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The mission of DLESE is to support excellence in Earth and space science education for all learners in all educational settings. DLESE is envisioned as an information network that will provide a) rapid, sophisticated access to collections of peer-reviewed teaching and learning resources, b) interfaces and tools to allow student exploration of Earth data sets, c) services to help users effectively create and use materials, and d) a community center to facilitate sharing and collaboration. The current DLESE discovery system enables searching and browsing for educational resources according to sub-disciplines in the Earth and space sciences, target audience (K-16, informal education), and resource type (e.g. lab exercises, simulations, curricula...). Future search capabilities will include compliance of resources with national science standards (e.g. National Science Education Standards, NRC, 1996; Project 2061, AAAS, 1989; state standards) and geospatial referencing. A special focus is being placed on discovery that describes multiple attributes of the Earth system: fundamental scientific principles, Earth system processes, Earth system components (physiographic, climatologic, biomes), principles of time and Earth history, hot topics in the news and emerging research, and ways of knowing about the Earth (observation, analysis, measurement, modeling, theory). Earth datasets will become increasingly accessible, supported by interfaces, tools, and instructional resources that promote their effective use in the classroom. Instructional resources can also be linked to examples of best practices in the use of these resources, and to community postings of opportunities (e.g. workshops, student internships), calendars, and other aggregated resources. Through the DLESE discovery system, any interested learner will be able to navigate deeply into a subject, or laterally to related topics, according to personal needs and interests.

URL: http://www.dlese.org

ED12A MC: Hall D Monday 1330h

Strategies Which Foster Broad Use and Deployment of Earth and Space Science Informal and Formal Education Resources II *(joint with P, T, PA)*

Presiding: **R Gabrys,** NASA Goddard Space Flight Center**; F Ireton,** SSAI**; B Meeson,** NASA Goddard Space Flight Center

ED12A-0156 1330h POSTER

Using Food to Demonstrate Earth Science Concepts

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One way to better engage K-16 students with the earth sciences is through classroom demonstrations with food. We summarize references from journals and the world wide web that use food to illustrate earth science concepts. Examples of how edible substances have been used include using candy bars to demonstrate weathering concepts, ice cream to mimic glaciers, and grapes to demonstrate evaporation. We also categorize these demonstrations into geology, weather, space science, and oceanography categories. We further categorize the topics by grade level, web versus traditional print format, amount of time necessary to prepare a lesson plan, and whether the activity is better used as a demonstration or hands on activity.

ED12A-0157 1330h POSTER

The Development of a Climate Time Line Information Tool

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The "Climate Time Line" or CTL tool currently in development at the National Geophysical Data Center will provide a climatic and "place-based" context for current weather patterns and a pre-instrumental context for current climate trends. Two audiences-GLOBE students and water managers involved with the Western Water Assessment–are targeted in the pilot project phase to test the CTL as a learning and decision-making support tool. Weather, climate and paleoclimatic observations will be integrated through a web-based interface that can be used for comparing data collected over 10 year, 100 year and 1000+ year periods, and made accessible and meaningful to non-technical users.

The Climate Time Line prototype will include the following features: 1) Access to diverse data sets such as NCDCs Historic Climate Network, GLOBE Student Data Archive, World Data Center for Paleoclimatology and historical streamflow data from the USGS; 2) Map Locator/Search Utility for regional inquiries and comparison views; 3) Varying temporal and spatial displays; 4) Tutorial and help sections to guide and support users; 5) Supporting materials including a "Powers of Ten" primer examining variability at various timescales; and 6) Statistical assessment tools.

The CTL prototype offers a novel approach in the scientific analysis of climate and hydrology data. It will facilitate inquiries by simplifying access to environmental data. Additionally, it will provide historical timelines for the intended user to compare the development of human cultures in relation to climate trends and variability–promoting an inquiry-rich learning environment. Throughout the pilot project phase, the CTL will undergo evaluation particularly in the area of usability, followed by a pre- and post- assessment of its educational impact on the targeted, non-technical audience. A hypernews workspace has been created to facilitate the development of the CTL.

URL: http://HyperNews.ngdc.noaa.gov/HyperNews/get/ClimateTimelineProject.html.

ED12A-0158 1330h POSTER

Cooperative Educational Project - The Southern Appalachians: A Changing World

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The Southern Appalachian Mountains, a popular recreation area known for its beauty and rich biodiversity, was chosen by the U.S. Geological Survey as the site to produce a video, booklet, and teachers guide to explain basic geologic principles and how long-term geologic processes affect landscapes, ecosystems, and the quality of human life. The video was produced in cooperation with the National Park Service and has benefited from the advice of the Southern Appalachian Man and Biosphere Cooperative, a group of 11 Federal and three State agencies that works to promote the environmental health, stewardship, and sustainable development of the resources of the region. Much of the information in the video is included in the booklet. A teachers guide provides supporting activities that teachers may use to reinforce the concepts presented in the video and booklet.

Although the Southern Appalachians include some of the most visited recreation areas in the country, few are aware of the geologic underpinnings that have contributed to the beauty, biological diversity, and quality of human life in the region. The video includes several animated segments that show paleogeographic reconstructions of the Earth and movements of the North American continent over time; the formation of the Ocoee sedimentary basin beginning about 750 million years ago; the collision of the North American and African continents about 270 million years ago; the formation of granites and similar rocks, faults, and geologic windows; and the extent of glaciation in North America. The animated segments are tied to familiar public-access localities in the region. They illustrate geologic processes and time periods, making the geologic setting of the region more understandable to tourists and local students. The video reinforces the concept that understanding geologic processes and settings is an important component of informed land management to sustain the quality of life in a region.

The video and a teachers guide will be distributed by the Southern Appalachian Man and Biosphere to local middle and high schools, libraries, and visitors centers in the region. It will be distributed by the U.S. Geological Survey and sold in Park Service and Forest Service gift shops in the region.

ED12A-0159 1330h POSTER

Using NASA's Global Change Master Directory as part of an Earth Science Curriculum

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NASA's Global Change Master Directory (GCMD) (http://gcmd.nasa.gov)provides tools for educators, students, and the general public to expand their knowledge of Earth science. Earth science data sets relevant to global change research may be located using the GCMD's free text and science keyword search interfaces. The complex issues of global warming and global climate change encompass all of the Earth science disciplines and demand authoritative information and data. Many data sets from federal agencies, including NASA and NOAA, university projects and research institutes are readily available on-line for downloading. They could prove useful in curriculum development for classroom instruction to illustrate, visualize, and manipulate data. In addition to searching for data sets, users can also search for educational resources such as Earth science curriculum material and software packages. These resources aid educators in accessing and evaluating Earth science data for their curriculum. Educators can also find resources that can be used in the classroom for illustrating, visualizing, and manipulating data.

URL: http://gcmd.nasa.gov

ED12A-0160 1330h POSTER

The Yohkoh Public Outreach Project: A Space Science Resource for Formal and Informal Education

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The Yohkoh Public Outreach Project (YPOP) is a NASA-funded web site maintained by scientists and educators at Lockheed Martin Solar and Astrophysics Lab. and Montana State University. YPOP includes a range of activities for youngsters, parents, teachers and anyone interested in learning more about the Sun. YPOP utilizes a number of approaches to the dissemination of solar data which incorporates elements of both formaleducation, via a number of lesson plans and classroom activities, and informal education, via access to the latest solar images, a solar tour, and updated movies. This combination has proved extremely effective in providing quality access to scientific data for a broad audience with a wide range of interests. The Yohkoh Public Outreach Project can be found at http://www.LMSAL.com/YPOP.

ED12A-0161 1330h POSTER

Partnerships for Creating Learning Resources Fostering Discovery and Dissemination

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Partnerships among educators and between educators and researchers within and among universities are especially important for fostering discovery, creating learning resources, and sharing materials for Earth system science education. Partners with diverse expertise motivate one another by contributing ideas and resources to the collaborative group, thus enabling discovery in the creation and enrichment of content being developed for the classroom or laboratory and also for informal education. The key to discovery in the interdisciplinary dimension of Earth system science requires knowledge and background experiences from many disciplines. Through sharing their expertise within collaborations, scientists and educators extend the usefulness of their work to others for use in their own classrooms, with perhaps modification of the resource to meet their specific needs. The new resource may be refined and redirected, and once again shared with other colleagues to extend the spiral of increasing utility and foster the broader use of the original resource. Collaborations enabling discovery become especially powerful when partnerships cross disciplines and extend horizons between fields of expertise in scientific research and professional education. Product dissemination and user community growth are natural results of a functioning collaborative of educators and researchers with common interests.

This collaborative community-building concept forms the core of successful education endeavors within the NASA/USRA Earth System Science Education Program (ESSE) which supported forty-five interdisciplinary teams between 1991 and 2000 to develop and offer courses on Earth system topics. Throughout this effort, ESSE recognized the value of partnerships, communication, and venues which promoted team building, and engaged in collaborations with the Inter-American Institute, the Woodrow Wilson Foundation and Project ALERT aimed to foster discovery in the creation, review and dissemination of learning materials. This paper will outline several of the strategies employed by the ESSE Program, including team meetings and tutorials, topical workshops, and the developing Journal of Earth System Science Education (JESSE), and will explore ways in which these strategies can be incorporated into emerging science education initiatives such as DLESE and the National Science Digital Library.

URL: http://www.usra.edu/esse/essonline

ED12A-0162 1330h POSTER

Student Participation in Rover Field Trials

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The LAPIS program was developed in 1999 as part of the Athena Science Payload education and public outreach, funded by the JPL Mars Program Office. For the past three years, the Athena Science Team has been preparing for 2003 Mars Exploration Rover Mission operations using the JPL prototype Field Integrated Design and Operations (FIDO) rover in extended rover field trials. Students and teachers participating in LAPIS work with them each year to develop a complementary mission plan and implement an actual portion of the annual tests using FIDO and its instruments. LAPIS is designed to mirror an end-to-end mission: Small, geographically distributed groups of students form an integrated mission team, working together with Athena Science Team members and FIDO engineers to plan, implement, and archive a two-day test mission, controlling FIDO remotely over the Internet using the Web Interface for Telescience (WITS) and communicating with each other by email, the web, and teleconferences. The overarching goal of LAPIS is to get students excited about science and related fields. The program provides students with the opportunity to apply knowledge learned in school, such as geometry and geology, to a real world situation and to explore careers in science and engineering through continuous one-on-one interactions with teachers, Athena Science Team mentors, and FIDO engineers. A secondary goal is to help students develop improved communication skills and appreciation of teamwork, enhanced problem-solving skills, and increased self-confidence. The LAPIS program will provide a model for outreach associated with future FIDO field trials and the 2003 Mars mission operations. The base of participation will be broadened beyond the original four sites by taking advantage of the wide geographic distribution of Athena team member locations. This will provide greater numbers of students with the opportunity to actively engage in rover testing and to explore the possibilities of science, engineering, and technology.

ED12A-0163 1330h POSTER

WINNERSS - Reaching a broad audience from an academic institution

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"Wisconsin Idea National Network - Education and Research in Space Sciences: Our Home in the Universe" is a Thematic Outreach Program from the University of Wisconsin-Madison. WINNERSS addresses the main current and future research topics in space sciences origins of the universe, beginning(s) of life in the universe, the abitability of our home planet. These themes have origins in what we have learned in the age of space exploration and bring together the diverse disciplines of physics, astronomy, astrophysics, geology and geophysics, chemistry, atmospheric science, oceanography, astrobiology or collectively, the space sciences. This has come about through evolution of our knowledge and our understanding of the role of different processes that have shaped our environment. These include the asteroid impacts on the earth and in our solar system, the discovery of possible microbial of life in Martian rocks that came to earth as meteorites, the discovery of planetary systems around other stars. At the same time, there has been a significant evolution in our knowledge and understanding of the universe and the fragility of the environment on our home planet. The sustainability and global environment are highlighted by global change processes such as weather extremes, ozone hole, and concerns about the global warming illustrated by events such as the break-up of Antarctic icebergs the size of Rhode sland. Following the long tradition of the Wisconsin Idea, WINNERSS will strive to highlight research in these and related topics through Informal Science Education, K-12 programs and teacher development in space sciences. Broad geographic reach is enabled through the alumni clubs and the UW-Madison Speakers Bureau.

WINNERSS is funded by the Wisconin Idea Program of the University of Wisconsin and is being implemented in collaboration with the Wisconsin Alumni Association, and the following components of the University of Wisconsin-Madison: the Graduate School, College of Letters and Science and the Office of Education Outreach of the School of Education.

URL: http://tellus.ssec.wisc.edu/outreach

ED12A-0164 1330h POSTER

The Atmospheric Radiation Monitoring (ARM) Education Program: An Integrated Approach

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The Atmospheric Radiation Measurement (ARM) Education and Outreach program supports ARM Operations at all three CART sites (North Slope of Alaska, Tropical West Pacific, and Southern Great Plains) in ways that are relevant to the needs of the communities and regions that host the ARM program sites. The goal of the education and outreach program is to develop basic science awareness, critical thinking skills, and improve environmental science capacity building for communities, teachers and students in ARM host communities and regions. This year, the primary goal is to extend the existing program to cover all three sites and to coordinate activities among the sites.

In order to achieve this goal, we:

o Bring awareness of the ARM program to host communities through public education relevant to the culture of the region; o Aid capacity building and community involvement in developing and implementing ARM education at each site; o Promote a broader knowledge of regional and international climate concerns for teachers and students through integration of ARM education across sites; o Assist access to ARM data for educational programs as technical resources permit, and to provide real time research experiences for students; and o Increase the knowledge base for teachers and students in basic science and critical thinking skills using curriculum-based enrichment activities in climate, climate change, and climate change effects relevant to each region.

URL: http://www.arm.gov

ED12A-0165 1330h POSTER

SOLAR Educational Outreach and SAGE III

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Students On-Line Atmospheric Research (SOLAR) is a NASA sponsored educational outreach program linked to the Stratospheric Aerosol and Gas Experiment (SAGE) III, which is scheduled for launch in December 2001. SAGE III is an extension to the currently operational SAGE II, and will continue the long-term monitoring of the global distribution of aerosols and gases in the atmosphere. SOLARs objective is to help K-12 educators infuse SAGE related science topics and other topics related to the Earth climate system into the classroom curriculum. SOLAR disseminates information to teachers via the SOLAR web page and through workshops and other presentations at national and regional science teacher conventions. In June 2001, SOLAR conducted a one-week workshop at the NASA Langley Research Center for middle and high school science teachers from across the US. SOLAR facilitates hands-on learning activities for students. For example, SOLAR students may assemble an inexpensive handheld sun photometer, and learn to use it to measure atmospheric optical thickness. Other hands-on student activities are also available. The SOLAR web page includes tutorials on the SAGE III experiment, the instrument, and related science topics, as well as interactive activities such as quizzes and puzzles.

This poster will highlight ongoing SOLAR outreach activities, and will feature events surrounding the SAGE III launch.

URL: http://www-sage3.larc.nasa.gov/solar/

ED12A-0166 1330h POSTER

Earth Data Multimedia Instrument - EDMI: A NASA-funded Showcase That Brings Research Technology to Secondary Education

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Through its NASA-funded work in partnership with scientists, schools and curriculum developers, Planet Earth Science Inc. (PES) develops multimedia education software to support Earth science education at the secondary level. One of the main ingredients of PES software is the use of geographical data sets from satellite or climate models to illustrate and explain complex and interacting Earth processes. The exploration of science learning and actual Earth-system data sets occurs in parallel, the science and the data continuously interacting with each other. Data exploration is made possible through a novel interactive courseware product (the EDMI or Earth Data Multimedia Instrument) PES is developing that melds the data visualization and analysis capabilities of Kodak's IDL with the interactive, multimedia authoring capabilities of Macromedia's Director. The Earth Data Multimedia Instrument (EDMI) is "mini-IDL" capability within an interactive Director-based GUI.

In this session we will demonstrate the EDMI technology through a couple of applications that showcase its powerful capability to grow a community of developers that can create cost-efficient tools to bring real (and real-time) data into secondary schools and better

integrate research and education. We will also highlight the role scientists play in finding ways to successfully partner with different constituencies, from educators to the private sector, to bring the best technology to the students desktop.

ED12A-0167 1330h POSTER

Using Volunteer Data in Scientific Research: Combining GLOBE and USGS Data to Relate Surface Water Alkalinity With Regional Geology

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Many volunteer datasets lack the spatial or temporal coverage necessary to make them useful to researchers without supplemental data. Alkalinity data from 35 GLOBE (Global Learning and Observation to Benefit the Environment) and 619 USGS (United States Geological Survey) surface water quality sites were compared with each other and the large-scale regional geology. Past analyses of GLOBE data, collected mostly by K 12 students, have shown that the majority of water sites tend to have lower alkalinity than observed at professionally monitored sites, but this may be a function of stream size rather than sampling error. GLOBE data tends to come from smaller streams than those monitored by the USGS, and thus represent a different sampling population. Both datasets displayed the same geographic trends in alkalinity, but the greater number of USGS sites made the trends easier to visualize spatially. The alkalinity of natural water in a region should reflect the geology of an areas bedrock, which provides the source material for mineral weathering. This is especially true for rivers, which integrate over an area, but should be reflected also in many smaller streams that drain representative parts of a basin. GLOBE and USGS observations were both consistent with the regional geology in all areas of the United States except the southeast, where either the mineralogy of silicate sedimentary layers deposited over the carbonate bedrock is a more important influence, or acidic precipitation and deposition has destroyed the buffering capacity of the water. This paper examines how GLOBE water quality data compares with and can be used in regional studies to supplement professional data. The example research project shows how teachers and students can compare their data with outside data, integrate different datasets using GIS, and use them together to understand one of the basic principles of hydrogeology.

ED12A-0168 1330h POSTER

DLESE and Data Access for the Educational Community

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The content delivered by a digital library serving the needs of the Earth system education community, particularly one whose mission is to promote active student-centered learning, must facilitate learner access to data that we as earth scientists find vital. Much of these data, however, must be extracted from, or processed as, a very large dataset that is intended for use in near real time, and which requires the use of visualization and processing tools to fully exploit. Hence, such datasets are difficult to access and use by anyone other than disciplinary researchers.

The DLESE DAtaset Working Group (DAWG) is exploring what it means to incorporate datasets into a digital library with an educational mission. In particular, the DAWG is charged with addressing how DLESE can 1) facilitate discovery across distributed data archives, 2) provide tools to help instructors and learners parse, process, and visualize datasets, 3) facilitate the integration of seemingly disparate datasets, and 4) facilitate the development and dissemination of educational content that utilizes datasets and datastreams.

In this presentation, we highlight both the similarities and differences in the needs of the research and educational communities, define the role of DLESE in providing data access within the educational community, provide an overview of activities of the Dataset Working Group, and describe synergistic initiatives that are working in concert with DLESE's Dataset Working Group. These initiatives include the Earth Exploration Toolbook, a collection of resources highlighting how to use specific datasets, and tools and educational products that make use of those datasets in the classroom, being developed by T. Ledley and P. Morin, and the Thematic Realtime Environmental Data Distributed Services (THREDDS) system, an infrastructure and protocol for the development and dissemination of context-specific datasets and tools, being developed at the Unidata Program Center.

URL: http://www.dlese.org/people/workgroups/dawg/index.html

ED12B MC: Hall D Monday 1330h

Earth System Science Education Alliance: Inquiry-Based, On-Line Learning Communities *(joint with PA)*

Presiding: **T Schwerin,** Institute for Global Environmental Strategies (IGES)**; B Myers,** Wheeling Jesuit University

ED12B-0169 1330h POSTER

ESSEA: Overview and Opportunities to Participate

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The Earth System Science Education Alliance (ESSEA) is a partnership between the Institute for Global Environmental Strategies (IGES) and the Center for Educational Technologies (CET) at Wheeling Jesuit University, through funding from NASA's Earth Science Enterprise. ESSEA is supporting universities, colleges, and science education organizations in offering Earth system science online graduate courses that have been developed within the CET at Wheeling Jesuit University. The courses have been successfully implemented for both in-service and pre-service teacher education.

An annual announcement by ESSEA solicits proposals from US teams interested in offering the courses. Currently 12 institutions from across the US are offering the courses, with plans to select and fund 8 new organizations in February 2002. This presentation will provide an overview of the ESSEA program and information on how to participate in ESSEA.

URL: http://www.strategies.org/essea

ED12B-0170 1330h POSTER

Overview of the Earth System Science Education Alliance Online Courses

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Science education reform has skyrocketed over the last decade in large part thanks to technologyand one technology in particular, the Internet. The World Wide Web has opened up dynamic new online communities of learners. It has allowed educators from around the world to share thoughts about Earth system science and reexamine the way science is taught.

A positive offshoot of this reform effort is the Earth System Science Education Alliance (ESSEA). This partnership among universities, colleges, and science education organizations is led by the Institute for Global Environmental Strategies and the Center for Educational Technologies^{TM} at Wheeling Jesuit University. ESSEA's mission is to improve Earth system science education.

ESSEA has developed three Earth system science courses for K-12 teachers. These online courses guide teachers into collaborative, student-centered science education experiences. Not only do these courses support teachers professional development, they also help teachers implement Earth systems science content and age-appropriate pedagogical methods into their classrooms.

The ESSEA courses are open to elementary, middle school, and high school teachers. Each course lasts one semester. The courses begin with three weeks of introductory content. Then teachers develop content and pedagogical and technological knowledge in four three-week learning cycles.

The elementary school course focuses on basic Earth system interactions between land, life, air, and water. In week A of each learning cycle, teachers do earth system activities with their students. In week B teachers investigate aspects of the Earth system – for instance, the reason rocks change to soil, the relationship between rock weathering and soil nutrients, and the consequent development of biomes. In week C teachers develop classroom activities and share them online with other course participants.

The middle school course stresses the effects of real-world events – volcanic eruptions, hurricanes, rainforest destruction – on Earths lithosphere, atmosphere, biosphere, and hydrosphere. Teachers team during week A of each cycle to research the effect of each event on individual spheres. In week B groups "jigsaw" to study the interactions between events, spheres, and positive and negative feedback loops. In week C teachers develop classroom activities.

The high school course uses problem-based learning to examine critical areas of global change, such as coral reef degradation, ozone depletion, and climate change.

The ESSEA presentation provides examples of learning environments from each of the three courses.

URL: http://www.cet.edu/essea

ED12B-0171 1330h POSTER

Problem-Based Learning and Earth System Science The ESSEA High School Earth System Science Online Course

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The high school Earth system science course is web based and designed to meet the professional development needs of science teachers in grades 9-12. Three themes predominate this course: Earth system science (ESS) content, collaborative investigations, and problem-based learning (PBL) methodology. PBL uses real-world contexts for in-depth investigations of a subject matter. Participants predict the potential impacts of the selected event on Earth's spheres and the subsequent feedback and potential interactions that might result. PBL activities start with an ill-structured problem that serves as a springboard to team engagement. These PBL scenarios contain real-world situations. Teams of learners conduct an Earth system science analysis of the event and make recommendations or offer solutions regarding the problem. The course design provides an electronic forum for conversations, debate, development, and application of ideas.

Samples of threaded discussions built around ESS thinking in science and PBL pedagogy will be presented.

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Facilitation of the ESSEA On-Line Course for Middle School Teachers: A Key to Retention and Learning

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There are fundamental differences between an on-line course and a traditional face to face classroom course offering. On-line courses are front-loaded, that is, students taking on-line courses first have to navigate an unfamiliar website as they become familiar with the organization of the course. In addition, students in an on-line course in many cases have the stress of having to relate with an instructor and collaborate with colleagues that they may never meet. Many may be unfamiliar with the use of telecommunications technology. These forces can combine to produce students that become disillusioned with the on-line learning process, and consequently drop the course.

The stress associated with an on-line course can be significantly reduced by the methods used by the facilitator of the course. Therefore, facilitation of an on-line course can be a key to student retention in on-line