

List of H2O Project Accomplishments, Curricula, Teaching Enhancements and Tools, and Links to Detailed Information

by

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In May 2010 the Ewing Halsell Foundation granted funds to the Harte Research Institute (HRI) and the Meadows Center for Water and the Environment (Meadows Center) to devise novel experiential, technology-enhanced ways to improve water education for students and teachers, from Texas' headwaters to the ocean. That project has become widely known simply as "H2O." In Phase I of H2O, **HRI and Meadows Center readied water education for students that will profoundly change how today's youth engage and relate to water -- creating tomorrow's adults who will understand and advocate wise water use.**

Phase I work developed an extensive suite of experiential (hands-on and interactive) water education curricula and learning tools. These are designed for use out-of-doors and in classrooms, and are enhanced by exciting and powerful new multi-media and mobile technologies sought by today's youth.

A list of the accomplishments, water education curricula, teaching enhancements and tools, along with links to more detailed information, are contained in the following table. These are broken down into seven categories:

- Progress reports, updates, and H2O websites
- Curricula for students, and teacher training and support
- Technology enhancements and tools for education and education research
- Teacher workshops
- STEM Corps
- Assessments
- Leveraging H2O through partnerships

List of Accomplishments, Curricula, Teaching Enhancements and Tools , and Links to Detailed Information

| Category | Short Description and Links to Detailed Information |
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| <p>Reports of H2O Progress</p> <ul style="list-style-type: none"> Websites, newsletters, reports | <p>H2O Website (www.water-texas.org)</p> <ul style="list-style-type: none"> Over 60 reports and updates on H2O accomplishments, provided on the website in easy to read articles, with pictures. The H2O website provides open, continuous, interactive reports and updates on H2O accomplishments funded by the Ewing Halsell Foundation. Links: http://www.water-texas.org/ <p>Aquatic Science Textbook review Website (www.aquaticedguides.org)</p> <ul style="list-style-type: none"> A website for all water science teachers in Texas to assist in the development by H2O of an Aquatic Science Textbook. Meeting Texas' teaching requirements the text will include experiential teaching activities and resources, enhancements, and digital learning tools for teaching middle and high school aquatic science. Links: http://www.aquaticedguides.org/ <p>H2O Update newsletters (superseded by continuous updates and reports on the H2O Website, above)</p> <ul style="list-style-type: none"> June 13, 2011. 11 pages, 9 articles September 15, 2011. 6 pages, 6 articles January 15, 2012. 8 pages, 8 articles Links: http://www.water-texas.org/u1.pdf http://www.water-texas.org/u2.pdf http://www.water-texas.org/u3.pdf <p>H2O fulfillment report and a proposal to sustain Texas' waters through water education, July 2011</p> <ul style="list-style-type: none"> This report and proposal summarizes completion of year 1 of work on design of a network of educators to implement experiential, technology-enhanced water education. Proposed is the work necessary to bring that network of educators to life and realize the ideals embodied in H2O. Funding is being sought to implement and sustain this network. Links: http://www.water-texas.org/r1.pdf <p>Education white papers and presentations</p> <ul style="list-style-type: none"> Integration of Mobile Technology into K-12 Outdoors Experiential Education: Practical Application Youth Education is the Key to Creating Future Scientists Experiential mobile-technology enhanced STEM education can connect students to water and the environment for life. Presented at the Regional Livability Symposium - Water: Key to our Future, University of Texas, February 15, Austin, TX. Links: http://www.water-texas.org/experiential-education/research-shows-experiential-education-on-water-works-update/ http://www.water-texas.org/experiential-education/stem-education-rudy-rozen/ <p>Dissertations</p> <ul style="list-style-type: none"> Analysis of an Informal Education Program. Ph.D. Dissertation. 2013 Links: http://www.water-texas.org/experiential-education/research-shows-experiential-education-on-water-works-update/ <p>Miscellaneous:</p> <ul style="list-style-type: none"> H2O to help students develop STEM skills Studies confirm a looming crisis in water education Links: http://www.water-texas.org/experiential-education/stem-education-rudy-rozen-2/ http://www.water-texas.org/experiential-education/stem-rudy-rozen/ |
| <p>STEM Corps</p> <ul style="list-style-type: none"> Job Corps student education on water | <ul style="list-style-type: none"> First in the nation STEM Corps -- Designed and supported with H2O-developed technology and experiential water education curricula, this program provides water education and related STEM skills to Job Corps students seeking a high school degree and who are interested in jobs in water. Links: http://www.water-texas.org/experiential-education/stem-corps-education-science-technology-math-rudy-rozen/ |

Curricula for students and teacher training/support

- New experiential, technology enhanced water curricula based on research showing experiential education connects students to water better than traditional teaching methods.

The Aquatic Science Textbook

- **A textbook on aquatic science and water conservation** aligned with Texas teaching standards (TEKS) for use in all Texas middle and high schools -- cooperative project with Texas Parks and Wildlife.
- **125-150 page textbook**, fully illustrated (in final draft review)
- **Bound book copy** -- to be published by Texas A&M University Press (in peer review)
- **E-Book** -- to be published by Texas A&M University Press, , interactive with specially produced videos for each chapter (in peer review)
- **iTunes University Book** version
- **Website book** -- interactive with specially produced videos for each chapter (in final draft review)
- Links: <http://www.aquaticedguides.org/>
<http://www.water-texas.org/experiential-education/renowned-underwater-photographer-h2o-aquatic-science/>
<http://www.water-texas.org/experiential-education/teachers-aquatic-science-education-guides-ready-for-review/>
<http://www.water-texas.org/experiential-education/meadows-centers-rudy-rosen-to-author-aquatic-science-guides/>
<http://www.water-texas.org/experiential-education/nature-aquatic-education-rudy-rosen/>
<http://www.water-texas.org/experiential-education/aquatic-science-education-guides/>

Experiential teaching activities and tools for teachers in Texas to teach aquatic science

- **500-600 page teachers' supplement** for the Aquatic Science Textbook for Texas' middle and high school students (in draft review)
- Links: <http://www.aquaticedguides.org/>
<http://www.water-texas.org/experiential-education/aquatic-science-guide-education/>
<http://aquaticedguides.org/aquatic-science-education-enrichments-rudy-rosen/>

Videos produced just for H2O and the Aquatic Science Textbook

- **14 videos**, one for each chapter of the Aquatic Science Textbook, covering essential topics about Texas' aquatic ecosystems and water conservation. (production underway, drafts available)
- **Headwaters and oceans water discovery centers** will also use the videos on iPads and multimedia educational displays and for teaching water topics.
- Links: <http://www.water-texas.org/education-video/first-look-video-for-aquatic-science-education/>
<http://www.water-texas.org/education-video/aquatic-science-education-video-rudy-rosen/>
<http://youtu.be/KlsMfWv42LQ>
<http://youtu.be/S79FJESVjC4>
<http://youtu.be/PwcfO3wHD58>
<http://youtu.be/vbWT9hbifUU>
<http://youtu.be/b88NMhraZgA>

Teaching with the Stars Teacher Training Units

- "Stars" is an extensive web-based, self-contained educational curricula for teacher training and instructional use outdoors and in classrooms. Includes videos, demonstrations, star teachers, instructional content and experiments, assessments, models, journaling, laboratory experiments, service learning features, Google Earth references, teacher and student assessments, adherence to state requirements, connection to networks of teachers, lesson plans, community connections, and templates for augmented learning. The following units were produced through H2O:
 - **Watersheds** - How watersheds work, from headwaters to ocean
 - **Tidewaters: Bays and Estuaries** - The oyster is featured as the coastal water pollution cleanup plant
- Links
 - Main Watershed Unit Link: http://www.geoteach.org/teacher_resources/watersheds/index.php
 - Main Tidewaters Unit Link: http://www.geoteach.org/teacher_resources/tidewaters/index.php
 - Reports of progress: <http://www.water-texas.org/education-video/tidewaters-teaching-uni-unveiled/>
<http://www.water-texas.org/education-video/experiential-stem-education-oysters-rudy-rosen/>
<http://www.water-texas.org/education-video/teacher-stem-education-bays-estuaries/>
<http://www.water-texas.org/education-video/stem-education-video-rudy-rosen-2/>
<http://www.water-texas.org/education-video/stem-education-video-rudy-rosen/>
<http://www.water-texas.org/education-video/teaching-video-rudy-rosen/>
<http://www.water-texas.org/technology-integration/teaching-techniques-rudy-rosen/>
<http://www.water-texas.org/education-video/teacher-training-video-rudy-rosen/>

Technology enhancements and tools for education and education research

- A key to H2O's enhanced water education is integrating new technology into classroom and outdoors experiential education

Water education technology test bed and headwaters/watersheds education center

- The education technology tools listed below were built by H2O to be used in education research and as day-to-day instructional platforms for 17,000 students in class groups and 150,000 unguided visitors to the headwaters education center.
- Low cost design and ease of use allows ready application of the technologies and educational tools by others.
 - **iPad/iPhone App**, now available at the Apple App Store. Named "Aquarena" the app was developed specifically for instruction and research in outdoor education. The prototype features educational content about the unique environment of the San Marcos springs, which includes an entire watershed immediately adjacent to the springs, a wetlands education area, a lake, and a headwaters river (the App is a "technology template" for use in outdoor locations anywhere). The new app is geared toward K-12th grade students and includes a species identification guide to the common fish, birds, plants, and animals that inhabit the area, a GPS photo-scavenger hunt, a QR Code scanner, videos, photos, and flexibility for teachers to add their own educational content.
 - **Interactive touch table**, allowing six replicate education experiments, and continuous interactive educational programming.
 - **Interactive kiosks**, allowing four replicate education experiments, and continuous interactive educational programming.
 - **iPads have been purchased and integrated into the outdoor instructional curricula**. H2O has purchased 30 iPads for class use. In constant daily, day-long use outdoors by students, various protective cases were tested. Currently, hardened waterproof cases (usable underwater) are on half for "wet" instructional curricula. Hardened shock- and weatherproof cases are on the other half.
 - **Multi-media, multi-screen array**, 3-D capable, completely programmable, expandable wall-sized display for teaching, research, and day-to-day display of education materials. Can be used for live interactive meetings or live virtual field trips, allows multiple simultaneous feeds, internet-based information, and webcam video or water gauge monitoring feeds.
 - **Linked 22-screen array**, allowing simultaneous display of live feed of virtual field trips or display of unique information on each screen from internet based feed or dedicated application. Total 22 screens linked.
 - **Outdoor education Wi-Fi network** -- provides connectivity for mobile devices, including the "Aquarena App" over the entire watershed immediately adjacent to the headwaters springs, a wetlands education area, lake, and headwaters river.
 - **Technology/GPS enhanced geocaching watershed scavenger hunt game** -- using the new mobile device App, students play an outdoors water education game across a 500-acre watershed guided by GPS, educational kiosks, and clues to an educational prize about watersheds.
- iPad links:
 - Apple App Store: <https://itunes.apple.com/us/app/aquarena/id594300970?mt=8>
 - Other links: <http://www.water-texas.org/technology-integration/ipad-iphone-stem-education-rudy-rosen/>
<http://www.water-texas.org/experiential-education/outdoor-education-watershed-rudolph-rosen/>
<http://www.water-texas.org/technology-integration/ipad-iphone-outdoor-education-rudolph-rosen/>
<http://www.water-texas.org/technology-integration/mobile-technology-rudy-rosen/>
- Education technology test bed links:
 - <http://www.water-texas.org/technology-integration/technology-education-rudy-rosen/>
 - <http://www.water-texas.org/technology-integration/education-technology-rudy-rosen/>
 - <http://www.water-texas.org/technology-integration/experiential-education-research-technology-rudolph-rosen/>
 - <http://www.water-texas.org/experiential-education/river-systems-institute-education-rudy-rosen/>
 - <http://www.water-texas.org/experiential-education/youth-education-rudy-rosen/>
 - <http://www.water-texas.org/experiential-education/outdoor-stem-education-research-watershed/>

Estuaries in the Balance: The Texas Coastal Bend – interactive web-based curricula

- In partnership with Hamline University, Center for Global Environmental Education, a 40-minute web-based learning program about the bays and estuaries was designed, programmed, and produced.
- The curricula module was launched November 2012 at the annual conference of the Texas association of science teachers where over 6,000 teachers attended sessions hosted by TAMUCC, Saving Cranes, and the Guadalupe and Blanco River Authority on different teaching techniques using the new module
- Over 2,000 students have attended aquatic education training utilizing the new curricula.
- HRI has showcased the module at many festivals around the state to introduce the public to the module. It is online and there is no charge for the use of the interactive, web based learning experience

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| <p>Teacher workshops</p> | <p>Four workshops were held in 2011 involving over 80 teachers who learned about teaching water education.</p> <ul style="list-style-type: none"> • Locations: TAMU-Corpus Christi, Beaumont, Waco, and Austin • Links: http://www.water-texas.org/?p=34 http://www.water-texas.org/?p=68 http://www.water-texas.org/?p=37 <p>Teachers' workshop in 2012</p> <ul style="list-style-type: none"> • Focused on applying H2O technology innovations to outdoor experiential education • Title: Using mobile technology for classroom and outdoor education • Hosted and financially supported by the Welder Wildlife Foundation • Links: http://www.water-texas.org/teacher-training/mobile-technology-stem-education-rudolph-rosen/ http://www.water-texas.org/teacher-training/rudy-rosen-stem-education-technology/ <p>Coastal Bend Bays and Estuaries Program workshops 2013</p> <ul style="list-style-type: none"> • “Learning on the Edge” a teacher workshop will be held in June 2013. The objective is to strengthen science teaching of the environmental treasures of the Texas Coastal Bend • HRI will instruct teachers in field techniques associated with the “Estuaries in the Balances: The Texas Coastal Bend” module. |
| <p>Assessments</p> <ul style="list-style-type: none"> • Teacher evaluations | <p>Teacher assessment survey on experiential water education funded by H2O</p> <ul style="list-style-type: none"> • Teacher opinion toward outdoor experiential water education and student learning was surveyed. • Teacher attitude toward use of technology in outdoor education was surveyed. • Survey results were used in a scholarly dissertation on the educational benefits of outdoor education. • Links: http://www.water-texas.org/experiential-education/research-shows-experiential-education-on-water-works-update/ |
| <p>Leveraging H2O through partnerships</p> <ul style="list-style-type: none"> • Partners helped leverage H2O funding and new leverage opportunities were sought | <p>Aquatic Science Education Textbook for Texas' Middle and High School Students</p> <ul style="list-style-type: none"> • Proposal for \$124,000 to Texas Parks and Wildlife Department • Ewing Halsell funds were matched 1:2, with each H2O dollar receiving 2 TPWD dollars. <p>iPad/iPhone App for outdoor experiential education (Aquarena App)</p> <ul style="list-style-type: none"> • Funding for programming and approval of App by Apple was supplied by Texas State University. Approx value \$35,000, matching H2O expenditures by about 2 to 1. <p>Outdoors educational Wi-Fi</p> <ul style="list-style-type: none"> • Funding to extend Wi-Fi throughout a watershed, including a wetlands area, allows education and research on outdoors use of mobile technology. Contributed by Texas State University. Approx value \$8,000, matching H2O expenditures by about 3 to 1. <p>STEM Corps</p> <ul style="list-style-type: none"> • STEM Corps is being conducted through a partnership between H2O, the Gary Job Corps in San Marcos, the Gilbert M. Grosvenor Center for Geographic Education, The Meadows Center for Water and the Environment, and Texas State University. • STEM Corps students use iPads purchased through H2O and technology enhanced curricula developed by H2O for outdoor and classroom learning about water and jobs in water-related industries. • Links: http://www.water-texas.org/experiential-education/stem-corps-education-science-technology-math-rudy-rosen/ <p>Experiential, technology enhanced water education center</p> <ul style="list-style-type: none"> • The Pioneer Foundation provided a generous grant to install a state-of-the-art aquarium and support technology at the headwaters discovery center. Approx value \$50,000 • Links: http://www.water-texas.org/experiential-education/aquatic-science-education-rudolph-rosen/ http://www.water-texas.org/funding-proposals/grant-stem-water-education-rudy-rosen/ <p>U.S. Environmental Protection Agency</p> <ul style="list-style-type: none"> • A proposed \$305,000 project with EPA would provide educational field trips to bay and freshwater locations for middle through high school students: 2,500 students for experiential learning about watersheds and 625 students in field trips to the bay. Over 100 teachers would be provided instructional training. Federal appropriations were cut for this program. • Links: http://www.water-texas.org/funding-proposals/fundraising-education-grant-rudy-rosen/ |

U.S. Department of Agriculture

- A \$2.5 million USDA project would pilot, then implement experiential water education activities for youth focusing on the interface between people, water, and agriculture in South and Central Texas watersheds. Federal appropriations were cut for this program.
- Links: <http://www.water-texas.org/funding-proposals/fundraising-grant-proposal-rudy-rosen/>