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**Integrating NASA Digital Educational
Assets (IDEA) Project Report**

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Integrating NASA Digital Educational Assets (IDEA) Project

Project Overview and Executive Summary

The Integrating NASA Digital Education Assets (IDEA) project, awarded to the National Science Teachers Association (NSTA), is piloting a transformative, scalable model at the school district level, designed to sustain electronic professional development (e-PD) for science teachers. The collaboration between NSTA and Oklahoma State University (OSU) leverages NSTA's partnerships with the GE Foundation and its ongoing science, technology, engineering, and mathematics (STEM) education effort in the nation's schools, the NASA Explorer Schools project, and other school districts across the United States.

The period covered in this report—September 1, 2009, to August 31, 2011 (hereafter referred to as “reporting period”)—was devoted to selecting and aligning NASA-content classroom resources; developing and deploying professional development (PD) opportunities for teachers, such as online short courses and web seminars; and providing access to synchronous and asynchronous tools that allow participants to collaborate as virtual communities, which includes a pilot rewards and recognition program for IDEA project teachers.

In August 2011, NASA approved NSTA's one-year, no-cost extension request. Delays in the initial grant award compressed the timeline for project activity implementation. While the project's major milestones were completed, additional time was needed for the innovative e-PD support systems and features developed for the project to reach their full potential. The new end date for the project is August 31, 2012.

The primary goals of the IDEA pilot project outlined in our original proposal are:

GOAL 1: Provide a demonstration project for NASA across school districts, illustrating how NASA might strategically partner with a district to align selected materials with both state standards and district curricula.

GOAL 2: Increase teacher content knowledge and pedagogical effectiveness by enhancing district curricula with aid of educational NASA classroom materials and e-PD content on Earth and space sciences for middle and high school teachers.

GOAL 3: Evaluate effectiveness of a blended e-PD delivery model that addresses scale and sustainability, and pilots cohort communities of practice.

GOAL 4: Increase student interest in Earth/Space Science and STEM career opportunities in these content areas.

The purpose of this document is to report the accomplishments and findings of the first two years of the IDEA project. A summary of the impact for each project goal follows.

GOAL 1: Provide a demonstration project for NASA across school districts, illustrating how NASA might strategically partner with a district to align selected materials with both state standards and district curricula.

The NSTA staff has many years of experience in collaborating with districts across a range of professional programs, including face-to-face (f2f), entirely online, and in a blended format, many in collaboration with NASA. When collaborating with districts, the key driver should be the needs of the teachers and students it serves, not the desire of the sponsor to imbue its program upon the district.

The IDEA project aspired to keep this driver paramount while simultaneously keeping the sponsor's goal to facilitate the embedding of NASA educational support resources to increase teachers' content knowledge (subject matter and pedagogical content) and inspire students' interest and awareness in STEM careers. This was accomplished by:

- Securing the commitment and 2+ year partnership with 13 districts, including inner-city, rural, and suburban schools systems from the southern, northern, and mid-eastern sections of the country.
- Consulting with NASA center and headquarters experts to obtain the “top-rated” and existing NASA approved materials for district review and consideration.
- Encouraging districts science supervisors to select their own leadership teams as they sought to develop and grow local leadership capacity within their districts.
- Providing sequestered time for district leadership teams to select NASA resources that were aligned to their unique needs based on local student learning achievement data and existing curricula, such that the NASA resources could be embedded to address deficiencies in learning or gaps in curriculum.
- Coupling NASA's resources alongside NSTA's teacher support resources in the Learning Center (over 7,700+ available), and within our community system where teachers may upload their own resources and create collections to rate and share with others.

Several key quantitative and qualitative statistics convey the impact of this portion of the project.

- Prior to attending district resource review and selection workshop, 26% were knowledgeable about the content. After the workshop, 87% indicated they would incorporate the new knowledge and/or skills into their teaching.
- Participants appreciated time to “identify gaps across middle and high school, go through resources with peers in different districts and work with colleagues in own district.”
- Over 4,000 individual resources were uploaded from the ~370 teachers that participated in the project.
- Over 320 personalized collections were created and are now part of the more than 2,500 user-generated resource collections in the Learning Center community.
- Over 400 individual community forum posts were created as part of a larger national network that has made over 8,000 posts in just the last year.

GOAL 2: Increase teacher content knowledge and pedagogical effectiveness by enhancing district curricula with aid of educational NASA classroom materials and e-PD content on Earth and space sciences for middle and high school teachers.

None dispute the necessity and importance of teachers' competency and confidence in the science they are charged to teach. Both are a significant factor in ultimately facilitating deeper student learning. Research documents that teacher weakness in either area typically leads to teachers spending less time on the subject matter. Often teachers are unable to implement known pedagogical strategies to facilitate learning certain challenging science phenomena. Teachers usually will ask more questions of their students but at a lower cognitive level to keep them from getting "off script," and at worst case teachers may facilitate student misconceptions that are hard to later overturn. This project demonstrated significant gains in both teacher competence and confidence through providing in-depth and extended learning experiences through online short courses, as well as self-directed, on-demand experiences via SciPack web modules.

Several key statistics demonstrate the impact of the project on teacher efficacy, teacher learning, and document extended contact hours of PD to support teacher learning:

- Prior to participating in the online short courses, 9.3% to 27.8% of the participants reported their perceived feeling of being *not adequately prepared* to teach any the four Earth/space science topic areas as addressed in the short course. After the course, 64.7% to 84.3% reported that they felt *well prepared or very well prepared*.
- Teachers completed a pre-participation (pretest) and post-participation (posttest) knowledge test, as well as a final assessment. Overall, pretest scores were 51.28% across all four online courses, while overall posttest scores were 71.79%, representing an increase of more than 20 percentage points.
- Nearly half of all participating educators took the time to reflect and generate a long-term professional growth plan (175 of 370 teachers), and several exemplary examples are included in Appendix 3J.
- Of the 64 synchronous web seminars offered by NSTA in collaboration with NASA via the Learning Center (54 through the NASA Explorer Schools program and 10 through this grant), over 98% of the participants state they would like to see more of these experiences offered, and the overwhelming majority rate the web seminar content as valuable, interactive, and relevant.
- Research states that teachers should receive between 50 and 80 hours of PD to facilitate a change in teacher practice. This project, in aggregate, provided more than 8,450 hours for the project's participating teachers (45 hours/teacher/online course), and SciPacks (10 hours/teacher/SciPack).
- Several qualitative comments reflect the range and value of the web seminars: "I learned that the earth is actually an electromagnet so I can teach this fact to my students;" "Applying the search for earth-like planets to mathematics is very valuable to myself and my students;" "As content specific info, this seminar helped clear up misconceptions I had about the Earth's orbit around the sun."

GOAL 3: Evaluate effectiveness of a blended e-PD delivery model that addresses scale and sustainability, and pilots cohort communities of practice.

As stated in the 2010 National Education Technology Plan: Through online learning systems, teachers may enhance their learning through blending the best of onsite PD with online PD that provides immediacy, convenience, self-direction, and collaboration with other colleagues and experts via professional learning communities...For teachers to effectively facilitate using interactive resources, learning systems, and connectedness to online communities, teachers need to experience it firsthand—as part of their own learning and professional development (US Department of Education, 2010).

This project gave districts the autonomy to explore a range of blended PD models and incorporated an innovative system of badges, points, and local leader boards to provide recognition as teachers increased their reputation as part of an online community. Data from the third party evaluator revealed a need for district administrator training in and awareness of the different blended models in the literature. We assembled this literature and orchestrated an administrator workshop focused specifically on that topic which was favorably received by the participants.

District administrators found significant value in the time to collaborate with their colleagues and discuss various models, strategies, and hurdles relevant to the unique needs of their districts. Similarly, teachers welcomed the opportunity to showcase how they effectively integrated the NASA resources in their classroom as part of the IDEA Capstone event and the importance of their new knowledge in the subject areas associated with the project. This is captured in the hundreds of teacher comments, PD plan reports, and the onsite group share-a-thon poster session at the capstone event.



Lorrie Armfield, an IDEA project participant from Prince George's County, Maryland, provided the following testimonial that reflects the power of blended on-demand models, teacher recognition, and teacher choice in self-regulating their own learning.

I am truly grateful for the honor bestowed upon me this morning. You have touched my heart and reminded me of how blessed I am to have a career that I am so very passionate about. I absolutely love teaching, and I am thankful for the opportunities provided through the Learning Center to expand my repertoire of teaching strategies in hopes of affecting positive academic changes in the lives of my scholars. This professional development is unlike any I've experienced in my 14 years as an educator. From the SciPacks and interactive videos, to journal articles and discussion forums, I am always able to find tools to actively engage my diverse student population (inclusive of those individuals who speak English

as a second language). I have explored and discovered so much at the Learning Center; this platform has 'hooked and held' my attention in ways that more traditional resources could not.

Teaching is truly its own reward, but to be acknowledged for doing something that encourages me to hone my craft and allows me to gain the perspectives of other educators is amazing. Thank you a million times over, and please know that I am sharing, listening, learning, and hopefully inspiring and motivating a new generation of educators to harness the power of the Learning Center to enhance their own understanding of various science concepts, and to transfer that knowledge to their students.

There is no one-size-fits-all model for blended PD. The IDEA project captured a range of models for NASA’s consideration for future deployments and iterations. The table below shows several aggregated frequency counts and types of activities that occurred via the online communities as part of the blended PD model from the ~370 teachers that participated in this project.

PD Resources and Activities	IDEA Project Participants	Impact
Added resources to their personal libraries	4,062	Created perennial learning space
Completed SciPacks (10-hour, self-paced experiences)	176	~1,760 contact hours of PD
Made posts in the community forums	405	Significant collaboration
Created and shared collections of resources	321	Community engagement
Reviewed and rated Learning Center PD resources	195	Critical curator of resources
Attended live web seminars	86	Engage with experts
Created PD Plans with personal goals to improve their science teaching	175	On-going growth

GOAL 4: Increase student interest in Earth/space science and STEM career opportunities in these content areas.

The goal to increase student interest in Earth/space science and STEM career opportunities was achieved primarily by increasing teacher content knowledge and pedagogical effectiveness through PD activities developed by the IDEA project. The project’s primary intent was not to regularly communicate directly with or provide programming for students. However, in the project’s second year we explored the opportunity to deliver three web seminars especially for students. These web seminars were offered exclusively to the IDEA project districts and supported the IDEA project goal to increase student interest in Earth/space science and STEM career opportunities. These seminars included a presentation from scientists about their career with NASA and an interactive Q&A session.

Edvantia evaluators asked teachers and administrators to reflect on what, if any, changes they had noticed in students as a result of the project. Many teachers reported seeing increased student excitement and interest through engagement with the NASA website and other activities. Several administrators indicated improvement in students' science scores, attributing the Learning Center resources as one of the contributing factors.

As part of the evaluation, Edvantia Inc., asked students directly to report their level of agreement on a 5-point scale (*strongly disagree* to *strongly agree*) with items related to their desire to take additional STEM classes and major in a STEM-related field. Students who attended the web seminar were much more likely to agree with the item, *I am likely to take extra science, engineering, or math courses in high school that are beyond what is required*. We are encouraged by these results and confirm the power and necessity of a multi-pronged and integrated approach to leverage technology to inspire and engage both teachers and students via NASA's scientists and engineers in support of STEM education.

Conclusion

Overall, the project has been very well received by the districts and teachers it intended to serve. The IDEA project's first year was an intense, but exciting, time as staff worked to enroll additional districts, oversaw the selection and standards correlation of NASA student support materials, and coordinated development and delivery of e-PD opportunities for teachers.

Insight was captured for future consideration by NASA regarding the breadth of teacher PD offerings and the essential nature of recruitment strategies when science administrators make opportunities available to their district teachers. Administrators at both large and small districts have myriad responsibilities (e.g., assessment, curriculum, professional development, student programming), and it appears that district email blasts are a ubiquitous method for making these opportunities available.

When the goal is to facilitate a cohort/team into a school-based professional learning community or larger district community of practice as part of a blended PD model, deployment efforts should be integrated in the highest possible manner into a larger district-wide PD plan. Administrators and teachers should understand the structure of the PLC teacher learning model, its value for implementation, and how it will be deployed. Our impression is that many administrators sent mass emails or talked individually with teachers as a recruiting method, recommending the opportunity from the perspective of an individual teacher learning experience instead of the intended blended PLC or CoP cohort.

Also, many district administrators across the country often have the misperception that they are incorporating a high quality blended learning model that leverages both onsite and online learning as espoused for in the 2010 National Educational Technology Plan, but in effect are merely "bolting on" an online component such as access to a digital repository or series of isolated formal online courses.

While many teachers valued the resources and demonstrated large amounts of online activity, which was confirmed by district administrator observations and teacher PD portfolio reports and significant gains in learning, the initial deployment structure was more akin to individual teacher

artisans improving their own practice instead of a small team working collaboratively toward a common goal. This may have been due, in part, to the way the administrators communicated the initial recruitment of teachers and experience structure. One understands the value of allowing teachers to select opportunities and resources that cater to their own learning needs and preference, but this must be balanced and delivered to facilitate a group PLC dynamic (e.g., discourse with other like-minded colleagues that may then work collaboratively face-to-face and online as a school-based PLC and part of a larger intra-school community of practice. When NSTA received and analyzed the data from Edvantia, we discerned this effort and structured a recent administrator training workshop with the focus on sharing the research on various blended professional development community models.

During the second year, staff worked to provide access to synchronous and asynchronous PD tools that allowed participants to collaborate as virtual communities, including a pilot rewards and recognition program for IDEA project teachers. The one-year no-cost extension granted by NASA will allow the participating teachers and students the opportunity of another school year cycle, as we continue to provide access to live support.

When considering where NASA might seek to improve its online content offerings, the SciPack web modules developed in partnerships with NSTA might be a worthwhile consideration. SciPacks address both subject matter knowledge using an inquiry-based approach and embed an array of engaging strategies to facilitate learning content beyond simple text and images. They draw off the latest literature in pedagogical content knowledge enumerating strategies for teaching science, what is cognitively appropriate by grade level, and known pre- or misconceptions students may encounter with particular science phenomena. From a variety of resources available to support teacher learning (e.g., NASA lessons, web page content, and activities), as well as NSTA's resources such as podcasts, web seminars, e-chapters and e-journal articles, etc., SciPacks were rated as the most valued resource component for teacher learning. In an environment where over 1.2 billion smart phones or tables are sold each year and the 2011 K-12 Horizons Report prognosticates the adoption horizon for mobile on-demand learning is less than 1 year, NASA might consider a review of the templates and granularity NSTA applies to create its learning modules. These modules may be used as stand-alone resources that are coupled with email content mentors and live chat online advisors and essential course material when part of a moderated online short course.

There seems to be some value also in further exploring how an integrated system of online badges linked to teacher profiles and local leader boards may both recognize and motivate teachers as they contribute to their profession.

In closing, we value the long-standing partnership we have with NASA and the opportunity to combine our expertise in online PD and delivery mechanisms with NASA's outstanding resources. Collaboratively, we are fulfilling our mission to inspire excellence and innovation in science teaching and learning for all.