NASA LE&RN

(Learning Environments and Research Network)

Annual Report (2009)

NASA-Sponsored Classroom of the Future (COTF)
NASA Digital Learning Network™ (DLN)
NASA Electronic Professional Development Network (ePDN)

2009 witnessed the consolidation of three NASA eEducation Projects into the NASA LE&RN initiative. Referred to as project activities, the three components are independently managed as cooperative agreements with Wheeling Jesuit University, Oklahoma State University, and the Georgia Institute of Technology respectively. COTF and DLN have been in operation for many years while the ePDN was awarded to GA Tech in April of 2009. Each component has its distinct goals and objectives, but due to the educational technologies shared by all commonalities associated with NASA's education framework, there is considerable synergy among the three. The LE&RN Project Office resides at the NASA Langley Research Center in Hampton, VA. The Project Manager is responsible for maintaining communications, providing guidance, and managing budgets. The LE&RN Project answers to the K-12 STEM Education Outcome Manager located at NASA Headquarters, Washington, D.C.

NASA-Sponsored Classroom of the Future (COTF) Annual Report
October 1, 2008-Sept. 30, 2009

Project Description:

Classroom of the Future comprises four separate projects: Product Review, NASA TV, Virtual Worlds and Educational Technology Benchmarking.

NASA Educational Product Review: Conduct pre-publication quality reviews of NASA education materials, using teachers and subject matter experts as reviewers.

NASA TV: Prepare NASA Educational TV monthly program schedules in association with NASA education and TV offices, and web stream routine and special events.

Virtual Worlds: Construct and explore educational experiences in Second Life to understand education opportunities within virtual environments.

EdTech Collaborative: Provide a forum for user-generated content discussing best practices in choosing and using educational technologies in conjunction with NASA STEM education resources.

Project Goals:

NASA Educational Product Review: Ensure that NASA education activities meet quality standards through external review by teachers and subject matter experts.

NASA TV: Provide operational support and content expertise to NASA Education TV.

Virtual Worlds: Create *Second Life* simulation MoonWorld to explore learning in virtual worlds.

EdTech Collaborative: Develop a web 2.0 collaborative website that discusses how NASA programs can be enhanced and expanded through strategic use of emerging edtech. Engage NASA educators in using the site to extend their outreach to educators.

Project Benefit to Outcome 1, 2, or 3:

NASA Educational Product Review: Directly supports NASA educational product/ curriculum development (Outcome 2.3) by providing quality evaluation of products.

NASA TV: Supports Outcome 2.3 (Curricular Support Services) by providing NASA experiences to millions of TV viewers and web stream recipients.

Virtual Worlds: This research ultimately supports Outcome 2.3 by our exploration of best practices for educational uses of *Second Life*.

Educational Technology Benchmarking: Educational Technology Collaborative (ETC) helps inform educators about technologies and their application to teaching and learning, and supports Outcome 2.1 (short-duration professional development). So far, ETC has been promoted to three specific audiences to enhance their professional development: Teachers from the NASA Explorer Schools, NASA curriculum developers, and Challenger Learning Centers staff.

Project Accomplishments:

NASA Educational Product Review:
Forty-two products were submitted for review between Oct 1, 2008 and Sept 30, 2009. Of these new submissions, 27 were approved, 4 were rejected, 12 are still in review, 9 are awaiting revisions, and 2 were withdrawn. The three centers submitting the most products were Johnson Space Center (17), Langley Research Center (9), and Goddard Space Flight Center (6). Additionally, 21 products from the previous year completed the review process–13 were approved and 8 were rejected (5 for non-COPPA compliance).

NASA TV:
- 12 months of NASA Educational TV Scheduling with the addition of new programming, 82 NASA eClips, 1 Passport to Knowledge, and 2 Space Place Live programs.
- 8 DLN events with video conference/web streaming support for NASA's Digital Learning Network events:
  - 2008 NASA's Global Celebration and National Distance Learning Week for the DLN on Nov 13. (9 hrs of live web streaming and Second Life content insertion).
  - DLN Video Conference, Nov. 18th on NASA Product Review project.
  - Streaming support for the DLN's STS-119 Special Webcast Event -- Feb. 18.
  - Web streaming and Second Life insertion for DLN program NASA Explores Virtual Worlds: May 27, 2009, 4-5 p.m.
  - Support for COTF personnel to participate in the videoconference on Sept. 21st
  - DLN live web streaming on Sept. 16th.
  - NASA Ames Research Center, Video Conference on Sept. 21st with AES staff members at NASA Langley.
  - DiLNfocus Speaker Series videoconference on September 9th.
  - Assistance with the Discovery Channel producer on NASA resources we used when developing the Underground Railroad Video. (What, how NASA technology was used)
- Web streaming support totaling (15,562,793) concurrent streams, (10,262,952) page views, and NASA COTF had (3,616,456) streams including: Mission STS125, Nov. 14 thru Nov. 29, Launch of NOAA-N Prime Feb 4th plus the launch of STS-119, rescheduled STS-125 Mission (Hubble). (launched May 12, landing May 24), streaming of LCROSS/LRO launch June 18, delayed STS-127 Mission. (launched on 6th attempt July 15, landing scheduled for July 31), delayed STS-128 Mission. (first attempt Aug 25, Second attempt Aug 28th), STS-128 Mission. Launch Aug. 28th 11:59pm, Landing Sept. 10th 7:05pm.
- Flash Streaming Special Coverage for the White House, Sept. 15th for Vivek Kundra, White House federal chief information officer. http://www.parabolicarc.com/2009/09/12/white-cio-outline-cloud-computing-plan-nasa-ames/
- Setup and testing of a NASA HQ Flash Encoder/Live Stream.

Virtual Worlds:
- Created plan for design of MoonWorld educational research experience in Second Life and selected contractor through bid process.
- Wrote scripts and procedures for avatars to progress through 16 geologic field stations, collecting rock samples and making terrain observations and measurements.
- Developed procedure to synthesize field data and experiences in a research facility in lunar base.
- Designed and collaborated with contractor to build Bioregenerative Life Support System (BLiSS) based on data and lessons from BioBlast.
- Conducted two preliminary tours of MoonWorld (LE&RN) and LE&RN POCs.
- Built associated website for registration of visitors.
- Conducted introductory tours of Second Life affordances for science education for ePDN and DLN.

Educational Technology Benchmarking:
- Website development: Based on participant feedback, the ETC website has undergone a major overhaul with many new features, functionality, and graphics and greater security.

- ETC has been promoted to the NASA Digital Learning Network, NASA Aerospace Educators, NASA Explorer Schools, NASA Langley Preservice Teachers Program, the NASA Learning Environments and Research Network, Engineering Education Teachers, the West Virginia Health Sciences Technology Academy, the West Virginia Technology Leadership Conference, and the West Virginia Science Teacher Association
- The ETC has been used as a collaboration vehicle for several ad-hoc and on-going NASA-internal groups such as the NASA web video working group, the LE&RN consortium, a group exploring educational uses of SecondLife, the DLN, the Georgia Tech ePDN group, and the Social Media Application, Resource and Technology for NASA Education Networking Team.
- Initiatives to promote additional teacher participation such as the Technology Triathlon, using the ETC as a forum for the Pre-service Teacher program judges, NES Sustainability group, teacher-users of the NASA DLN, and a new initiative to recognize effective use of NASA education resources called STELLAR Practices, which will highlight exemplary teachers and provide a stipend for their achievements.
- ETC hosts a total of 331 articles. We created content around current issues such as digital citizenship, YouTube, Social media, mobile technologies, and articles specifically targeting each of the six ISTE technology standards categories.
- In the last twelve months, the website has logged 9,000 visits and 45,000 page views with visitors viewing an average of 4.8 pages and spending nearly six minutes per visit.
- There are nearly 270 registered users.
- Spin-off site called the CLC-Collaborative (www.clccollaborative.com) for informal educators, and presentation at the annual Challenger Learning Center conference. Much of the impetus for this was to respond to the new Space Act Agreement signed by the CLC network and NASA.
- Paper based on the ETC, “Blending Globalization and Curriculum Analysis to Study Technology-focused Teacher Training” at the American Educational Research Association annual meeting
- Seven of our research manuscripts from prior funding cycles are to be published in a book, *ICTs for Modern Educational and Instructional Advancement: New Approaches to Teaching* (L. Tomei, ed.) Hershey, PA: IGI Global

Project Contributions to Part Measures:

NASA Educational Product Review: The NASA Educational Product Review process is an infrastructure activity that directly supports NASA educational product/curriculum development.

NASA TV: PART Measure 10. Number of people reached via eEducation technologies per dollar invested. Explanation: NASA will continue to use internet- and web-based technology to deliver content to reach ever-larger numbers of participants. In 2008 COTF carried 4,658,962 streams and in 2009, 3,616,456. COTF’s volume of web streaming depends upon how many special programs NASA delivers. In 2008, 47 people viewed a COTF streamed program for each dollar spent, for a cost per viewer of 2.1 cents. Preliminary estimate for 2009 is 50 viewers per dollar or 2 cents each. The percentage reduction in cost – or increase in efficiency - in 2009 compared to 2008 is 6.5%.

Virtual Worlds: NA at this time due to focus on development of simulation, to be open to public in October 2009.

Educational Technology Benchmarking: Determining baselines in 2008.
PART Measure 2. Percentage increase in number of elementary and secondary educators utilizing NASA content-based STEM materials and programs in the classroom. Explanation: Educators obtain NASA STEM resources in a number of ways including direct participation in training workshops where materials are demonstrated. Feedback from these educators will be the basis for setting the percentage baseline.
PART Measure10. Number of people reached via eEducation technologies per dollar invested. Explanation: NASA will continue to use internet- and web-based technology to deliver content to reach ever larger numbers of participants. Percentage reductions will be per year over the preceding year.

Improvements Made in the Past Year:

NASA Educational Product Review:

- The product review team provided developers with information on common mistakes caught in the NASA Educational Product Review procedure.
- A second experienced AP Calculus teacher (Oct 2008) and five new science teachers (Aug 2009) were brought on board the team to assist in facilitating reviews.
- Cummings gave an interactive presentation for the DLN bi-monthly meeting to introduce the designers of DLN activities to the NASA Educational Product Review process. Various responses to review questions were presented and participants at different NASA centers evaluated their value to developers. (Nov 2008)
- Rewrote and reviewed grades 5-8 and K-4 versions of the DLN educator guide, *A View From the Top: Looking at Earth from Space,* to assist the DLN in developing future activity guides that go through review more quickly.
- Sent out call for reviewers to the National Science Teachers Association listserv resulting in 87 science educators signing up to help perform product reviews (Apr 2009).
- Presented summary of the NASA educational product review process and how the LE&RN POCs may contribute by either participating as reviewers or helping recruit reviewers who are qualified content experts and educators (WebEx - May 2009).
- Summarized the product review process via teleconference for the new ePD team (May 2009).
- Provided list of approved activities to feature in the upcoming Education Resources Showcase Calendar via teleconference with Robert Starr, Renee Elias, and Troy Merryfield (July 2009).
- Worked with COTF programmer on COTF Product Review databases and website to design a more interactive NASA Educational Product Review website that will enable submitters to view their current review status (somewhat like viewing NSF proposals under review) – in early test stage.

NASA TV: Based on COTF NASA Ed TV Survey achieved stability in programming. Added additional encoder backup (Quicktime and Windows). All 19 video conferences were new for DLN.

Virtual Worlds: Initiated MoonWorld project as described above, with improvements/tweaks introduced continuously throughout development.

EdTech Collaborative: Developed and continuously refined Educational Technology Collaborative websites in response to user feedback.

Project Partners and Role of Partners in Project Execution (for follow up):

The ETC team has collaborated with the following groups to encourage the use of the website for discussion of topics related to best practices in the use of edtech for STEM education:

External

- The Challenger Learning Center for Space Science Education and numerous Challenger learning Center franchises (Note: during this year, NASA and the CCSSE signed a Space Act agreement)
- The NASA Digital Learning Network

Internal

- The NASA Langley Preservice Teachers program
- The NASA ePDN program from Georgia Tech
- The NASA web video working group

NASA Digital Learning Network™ (DLN) Annual Report
October 1, 2008-Sept. 30, 2009

Project Description

NASA's Digital Learning Network™ began in the spring of 2003 with three Hub Sites (NASA Glenn, NASA Johnson, and NASA Langley) that provided leadership and guidance in the expansion of the network to include all NASA education offices associated with its 10 field centers and NASA Headquarters. NASA's Digital Learning Network™:

- Fosters the effective use of interactive instructional technologies through the delivery of NASA educational content for the benefit of its students and educators.
- Promotes collaborative activities among its member sites in order to optimize learning experiences for its students and educators.
- Encourages open communication among its member sites so that expectations, limitations, strengths, and weaknesses can be objectively addressed for mutual improvement and positive development.
- Provides timely responses to internal and external inquiries about technical issues, content development and delivery, and event scheduling.
- Encourages innovation and experimentation by its member sites with the expectation that instructional integrity is maintained and NASA educational goals and standards are upheld.
- Strives to reach targeted populations associated with the NASA Explorer Schools Program and other NASA distance learning initiatives that target underserved populations while providing access to appropriately equipped members of the general education community.
- Participates in the development of an agency-wide infrastructure that makes use of existing and emerging interactive instructional technologies.
- Contributes to the professional development of internal and external educators through distance learning-based events.

Project Goals

The goal of NASA's Digital Learning Network™ is to enhance NASA's capability to deliver unique content by linking customers with one or more NASA Centers and broader audiences in an integrated fashion. This coordinated digital learning network leverages NASA's unique content, facilities, and personnel so that we can provide students and educators at the precollege and university levels across the Nation and around the world with unique experiences. Learners at all levels have the opportunity to interact directly with NASA engineers, scientists, and education specialists to gain a new appreciation for the importance of STEM education.

Project Benefit to Outcome 1, 2, or 3:

The DLN provides a cost-effective method of delivering NASA-related instructional content via distance learning technologies. As an Outcome 2, K-12 STEM initiative, it extends NASA’s reach by connecting directly with students and teachers in formal and informal learning environments. Using its primary delivery technology, videoconferencing, the DLN exposes participants to a variety of STEM concepts by the use of real-time interactions with NASA personnel. Its secondary delivery technology, webcasting, extends programming for students and teachers to watch presentations on their desktops. A certain degree of interactivity is provided during webcasts using email for participants to pose questions to the presenters. The DLN has grown and average of 25% each year since it began in 2003. As more schools turn distance learning alternatives, future growth is anticipated. Videoconferencing has penetrated 30% of the K-12 user base with an obvious potential for continued growth.

Project Accomplishments:

The NASA Digital Learning Network™ has extended NASA's technology-based, educational efforts in a very instructionally viable and cost-effective way.

- Total number of events (08/09 comparison):
  - FY 08 – 3129,
  - FY09 - 3943 - 20.64% increase

- Numbers of students and teachers reached (08/09 comparison)
  - FY 08 =124,381
  - FY09 = 152,412 - 22.54% increase

- Increased DLN/education outreach partnerships: -
  - Interdisciplinary National Science Project Incorporating Research and Education Experience (INSPIRE) presentations
  - NES sustainability conference presentations

- Provided infrastructure for the delivery of STS-119 Space Suit training events from JSC

- Completed monthly electronic professional development events (NASA eEducation Product Showcase Series) for the general educator public via webcasting

- Produced and delivered LaunchCasts from Kennedy Space Center before and during launches

- Planned, prepared, and produced the International Happy Birthday NASA party with Discovery Education and USDLA connecting US and International schools in the celebration of NASA's 50th anniversary. 10-hours of continuous videoconferences and webcasts.

- Procured equipment to equalize production needs for each center upgrading Tricaster units and upgrading lighting and HD camera capabilities for studios.

- Trained DLN Coordinators to deliver selected modules so time zones would be equally represented allowing more educators options for signing up for more modules.

- Developed Wall-E LCROSS/Lidar Module from Goddard Space Flight Center

- Received notification from Center for Interactive Learning and Collaboration (CILC) of annual awards: KSC, JPL, JSC, and GSFC DLN as Pinnacle Award winners with ARC as runner-up.

- Presented new career series. ARC and JPL featured scientists and engineers in a new series titled DLiNfocus connecting classrooms of students in middle and high schools with NASA career experts.

- DLN wins Teacher's Choice Award from Berrien Regional Education Service Agency for the 5th year in a row.

Project Contributions to PART Measures:

- Percentage of elementary and secondary educators using NASA content-based STEM resources in the classroom. WHAT: Percentage of teachers who used pre-activities before they completed DLN events. How: DLN Coordinators query the teachers prior to the beginning of the events. WHEN: Every event that has a pre-activity. 47%
- Percentage increase in number of elementary and secondary student participants in NASA instructional and enrichment activities. WHAT: Number of students in DLN events as indicated by teachers at the end of each event and updated when the event is closed out in the system. HOW: Automated data collection system that captures daily activity and is compiled and checked for accuracy during the event close out process performed by DLN Coordinators. WHEN: Upon close out of completed events. 08 – 108,970; FY 09 - 137,428: Increase – 26.12%

- Level of student interest in science and technology careers resulting from elementary and secondary NASA education programs. Unable to collect data due to OEPM not being available during FY09.

- Dollar invested per number of people reached via e-education technologies. WHAT: DLN admin system report. WHEN: Upon close out of events. HOW: Total number of videoconference participants Total number of website hits in FY 09 – 234,293 = $1.56/hit (dln.nasa.gov)

Improvements Made in the Past Year:

The DLN continues to grow in number of events delivered and students and teachers served. The NASA Education Coordinating Committee (ECC) established the DLN as an agency infrastructure and the project was renamed an activity and placed in the NASA Learning Environments and Research Network (LEARN) Project. Improvements centered around subsequent realignment of the DLN with other eEducation activities and balancing out delivery options of selected modules among the sites. Website operations and efficiencies were also addressed to handle the increasing interest in and use of the DLN.

- The DLN Assistant Manager was elevated to Manager to provide a structure whereby all three LEARN activities are now represented by a lead as part of a management team approach to further the synergy of three activities under one project.
- Cross training of more popular modules was accomplished in order to spread the delivery opportunities across time zones and therefore make them more accessible.
- New module development based new missions have been developed or mission concepts have been integrated into the existing modules. New modules are submitted to COTF for evaluation under their educational products review.
- With Project LEARN now being a fully recognized project, DLN is actively seeking ways to collaborate with COTF and ePDN. This also includes participating in COTF's Ed Tech Collaborative to solicit qualitative feedback from our customers regarding module and delivery quality.
- The DLN website was rebuilt due to security compromises and plans were made for its redesign in 2010. It will be redesigned to be more intuitive for easier customer and administrative use and will conform itself to the design of the portal for consistency.

Project Partners and Role of Partners in Project Execution (for follow up):

- The DLN provided ePDN (Electronic Professional Development Network) staff with connectivity during start up meeting when the award was made in April, 2009.
- The DLN worked with COTF (Classroom of the Future) to set up and use the EdTech Collaborative as a mean of exploring the potential for collaborative communications among the various DLN sites.
- The DLN worked with Flight Projects to deliver a number of ePD events about the STS 119 education resources.
- The DLN partnered with CORE (Central Operation of Resources for Educators) and ERCN (Educator Resource Center Network) to plan, prepare, and produce monthly webcasts targeting ERCN members.
- The DLN partnered with the United States Distance Learning Association and Discovery Education in the planning, preparation, and delivery of the NASA 50th Anniversary Global Birthday Party

NASA Electronic Professional Development Network (ePDN) Annual Report
October 1, 2008-Sept. 30, 2009

Project Description

The Electronic Professional Development Network (ePDN) brings together multiple partners to tackle developing effective electronic professional development courses showcasing NASA data and programs for Science, Technology, Engineering, and Mathematics (STEM) K-12 teachers across the nation.

The project was established in April 2009 as a collaborative agreement between NASA's Langley Research Center (LaRC) and the Georgia Institute of Technology (Georgia Tech). The three Georgia Tech partners involved in the project are the Distance Learning & Professional Education (DLPE) unit, the Center for Education Integrating Science, Mathematics and Computing (CEISMC), and ORBIT Education, Inc, a NASA-themed educational service provider.

These three partners collaborate with scientists and engineers from NASA centers and mission directorates, the other LE&RN components - Classroom of the Future (COTF) and Digital Learning Network(DLN), Georgia Tech and from industry to bring STEM content to K-12 teachers through modular-based ePD certificate programs, and through shorter workshops and events. The courses and workshops will be designed to emphasize best practices, incorporating inquiry learning, case-based scenarios, and data analysis actively into the programs. They will also be designed to promote teachers' use of new communication tools such as video sharing, podcasting, visualizations, virtual worlds, and social networking.

Project Goals/ Project Benefit to Outcome 1, 2, or 3:

ePDN Goal - Introduce and familiarize K - 12 educators with NASA-related instructional resources through online learning technologies and methods so they are better prepared to improve students' STEM literacy.

a. Objective 1: Plan, prepare, produce, deliver, and evaluate ePDN certificate programs, workshops, and other events designed to familiarize educators with NASA-related instructional resources and to train them how to use these materials in their learning environments.

b. Objective 2: Increase the acceptance and use of eEducation technologies by educators who use NASA educational resources.

Both of these objectives map to Outcome 2, Objectives 2.1 and 2.2.

Project Accomplishments:

- Collaborative agreement between Georgia Tech and NASA was finalized in April 2009.
- All current hiring needs for the Georgia Tech team have been completed.
- A master timeline for the development of the four certificate programs has been developed.
- Development on the first certificate program, Using Robotics to Enhance STEM learning, began in July 2009.
- www.nasaepdn.gatech.edu, the project's website, was launched in September, 2009.
- The ePDN team connected with various NASA education projects to discuss possible synergies, including Education Flight Projects, CoTF

Project Contributions to Part Measures:

A baseline will be set in 2010 for the following Outcome 2 metrics and will be available for next year's report:

Objective 2.1, measure 2.1.1(c) – percentage of elementary and secondary educators who haven't participated in intensive NASA training programs and use NASA content-based STEM resources in the classroom

Objective 2.1, measure 2.1.2(d) – cost per participant for NASA elementary and secondary education

Objective 2.2, 2.2.1 – percentage of elementary and secondary educators who participate in NASA training programs who use NASA resources in their classroom instruction.

Objective 2.2, measure 2.2.2(d) – cost per participant for NASA elementary and secondary education

Improvements Made in the Past Year:

The ePDN activity has progressed from CAN to funded agreement.

Project Partners and Role of Partners in Project Execution (for follow up):

Internal:

1. The ePDN team is working with COTF to integrate its efforts in learning in virtual worlds as a component of some of the courses, especially in its Earth Science certificate program current under development..
2. The DLN is featuring the ePDN in an Education Resources Showcase webcast in the spring of 2010. This works began in 2009
3. Flight Projects is working with the ePDN team to coordinate robotics course work associated with its STS-131 activities.

External

1. Lego Education Group and the ePDN are working on collaborations associated with robotics activities that students will complete as part of the courses
2. First Lego League of Georgia is cooperating with ePDN by providing 16 Teacher/Coaches who are testing the courses before public launch.