

*Exploring Science Content:
Digital Strategies for Science Teaching and Learning*

A proposal submitted by the Union County School Board
in response to the Mathematics and Science Partnership RFP

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Exploring Science Content: Digital Strategies for Science Teaching and Learning

1. Project Abstract/Summary

The goal of the *Exploring Science Content* project is to design, develop, disseminate, and evaluate research-based online science education modules focused on innovative, technology-rich practices and resources to enhance science learning in Union County secondary schools and schools statewide. Specifically, faculty, teachers and scientists from Union County, the University of Florida, and the Florida Center for Instructional Technology will (1) produce, formatively evaluate, and make available statewide 7 online teacher modules keyed to the science strands A – G with Strand H throughout the modules and (2) produce and disseminate a rich collection of online science media resources for classroom use consisting of 2000 maps, 12 virtual reality tours, 1000 photographs, 50 video clips, 750 clipart drawings, and 50 primary source documents and data sets. These digital resources will be distributed via the Internet from the FCIT website (<http://fcit.usf.edu>) and will also be available on CD-ROMs upon request and via both the annual FAST and FETC conferences.

2. Project Need

Successful completion of FCAT Science will soon be required for graduation from Florida's high schools. While increased attention to Science is positive for the students in Florida and for the future of the State, the elevated status of Science is challenging many districts. Union County is one of those districts.

Union County is a small rural county in Northern Florida that serves 2194 students in five schools. In addition, the County is home to an alternative school and a juvenile facility whose enrollments are determined by specialized criteria. Forty four percent of the students in the County are eligible for free and reduced lunch and 47% are female. In 2006, Union County eleventh graders scored well below the state average with only 29% achieving a score of Level 3 or above on FCAT Science. Union's scores were particularly weak in the area of Earth Science, which mirrors a statewide deficiency in this area.

In addition to the elevated status of the Science FCAT, the Florida Science Standards are currently under revision and districts will soon redesign and realign Science-related curriculum resources accordingly. This challenge is often magnified for small districts that lack the personnel to dedicate to specific content areas. Union County is one such district, employing one "Director of Curriculum and Instruction" to oversee all content areas. Both Union County teachers and administrators are hungry for high-quality Science resources and curriculum materials that will help improve the quality of Science instruction, increase student achievement and meet the needs of a challenging student population.

The development of researched-based online science education modules focused on innovative best practices related to teaching and learning science (Priority #2 in the 2007-2008 MSP RFP) will provide such resources to Union County while simultaneously providing digital resources statewide. This effort aligns with Union County's Technology Mission to "to maintain and enhance the quality of learning and increase the effectiveness of teaching through the application of appropriate learning technologies."

In summary, Union County is a high-need LEA with goals to improve Science teaching and learning and increase Science FCAT scores through the use of innovative digital technologies. A 2007-2008 MSP grant will enable Union County to collaborate with established partners (University of Florida and the Florida Center for Instructional Technology) to meet these goals while simultaneously providing expert-led, field experiences for its secondary Science teachers and contributing thousands of digital resources to schools statewide, increasing the content knowledge and skills of all secondary Science teachers and providing a rich and innovative classroom resource for Science students.

3. Project Design and Implementation

Goal

- To design, develop, disseminate, and evaluate research-based online science education modules focused on innovative, technology-rich practices to enhance science learning in Union County secondary schools and schools statewide.

Objectives

- To produce and disseminate a rich collection of online science media resources for classroom use consisting of 2000 maps, 12 virtual reality tours, 1000 photographs, 50 video clips, 750 clipart drawings, and 50 primary source documents and data sets.
- To produce, formatively evaluate, and make available 7 online teacher modules that integrate that integrate exemplary digital resources and teaching practices with Florida science strands A – G (integrating Strand H throughout the modules).

Overview

The goal of the *Exploring Science Content* project is to design, develop, disseminate, and evaluate research-based online science education modules focused on innovative, technology-rich practices to enhance science learning in Union County secondary schools and schools statewide. This project is a collaboration among the Union County School District, the University of Florida, and the Florida Center for Instructional Technology (FCIT). The science resources will be modeled after and will extend FCIT's successful creation of *Exploring Florida: Social Studies Resources for Teachers and Students*

(<http://fcit.usf.edu/florida>). This resource repository houses thousands of resources for multimedia projects (i.e. photographs, maps, music, VRs, movies, documents, and more) and dozens of reading passages with FCAT-like questions for teachers to implement in their classrooms.

The *Exploring Science Content* resources will correspond to each of the Florida Science Standards and will place special emphasis on the Earth Science strand on which Union County students and students statewide have shown low performance. The resources will include 2000 maps, 12 virtual reality tours, 1000 photographs, 50 video clips, 750 clipart drawings, and 50 primary source documents and data sets. In addition, content experts for each science strand will develop reading passages about the science content with FCAT-style questions and iQuizzes. All resources will be available statewide on FCIT's web site, which currently receives about 1.5 million hits each school day (<http://fcit.usf.edu>).

Specifically, the digital resources that will be developed for *Exploring Science Content* are:

- *Maps.* The project will support digitizing, metatagging, and posting 2,000 Florida maps to support science teaching and learning. Each map will be available as a JPEG or GIF file for viewing and as a PDF for high-quality printing. Maps with sufficient detail will also be available in a "Zoomified" version that allows students to zoom in and out and move around the map to examine selected areas in detail. The maps will include the following categories: USGS topographic, nautical, groundwater, coastal zone management, water management, and Florida Geological Surveys.
- *VRs.* Developers will create virtual reality tours of at least 12 environmentally and scientifically significant areas in Florida. Each tour will consist of multiple VR movies that allow students to pan around the environment and zoom in to examine details. Example locations will include springs, rivers, coastal areas, the Everglades, lakes, highlands, and hammocks. Other types of destinations of scientific interest may also be included as recommended by participating science teachers from Union County.
- *Photographs.* Teachers and developers will capture and post with sufficient metadata (including lat/lon) at least 1000 photographs of the Florida environment and science facilities. The photos will include a variety of landforms, ecosystems, and plants and animals.
- *Video clips.* Developers will capture, edit, and post a minimum of 50 video clips to support science instruction. These clips will be available for download and use by students and teachers in presentations, websites, and for creation of student movies.
- *Clipart illustrations.* Developers will digitize, metatag, and post a minimum of 750 line drawings to support science instruction. The illustrations will include Florida flora and fauna as well as illustrations of geologic structures, weather phenomena,

and scientific instruments. Some of the 1000 illustrations may be repurposed from existing FCIT websites.

- *Documents and data sets.* We will post a minimum of 50 primary source documents and data sets for student use. The documents will include such items as diaries of early Florida naturalists, nineteenth century plans to radically alter the Florida environment, reports on agricultural experiments, and other primary source documents allowing for student practice in critical reading in the content area. The data sets will include such information as temperature variations from year to year or from month to month, tides, agricultural production, rainfall, storm frequency, and mining production.
- *Additional digital assets.* Upon recommendation of subject matter experts, additional digital assets may be added to the list of deliverables above to support specific areas of the online Science professional development modules and/or to reflect advances in technology during the project period.

The *Exploring Science Content* Advisory Council will be responsible for overseeing the content included in the digital resources. The Advisory Council will include STEM faculty, science educators and educational technologists from the three partner institutions. In addition, selected content consultants (STEM faculty) will take an active role in designing and developing content. Union County teachers will also be actively involved through scientist-facilitated field visits to a range of Florida's natural and scientific sites and facilities in which they capture digital media and data files for the *Exploring Science Content* resources. FCIT will coordinate the design and development of the *Exploring Science Content* resources.

As the *Exploring Science Content* resources are being created, online learning specialists at the University of Florida, in collaboration with the Advisory Council and STEM content experts, will package them as exemplary online modules designed to assist teachers in using these resources in their classrooms. Lessons learned from FCIT's Social Studies repository suggest that teachers need structured guidance in order to make the best use of digital content in their classroom.

Seven modules keyed to science strands A – G will be created. Strand H will be integrated throughout the modules. This structure may be modified during the project period to better support scheduled revisions to the current Sunshine State Science Standards.

The current Sunshine State Standards Science strands are:

- A. The Nature of Matter
- B. Energy
- C. Force and Motion
- D. Processes that Shape the Earth
- E. Earth and Space
- F. Processes of Life

- G. How Living Things Interact with Their Environment
- H. The Nature of Science.

These online modules will be freely available on FCIT's website, and may be used as the basis for an online graduate certificate program. Teachers will also have the option to complete these modules for university credit through the University of Florida. These online modules will be piloted by Union County secondary science teachers and refereed by the Advisory Council. The University of Florida is well positioned to create these modules due to its national reputation in the area of online learning and virtual schooling, its successful implementation of online programs for teachers, and its infrastructure for online design and development set up through the College of Education's Office of Distance Education.

Each module will include consistent elements including but not limited to:

- An introductory overview addressing the content of the science strand.
- Perspectives of practicing scientists about the context of their work and examples from their work in the form of digital text, audio, and/or video.
- An overview of relevant digital resources designed to enhance teaching and learning for content within the science strand.
- Information to enhance teachers' technological pedagogical content knowledge (TPCK), including, but not limited to:
 - Strategies for teaching the content to K-12 student using technology (including the digital resources housed on FCIT's website).
 - Strategies for teaching the content to K-12 students using student-centered, hands-on approaches.
 - Sample lesson and units illustrating effective practice
 - Opportunities to participate in a science educators' community of practice by collaborating with other teachers and with scientists
 - FCAT-style reading passages contributed by the scientists, with sample questions and writing prompts

Activities/Methods

- A multi-agency project Advisory Council will be formed consisting of 10 members representing the science disciplines and education experts. Members will include university scientists and science educators, university educational technology and instructional design specialists, and scientists from state science agencies and organizations. The Advisory Council will provide direction to the developers and other project partners.
- An additional panel of content consultants from science and education will provide ongoing review of resources and modules during design, development, and evaluation stages.

- Union County science teachers will work throughout the school year with a district science coach to acquire skills with hands-on science strategies and technology-supported teaching.
- The Union County teachers will participate in visits with scientists to noteworthy natural and scientific sites in Florida such as the Florida Museum of Natural History, the Florida Program for Shark Research, Paynes Prairie Preserve, and university lab facilities. Based on their content knowledge and skill acquisition, teachers will make recommendations about the digital resources and modules.
- Digital content developers will visit the sites to record audio, images, and video.
- Based on the recommendations of the Advisory Council, the content consultants, the teachers, and the education faculty, the developers will create online teaching and learning resources correlated with each state science strand. The resources will form the basis of the online teaching modules, which are intended to serve as a “digital science coach” for K-12 science teachers statewide by demonstrating highly effective science teaching with rich digital resources.
- Teachers in Union County and statewide may earn graduate credit by using the online modules. In-service teachers, preservice teachers, and teachers in educator preparation institutes statewide will have access to both the modules and the university graduate certificate program in science education.
- Project evaluators will assess the match of resources and modules with the Florida Science Strands in accordance with FCR-STEM evaluation requirements. They will also judge the grade-level appropriateness and pedagogical quality of the resources and modules.

Timeline

- June-July, 2007: formation and first meeting of the Advisory Council; formation of the content consultants group; hiring the district science coach.
- August-September, 2007: the district science coach and science teachers develop specific professional development goals; field sites for teacher-scientist investigations are identified and trips are scheduled; developers identify digital media capture plans for all science strands.
- October-November, 2007: field trips and media capture begin; content consultants and education specialists plan modules.
- December, 2007-January, 2008: field trips, media capture, and module design continues.

- February-March, 2008: The Advisory Council meets to review the materials developed to date and to make recommendations regarding further development; field trips, media capture, and module design continue.
- April-May, 2008: Field trips and media capture conclude; content consultants review materials; teaching modules and the graduate certificate program are developed.
- June-July, 2008: digital resources and modules are reviewed and evaluated; materials are posted online; teachers participate in certificate program.

Partnerships

STEM faculty, science educators and educational technologists from the Union County, FCIT and UF will take an active role in this project. *Union County*, a high-need LEA, will provide secondary science teachers, administrators and a science specialist for the project. *FCIT* will provide educational technologists with expertise in materials development. The University of Florida will provide online learning specialists, science educators scientists from organizations such Florida Museum of Natural History, Florida Program for Shark Research, Paynes Prairie Preserve, the Florida Birding Trail and from program such as Wildlife Ecology and Geology. In addition, FCR-STEM will provide evaluation experts.

4. Evaluation

Evaluation will be coordinated in collaboration with FCR-STEM. Evaluation instruments and methods for evaluating the project will be determined through the partnership with the FCR-STEM. Grant award recipients will subcontract with the Florida Center for Research in Science, Technology, Engineering, and Mathematics (FCR-STEM) for formative and summative evaluations of their work with the *Florida Science Partnership* grants. Program managers will coordinate with FCR-STEM to establish protocols for providing data and deliverables that will allow FCR-STEM to effectively evaluate their work in a timely manner.

5. Support for Strategic Imperatives

Reading. Fourteen reading passages will be added to the existing *Exploring Florida Then and Now* resource. Each passage will contain a PDF for printing the passage, teacher notes, a reproducible reading strategy for reading in the content area of Science, "FCAT-like" student questions, and an activity sheet. This format has proven to be very successful in supporting reading of the existing Social Studies passages. We will now extend the content to support the reading of Science passages as well. Each of the new Science passages will also be added to the existing Lit2Go project (<http://etc.usf.edu/lit2go>), which delivers Mp3 files to students through the Lit2Go website as well as through an iTunes server. While a generation or two ago, most

children had the opportunity to be read to on a regular basis, that is not longer a universal experience for students in our contemporary society. This project supports reading success by providing students with the opportunity to listen to passages read by fluent adults-“the single most important activity for building the knowledge required for eventual success in reading” (Becoming a Nation of Readers, Anderson et al. 1985). Studies by Livaudais (1985), Beers (1990), Martinez and Roser (1985), and Anders and Levine (1990) show that reading aloud:

- builds background knowledge-an essential ingredient for comprehension
- improves listening comprehension-a precursor to reading comprehension
- improves listening vocabulary-the store of words that informs speaking vocabulary and reading vocabulary
- builds vocabulary of both common and rare words
- creates interest in reading
- improves students' understanding of sentence structure and usage
- improves students' ability to visualize the text

Strategic Imperative 3: Improve student rates of learning. Student (and teacher) access to a rich collection of media assets and primary source materials allow students to be actively engaged which results in increased rates of learning. It is an accepted principle that students learn best by doing. Nonetheless, in many Science classrooms students are expected to become passive receivers of knowledge transmitted from their teachers and their textbooks. This project will provide Florida students with digital content they can directly manipulate and which is comprehensive in scope and focused specifically on Sunshine State Standards.

6. Dissemination Plan

Exploring Science Content will be distributed via the Internet from the FCIT website (<http://fcit.usf.edu>). Currently the FCIT website receives about 1.5 million hits each school day. This plan ensures that these resources will be widely seen by large numbers of Florida students and teachers. All of the audio content will also be available via on iTunes server. Serving educational content via iTunes is a fairly recent development, but has proven to be very effective because most contemporary students are already very familiar with this delivery system. We will also make the content available on CD-ROMs for those teachers who do not have high-speed Internet connections in their classrooms.

Marketing of information about the *Exploring Science Content* resources will be an ongoing effort. Because these Science resources will be built onto the existing foundation of the Exploring Florida website, the district and partners will be able to begin marketing the content as soon as the first content is posted because we will not have to wait for the development of a new site or delivery vehicle. The first method will be the use of prominent links from the FCIT homepage. We will also send announcements about the project to the Science supervisors in Florida and ask that we have the opportunity to address a meeting of their organization during the school year.

FCIT will arrange for the rental of vendor booths at the Florida Association of Science Teachers (FAST) Conference and the Florida Association of Media Educators (FAME) and will request presentations to present digital science resources including the *Exploring Science* project at these conferences. FCIT will also have a vendor booth at the Florida Educational Technology Conference (FETC) to market the project and will request presentations that will include promotion of this project. In addition, efforts will be made to place items describing the project in the FAST journal and publications of other groups that reach Florida science educators, such as the League of Environmental Educators of Florida (LEEF).

An additional avenue for marketing and professional development will be the Florida Digital Educator Program. The FDEP is committed to utilizing digital resources such as these in the K12 classroom. All of the Master Digital Educators will be made aware of the *Exploring Science Content* resource and will be encouraged to incorporate resources from this site into their training.

Summary of dissemination plan:

- Using online delivery of this content is an extremely effective, realistic, and cost-effective method of sharing this valuable content with as many students and teachers in Florida as possible. It provides the best return on investment of any method available.
- Delivery of the *Exploring Science* resources will occur via "traditional" and innovative means. By now, Web delivery of content has become nearly a traditional method, but is still an effective one. The high rates of hits to the FCIT website confirm this. We are also planning to utilize a fairly new delivery system for educational content--an iTunes server. This server is currently used to deliver FCIT Lit2Go content directly to the iTunes application available for both Windows and Macintosh computers. Using iTunes as a delivery system makes it extremely easy to transfer Mp3 audio files directly to student players in a format that most students are extremely familiar with. For those Florida schools that do not as yet have high-speed Internet connections in their classrooms, FCIT will also make the materials available on CD-ROMs to be distributed at both the annual FAST conference and at the Florida Educational Technology Conference.
- Science teachers in Union County will be notified of this project directly and will be consulted in the planning of these deliverables. The Science supervisors of the remaining 66 Florida districts will also be informed of the existence of these resources via email and we will request time at a statewide meeting to present this project. Other teachers in the state will find the resources prominently featured on the FCIT homepage—a frequent web destination for Florida educators.
- The project update website will be hosted and maintained by FCIT. The URL of the site will be <http://etc.usf.edu/reports/union1/>. This site will track the progress of deliverables as enumerated in the attached "Deliverables Form", provide a copy

of the proposal, and announce the availability of these resources. The public will also be encouraged to comment on the project and its deliverables through the site. This website will be updated at least once per month during the project period.

- The deliverables include 7 online Science education modules and at nearly 4000 supporting digital assets. These will be shared freely with other districts through the FCIT website, which is already a well-known and well-used resource for Florida schools.
- Private school students and teachers will have the same access to the digital content on FCIT servers as public school students and teachers. Through mailings and educational conferences, FCIT attempts to make private schools in the state aware of the free resources available to them.
- All digital resources delivered through this project will be reviewed to ensure equitable access. FCIT resources in general are already accessible. All images, for example, are given descriptive alt tags. Every audio or video asset will have a text equivalent.
- As an additional delivery system, many of these assets will be tagged for inclusion in the Florida Digital Warehouse. This project is currently under development and is expected to go live during the 2007-08 academic year. Once implemented, the Florida Digital Warehouse will be a one-stop search engine for Florida students and teachers to find Florida educational resources through a state portal.

7. Budget Narrative

The attached budget provides cost-effective statewide impact. As noted above, every aspect of this project not only meets specific Union District needs, but will also be readily shared with all school districts in the state.

Professional Development Support Lines. Direct PD activity accounts for 41% of the total project budget. The largest line in this section is the \$262,651 subcontract to the University of Florida to produce the seven online science education modules for teachers. The topics selected for the online modules correlate with the Sunshine State Standards for Science:

1. The Nature of Matter
2. Energy
3. Force and Motion
4. Processes that Shape the Earth
5. Earth and Space
6. Processes of Life
7. How Living Things Interact with Their Environment

These modules will be freely available from the FCIT website and can be utilized by schools and districts across the state to support the dissemination of best practices in Science education

The school-based Science coach (\$65,000 plus fringe) will fulfill a desperate need in Union schools. Currently there is no dedicated Science supervisor to support the professional development of the district Science faculty—a recognized need on the part of the district and teachers alike. The salary level will enable the district to fill this position with a highly-qualified applicant.

The “Teacher training by in-service contractors” line of \$14,000 covers the tuition of the district Science faculty to participate in a Science education graduate course piloting the seven online modules. This activity not only allows for a rigorous usability testing of the modules, but also provides direct professional development to the district teachers and may start them on their way to earning a university certificate in science education.

Project Evaluation. The project evaluation line of \$39,896.97 reflects the 5% allotment to FCR-STEM for project evaluation as specified in the RFP.

Other Project Costs

The Florida Center for Instructional Technology will provide all of the digital assets envisioned in this project to support the hands-on approach of the online science education modules and to provide valuable resources to support the implementation of best practices by Science teachers statewide. FCIT is well known for providing collections of digital assets that are used extensively in Florida schools. Utilizing FCIT for this project will result in a larger set of digital assets than other providers could produce because they will be building this collection on top of existing collections that also support Science instruction. The subcontract to FCIT is for \$300,000.

The district project coordinator’s salary will be \$65,000 plus benefits. In a small district such as ours where everyone wears multiple hats and is stretched thin, it is essential that we have a dedicated project coordinator to arrange for the various activities and trips, support the participants and coordinate the project with the partners. The project coordinator and the science coach will share an expenses line of \$10,000 to support their activities in completing this project.

An essential component of this project is the planned travel of the district Science teachers to noteworthy natural and scientific sites in Florida where they will have the opportunity to interact with scientists who are specialists in each of the particular locations. A line of \$25,000 is reserved to cover these travel expenses as well as any incidental travel of the project coordinator to meet with partners and for district staff to attend the annual Grant Fiscal Management training provided by the Florida department of Education. A line of \$10,000 is given to provide for substitute teachers when the

district Science teachers are participating in their off-site professional development opportunities.

District Science teachers will be invited to participate in grant activities such as needs analysis during the summer. Some professional development travel for the teachers will occur outside of the school day. One or more of our districts teachers may also be invited to sit on the project Advisory Council. A stipend line of \$10,000 will cover teacher participation in project activities outside of the contract day.

Less than 1% of the budget is dedicated to capital outlay. We have budgeted \$6,000 for computers for the Science coach and project coordinator positions and other equipment such as cameras that will be utilized in the completion of this project.

Indirect costs of \$25,135.09 have been calculated at the approved rate for the Union County School District.

The budget total of \$862,971.46 supports a project that will have a tremendous impact upon Science teaching and learning in our district while simultaneously making these resources freely available to other districts statewide. Form DOE101 is attached.