rain
___ Nitrogen oxides
___ Stratospheric ozone

A) Ozone that may be found up to a few hundred feet above the ground that is caused by sunlight powering reactions between nitrogen oxides and volatile organic compounds in the air.
B) The combination of nitrogen monoxide and nitrogen dioxide in air, most of which comes from natural sources although a significant amount is from engines, boilers, and other heating devices.
C) Often called the ozone layer, this ozone is formed when the most harmful type of ultraviolet light is absorbed by oxygen, which also warms the surrounding air.
D) Solid particles or droplets that are suspended in air, the smallest of which may pose the greatest health risks.
E) Precipitation that has a low pH, which can be caused by nitrogen oxides in air reacting to form nitric acid.

Ground-level ozone – correct answer = A
A – 85.7%
B – 14.3%
C – 0%
D – 0%
E – 0%

Particulate matter – correct answer = D
A – 0%
B – 0%
C – 0%
D – 100%
E – 0%

Acid rain – correct answer = E
A – 0%
B – 0%
C – 0%
D – 0%
E – 100%

Nitrogen oxides – correct answer = B
A – 0%
B – 85.7%
C – 14.3%
D – 0%
32) How is stratospheric ozone beneficial?
A) It absorbs the vast majority of the most harmful type of ultraviolet radiation (UVc).
B) In absorbing ultraviolet light, the ozone layer warms the stratosphere, making it more stable.
C) Ozone at any level of the atmosphere helps clean the atmosphere of organic compounds by reacting with them to make more water-soluble compounds, facilitating their removal from the air.
D) A and B only
E) All of the above
Correct answer = E
A – 0%
B – 0%
C – 28.57%
D – 42.86%
E – 28.57%
**Post-test for Teaching Environmental Sciences**

The following results were achieved by your class for the pre-test. The percentage after each answer indicate the percentage of teachers who chose that answer.

1) Unless the exhaust gas is actually tested, there is no way to even have a rough idea of how much pollution your vehicle makes.

   ___ True  ___ False

   **Correct answer: T**

   **T – 97.68%**

   **F – 2.32 %**

2) Match each term below to its best meaning in environmental science:

   ___ Pollution

   ___ Succession

   ___ Estuary

   ___ Riparian zone

   ___ Biome

   A) The area along the edge of a stream or lake.

   B) A material present above its natural level causing harm to the environment.

   C) A broad ecological unit characterized by the distinctive climax species.

   D) The change of species and populations in an area over time.

   E) An area where fresh and saltwater mix, creating diverse ecological niches.

   **Pollution – correct answer = B**

   A – 0%

   B – 100%

   C – 0%

   D – 0%

   E – 0%

   **Succession – correct answer = D**

   A – 0%

   B – 0%

   C – 0%

   **D – 91.75%**

   E – 9.25%

   **Estuary – correct answer = E**

   A – 0%

   B – 0%

   C – 0%

   D – 0%

   **E – 100%**

   **Riparian zone – correct answer = A**

   A – 100%

   B – 0%

   C – 0%

   D – 0%

   E – 0%

   **Biome – correct answer = C**

   A – 7.05%

   B – 1.2%

   **C – 91.75%**

   D – 0%

   E – 0%

3) Plants must take in oxygen to survive.
4) Most waste is disposed of by burying it in landfills. Which of the following are effective in reducing the amount of waste going to landfills?
A) Not creating waste: reusing or reselling things, more efficient manufacturing, informed purchasing (only amounts that will be used; only items with limited packaging; preferring recycled), and using wastes as a resource (like composting)
B) Recycling used materials into new products.
C) Buying products that are made from recycled materials.
D) All of the above.
E) None of the above. Although these are popular and make people feel like they are doing something good, none of these actually has a significant impact on the amount of waste going to landfills.
Correct answer = D

5) When a lake becomes eutrophic, excessive nutrients cause algae to grow explosively. What is the MOST significant impact on the ecology of the lake?
A) The water turns green and smells bad, ruining people's enjoyment of the area.
B) During daytime, there is plenty of oxygen, but at night the algae consumes almost all of the oxygen causing fish and other animals to suffocate.
C) The large amount of algae causes a huge growth of bacteria, which can cause disease to the fish and other water life and to animals when they drink the water.
D) There really is not an impact on the water body. The algae is food for the water life, so more and larger fish grow in the lake.
Correct answer = B

6) A septic tank is completely different than a sewage treatment plant. A septic tank does not actually treat sewage, but isolates it from water sources.
___ True ___ False
Correct answer = F

7) What is a species?
A) A group of organisms that all look pretty much the same, like a breed of dogs.
B) A group of animals that can interbreed and produce fertile offspring.
C) A family of organisms that share many characteristics, like beetles.
Correct answer = B

8) Water treatment may require several steps to make water safe for drinking. Match each term below with the definition that best describes its meaning.
___ Chlorination
Filtration bed

A) Pushing clean water backwards through a system to remove contaminants from filters and membranes.
B) Adding a chemical to drinking water to kill pathogens.
C) A layer or multiple layers of sand, coal, or other inert materials that remove particles from water as it flows through the layer(s).

Chlorination - correct answer = B

A – 0%
B – 100%
C – 0%

Filtration bed - correct answer = C

A – 0%
B – 0%
C – 100%

Backwash - correct answer = A

A – 100%
B – 0%
C – 0%

9) The only TEKS standards that can be successfully covered through teaching about environmental science are those for science and math.

___ True  ___ False

Correct answer = F
T – 0%
F – 100%

10) What is pH?

A) A measure of how much salt or other dissolved solids are in water.
B) A measure of how acid or alkaline a solution in water is.
C) A measure of how much bacteria is in water.

Correct answer = B

A – 0%
B – 92.17%
C – 7.29%

11) The federal Resource Conservation and Recovery Act (RCRA), which regulates hazardous waste, applies to all wastes that can harm the environment.

___ True  ___ False

Correct answer = F
T – 100%
F – 0%

12) Match the following terms to the proper definition for air quality issues.

___ Carbon monoxide
___ Solar radiation
___ Carbon dioxide
___ Lead
___ Catalytic converter

A) A greenhouse gas that may be a cause of global warming.
B) A poisonous gas that forms when fuels are burned very quickly, as in a gasoline engine.
C) A heavy metal that can be emitted as an air pollutant by certain types of facilities.
D) An emission control device on gasoline-powered vehicles and some wood stoves that removes some nitrogen oxides, volatile organic compounds and carbon monoxide from the exhaust.
E) Sunlight, some of which can cause reactions that lead to ozone formation.

Carbon monoxide – correct answer = B

A – 0%
13) What is meant by the term “endangered species?”
A) An individual animal is in danger of being killed because of development, pollution, or other problems in its habitat.
B) This type of animal is dangerous to other animals and people who live in the same area.
C) This type of animal has been listed by the federal government as being in danger of becoming extinct.
D) None of the above.
Correct answer = C

14) During the 1980’s, Ronald Reagan was criticized by some people for stating that trees cause pollution. However, this statement is accurate.
   ___ True  ___ False
Correct answer = T

15) What laws and regulations cover hazardous wastes generated by schools?
A) School policies are all that apply to hazardous wastes generated at schools.
B) Schools are subject to the same laws for hazardous wastes as any other facility.
C) Schools are specifically exempted from hazardous waste laws and regulations.
D) A and C only.
Correct answer = B
16) When rain enters a storm drain, it is treated before being released. You must not pour oil down these because it overloads the treatment plant.

___ True       ___ False
Correct answer = F

17) Why is the level of fecal coliform bacteria measured in water to be used for drinking?
A) To determine how healthy the body of water is. Since these bacteria only come from sewage, they can show if the water has been contaminated.
B) These organisms are indicators species that can show when pathogens are likely to be present.
C) These bacteria are found in the intestines of animals, so they are only found in water that is contaminated with fecal matter. This means that these bacteria will make you sick if you drink the water.
D) A and C only.
Correct answer = B

18) Which of the following is NOT a benefit from wetlands?
A) Wetlands filter water entering streams and aquifers, improving water quality.
B) Wetlands can provide habitat for a variety of species.
C) Wetlands are the primary sources of drinking water for many communities.
D) Wetlands protect against flooding by slowing down runoff entering streams.
Correct answer = C

19) About 3/4 of the Earth’s surface is covered with water (seas, freshwater, and glaciers). How much of this water is readily available for drinking?
A) About half.
B) About a third.
C) 10%.
D) Less than 1%.
Correct answer = D

20) Removing grass clippings is best for your lawn. Leaving them in place can smother the grass, and rotted clippings can give disease to the grass.

___ True       ___ False
Correct answer = F

21) Old computers, cell phones, and electronic devices cause greater environmental problems than most consumer goods if not recycled or disposed properly.

___ True       ___ False
22) Why are children more susceptible to ground-level ozone than adults? Mark all answers that are correct.
A___ Since children are usually shorter than adults, they are closer to the ground and breathe in higher concentrations of ozone.
B___ Children have developing organs and longer life expectancies, both of which may increase the chances of their developing cancer later in life.
C___ Children tend to be outside more during the ozone season and tend to be more active than adults. Breathing more air exposes them to more ozone compared to their body size.
D___ Because adults breathe more air than children, adults, not children are the most susceptible to ozone.
Correct answers – B and C (must get both and only these for answer to be correct)
A only – 0%
B only – 0%
C only – 0%
D only – 0%
A and B – 0%
A and C – 0%
A and D – 0%
**B and C – 100%**
B and D – 0%
C and D – 0%
A, B and C – 0%
A, B and D – 0%
B, C and D – 0%
A, B, C, and D – 0%

23) What NATURAL events can affect the amount of ozone in the stratosphere?
A) Volcanoes injecting nitrogen oxides into the stratosphere.
B) Trees releasing hydrocarbons into the air.
C) The release of Freon into the air.
D) Second and third answers only.
Correct answer = A
A – 100%
B – 0%
C – 0%
D – 0%

24) New landfills are required to have a liner, which is a layer at the bottom of each landfill cell that water cannot penetrate. What is its purpose?
A) It prevents rain water from entering the landfill so the decomposition of wastes and generation of odors can be better controlled.
B) It prevents rain water and other liquids from leaving the landfill because they could pollute groundwater.
C) It prevents groundwater from coming up into the landfill during wet weather.
D) There is no such layer required for any landfill.
Correct answer = B
A – 0%
**B – 100%**
C – 0%
D – 0%

25) Match the following terms relating to pollution prevention and recycling to the correct definition below:
___ Reduce
___ Reuse
___ Recycle
___ Rebuy

A) Using an item again for the same or another purpose instead of disposing of it.
B) Taking steps to not generate waste in the first place.
C) Buying by preference items that are made from recycled materials.
D) Diverting wastes that can be used again to a manufacturing process rather than to a landfill.

Reduce – correct answer = B
A – 0%
B – 100%
C – 0%
D – 0%

Reuse – correct answer = A
A – 100%
B – 0%
C – 0%
D – 0%

Recycle – correct answer = D
A – 0%
B – 0%
C – 0%
D – 100%

Rebuy – correct answer = C
A – 0%
B – 0%
C – 100%
D – 0%

26) The U.S. Environmental Protection Agency tells the Texas Commission on Environmental Quality directly what to put into state regulations.

___ True
___ False
Correct answer = F
T – 13.87%
F – 86.13%

27) The Texas Commission on Environmental Quality issues permits that allow businesses to release pollutants.

___ True
___ False
Correct answer = T
T – 100%
F – 0%

28) The only way that someone can really have a positive impact on the environment is by joining a big group and working together to make changes.

___ True
___ False
Correct answer = F
T – 0%
F – 100%

29) The issues related to air pollution, water contamination, and waste disposal are completely separate from each other.

___ True
___ False
Correct answer = F
T – 0%
F – 100%
30) To protect groundwater and public health, what types of protection must gas stations have for their tanks?

A) The tanks must be located above ground so that any gasoline or diesel spilled evaporates.
B) No special protection is needed. Since gasoline and diesel float on top of water, they do not present any real hazard to groundwater.
C) The tanks must be double-walled or must have a special system installed to prevent the tanks from rusting.
D) Any spills must be cleaned up immediately, but the tanks are not a concern because they are made of fiberglass.

Correct answer = C
A – 0%
B – 0%
C – 100%
D – 0%

31) Match the following terms to the proper definition for air quality issues.

___ Ground-level ozone
___ Particulate matter
___ Acid rain
___ Nitrogen oxides
___ Stratospheric ozone

A) Ozone that may be found up to a few hundred feet above the ground that is caused by sunlight powering reactions between nitrogen oxides and volatile organic compounds in the air.
B) The combination of nitrogen monoxide and nitrogen dioxide in air, most of which comes from natural sources although a significant amount is from engines, boilers, and other heating devices.
C) Often called the ozone layer, this ozone is formed when the most harmful type of ultraviolet light is absorbed by oxygen, which also warms the surrounding air.
D) Solid particles or droplets that are suspended in air, the smallest of which may pose the greatest health risks.
E) Precipitation that has a low pH, which can be caused by nitrogen oxides in air reacting to form nitric acid.

Ground-level ozone – correct answer = A
A – 93.17%
B – 6.83%
C – 0%
D – 0%
E – 0%
Particulate matter – correct answer = D
A – 0%
B – 0%
C – 0%
D – 100%
E – 0%
Acid rain – correct answer = E
A – 0%
B – 0%
C – 0%
D – 0%
E – 100%
Nitrogen oxides – correct answer = B
A – 0%
B – 93.17%
C – 6.83%
D – 0%
32) How is stratospheric ozone beneficial?
A) It absorbs the vast majority of the most harmful type of ultraviolet radiation (UVc).
B) In absorbing ultraviolet light, the ozone layer warms the stratosphere, making it more stable.
C) Ozone at any level of the atmosphere helps clean the atmosphere of organic compounds by reacting with them to make more water-soluble compounds, facilitating their removal from the air.
D) A and B only
E) All of the above
Correct answer = E
A – 0%
B – 0%
C – 14.68%
D – 28.18%
E – 57.14%
Appendix C: Caller Times Article
Outdoors

Day camp teaches kids awareness of Coastal Bend's natural offerings

By David Sikes (Contact)

Sunday, August 19, 2007

Day camp

ARANSAS PASS -- Coastal Bend kids should know what's beyond the water's edge. I'm not necessarily suggesting they become junior biologists, but c'mon they live on the coast. If curiosity alone doesn't invite or compel them to explore the outdoors, then maybe we should.

This is a basic and noble conservation premise, to introduce kids to their immediate natural environment so as to balance these insights with the nonsense popular culture pours into their heads.

Here's a simple test. If your child can provide details on the nature and number of tattoos or piercings on any celebrity, then they might not know the difference between a blue heron and blue crab. Any program or person who seeks to remedy this disconnect should garner our support and gratitude.

Jim Needham with the Office of Community Outreach at Texas A&M University-Corpus Christi is doing his part through the university's Gulf Coast Environmental Education Program. His partners in this endeavor are Joe Miller, director of Education and Youth Issues at the university, and Jay Tarkington, director of the Aquatic Education Program at the university's Center for Coastal Studies. These guys like to play in the water and their enthusiasm translates well in classrooms without walls.

During the course of nine summers Needham has introduced hundreds of school-aged kids to the critters and components of this estuary we call the Coastal Bend. This is not a summer camp in the traditional sense. I guess you'd call it a day camp. For five consecutive days these kids are exposed to activities and places they might not otherwise experience, which, of course, is the idea.
Texas Parks & Wildlife provided most of the start-up funding for the program back in 1999, which allowed Needham to purchase a fleet of kayaks, life jackets, paddles and a trailer. This equipment is used for other programs throughout the year, providing instruction and recreation to many other groups.

TPW, along with local businesses, Coastal Bend Bays & Estuaries Program and the Coastal Bend Bays Foundation filled the funding gaps during those first couple years.

Since then, the Environmental Protection Agency, either through federal or regional environmental education grants, has funded the program. Future funding is uncertain. I guess these folks figure if we teach kids about the outdoors the result might make the EPA's job a little easier. Makes sense.

Originally the program reached out to students at Solomon Coles, Oak Park, Crossley and Gibson elementary schools. And as spots became available, Needham invited kids with the Homeschooling Association of South Texas. The program has expanded to include boys & girls clubs and other youth organizations. Some groups have returned the following year and one student who had moved away even flew in to enroll in a second summer session.

Each five-day session can accommodate about 20 kids, so about 100 kids participate each summer. The program cost between $15,000 and $20,000 each summer, which includes hiring a science teacher for five weeks. Laura Heil with the Calallan school district was the program's science teacher this summer. She answered some of the kids' tougher questions.

I tagged along with one of the groups several years ago and then again this summer. Not once did I hear the word icky or a complaint. Mostly I heard questions, lots of them. The most common questions? What kind of (bird, fish, plant) is that? or What's this?

With the exception of a single query, each of the kids' questions was answered by staffers. And all of the adults' questions eventually resulted in an accurate response from the kids. Some credit for this level of field knowledge goes to Jay Tarkington, who enlightens thousands of kids through his Aquatic Education Program. Tarkington is the captain and resident naturalist aboard the Wetland Explorer, a 36-foot floating classroom. He also engages kids with his Wetland on Wheels trailer and at his latest teaching tool, the Estes Education Station, a cabin on a small island at the northernmost section of Estes Flats.

Tarkington's shallow-water curriculum, if you can call it that, fits nicely with Needham's program. The kids do a little trawling, seining, core sampling, seagrass identification, island hopping and birding, while Tarkington weaves in coastal history, anthropology and some geology of the region. The kids don't even know they're learning new stuff.

But I'm getting ahead of myself. You probably want to know the full scope of what kids should expect from Needham's summer program.

"We try to mix a working knowledge of coastal ecology with some fun," Needham told me. "We offer challenging activities while emphasizing environmental stewardship. By
the end of the week they're competent kayakers with a basic knowledge of the coastal environment and a sense of accomplishment and pride."

Sounds worthwhile to me.

For the younger kids -- generally the youngest are 11 -- Day 1 is spent learning basic paddling skills and kayak safety in a swimming pool. They test their skills in Rockport's Little Bay on day two.

During day three they visit the CCA/AEP Marine Development Center. That's the redfish and trout hatchery in Flour Bluff run by Texas Parks & Wildlife. Day 4 features a more adventurous morning of paddling and exploring the Lighthouse Lakes in Aransas Pass.

And on Day 5 the younger kids visit the Texas State Aquarium.

For the older students or ones with more experience, the week begins at Rockport's Little Bay. The following day is spent in Tarkington's floating classroom and at the Estes Education Station.

The next day they paddle the Lighthouse Lakes and show off what Tarkington taught them. And then they visit Padre Island National Seashore to learn about beach and barrier-island ecology with Buzz Botts and to do a little beach combing.

Day 5 is a surfing lesson near Horace Caldwell Pier. I'm thinking this is where Needham, a longtime surfer and active member of the Surfriders organization, really shines.

I suppose some of you are wondering about that single unanswered question I mentioned earlier. The one that stumped the program's crack staff. From her kayak, Sarah McClanahan asked what's black and flat with white spots?

This was not meant to be a riddle. The young student asked this question while peering into the water from her kayak. She really wanted to know what she had found. But before any of the adults could get a look, whatever she had seen disappeared.

I figure it was a flounder or some other flatfish. Care to guess?

**How to Get Involved**

Contact **Jim Needham**, dean of the Office of Community Outreach at TAMUCC about the Gulf Coast Environmental Education Program at 825-2708 or e-mail him at James.Needham@tamucc.edu.

Contact **Jay Tarkington**, director of the Aquatic Education Program in the Center for Coastal Studies about his Wetland Explorer floating classroom or his Estes Education Station through www.Wetlanded.org or call him at 443-6701.

Contact **Joe Miller**, director of Education & Youth Issues at Texas A&M University-Corpus Christi, at 825-5967 or e-mail him at joseph.miller@tamucc.edu.

Contact David Sikes at 886-3616 or sikesd@caller.com