Year 1 Report Appendix

Table of Contents by Sections

Tables 1-8 references in Major Findings Section of Report

Table 1: Construct reliabilities measures for *ICT Capabilities-Teacher*

Constructs	Brief Description	No. of Items	Crobach's alpha (n=44)
Problem solution	Problem solving capabilities, from planning to production of solution	6	0.86
Communication and metacognition	Capabilities to communicate, collaborate, judge, and reflect	4	0.63*
Basic ICT capabilities	Core ICT competences	6	0.82
Analysis and production capabilities	Capabilities to perform word processing tasks, use of spreadsheets, databases, and presentation	7	0.76
Information and Internet-related capabilities	Capabilities to find, produce, and manipulate visual and textual information	10	0.90

*Communication and metacognition was the only construct that did not meet our target (.70). The decision to keep this construct is explained in the report.

Table 2: Construct reliabilities measures for *Formal/Informal Technology Usage-Teacher*

Constructs	Brief Description	No. of Items	Crobach's alpha (n=44)
Information searching/locating	News, search engine, video, buying, spreadsheet, 2d map tools, google earth, learning not school work,	10	0.71
Social networking	Create and share text based info, create and share multimedia info, second life, email, gaming, instant message, blog	6	0.23*
Productivity	Buying, create and share text based info, create and share multimedia info, spreadsheet, 2d map tools, Google earth, email, word, blog, Google site, movie editor	18	0.84
Entertainment	Create and share text based info, create and sharer multimedia info, second life, learning not school work, gaming, blog, movie editor	5	0.60*
Communication	Email, instant message, blog, google site, movie editor	7	0.70
Collaboration	Google word, Google spreadsheet, blog, Google site	5	0.63*

*Social networking, entertainment, and collaboration were the constructs that did not meet our target (.70). The decision to keep this construct is explained in the report.

Table 3: Construct reliabilities measures for *Teacher New Literacies Scenarios*

Constructs	**Brief Description**	**No. of Items**	**Crobach's alpha (n=44)**
Identify questions/Recognize relevant information	Using ICTs to identify research questions, recognize information relevant to the problems	9	0.87
Locate/manage information	Using ICTs to locate information relevant to the problems, and manage information located.	8	0.87
Evaluate information	Using ICTs to evaluate the usefulness of the data collected	14	0.93
Synthesize information to answer questions	Using ICTs to synthesize information and produce information to answer questions.	12	0.92

Table 4: Construct reliabilities measures for *Teaching Science as Inquiry*

Constructs	**Brief Description**	**No. of Items**	**Crobach's alpha (n=44)**
Engages in Scientifically Oriented Questions	Self Efficacy	7	0.84
	Outcome Expectancy	8	0.86
Gives Priority to Evidence When Answering Questions	Self Efficacy	8	0.87
	Outcome Expectancy	8	0.85
Formulates Explanations from Evidence	Self Efficacy	6	0.72
	Outcome Expectancy	7	0.86
Connects Explanations to Scientific Knowledge	Self Efficacy	6	0.82
	Outcome Expectancy	4	0.78
Communicates and Justifies Explanations	Self Efficacy	7	0.84
	Outcome Expectancy	7	0.86

Table 5: Construct reliabilities measures for *ICT Capabilities-Student*

Constructs	**Brief Description**	**No. of Items**	**Crobach's alpha (n=189)**
Problem solution	Problem solving capabilities, from planning to production of solution	6	0.83
Communication and metacognition	Capabilities to communicate, collaborate, judge, and reflect	4	0.74
Basic ICT capabilities	Core ICT competences	6	0.82
Analysis and production capabilities	Capabilities to perform word processing tasks, use of spreadsheets, databases, and presentation	7	0.84
Information and Internet-related capabilities	Capabilities to find, produce, and manipulate visual and textual information	10	0.88

Table 6: Construct reliabilities measures for *Formal/Informal Technology Usage-Student*

Constructs	**Brief Description**	**No. of Items**	**Crobach's alpha (n=189)**
Information searching/locating	News, search engine, video, buying, spreadsheet, 2d map tools, google earth, learning not school work,	10	0.79
Social networking	Create and share text based info, create and share multimedia info, second life, email, gaming, instant message, blog	6	0.60*
Productivity	Buying, create and share text based info, create and share multimedia info, spreadsheet, 2d map tools, Google earth, email, word, blog, Google site, movie editor	18	0.88
Entertainment	Create and share text based info, create and sharer multimedia info, second life, learning not school work, gaming, blog, movie editor	5	0.68*
Communication	Email, instant message, blog, Google site, movie editor	7	0.77
Collaboration	Google word, Google spreadsheet, blog, Google site	5	0.76

*Social networking and entertainment were the only constructs that did not meet our target (.70). The decision to keep this construct is explained in the report.

Table 7: Construct reliabilities measures for *Student New Literacies Scenarios*

Constructs	**Brief Description**	**No. of Items**	**Crobach's alpha (n=189)**
Identify questions/Recognize relevant information	Using ICTs to identify research questions, recognize information relevant to the problems	9	0.90
Locate/manage information	Using ICTs to locate information relevant to the problems, and manage information located.	8	0.86
Evaluate information	Using ICTs to evaluate the usefulness of the data collected	14	0.92
Synthesize information to answer questions	Using ICTs to synthesize information and produce information to answer questions.	12	0.93

Table 8: Construct reliabilities measures for *Students' Motivation Toward Learning Science*

Constructs	**Brief Description**	**No. of Items**	**Crobach's alpha (n=189)**
Self-efficacy	Students believe in their own ability to perform well in science learning tasks.	7	0.84
Active learning strategies	Students take an active role in using a variety of strategies to construct new knowledge based on their previous understanding.	8	0.90
Science learning value	The value of science learning is to let students acquire problem-solving competency, experience the inquiry activity, stimulate their own thinking, and find the relevance of science with daily life.	5	0.87
Performance goal	The student's goals in science learning are to compete with other students and get attention from the teacher.	4	0.87
Achievement goal	Students feel satisfaction as they increase their competence and achievement during science learning.	5	0.83
Learning environment stimulation	In the class, learning environment surrounding students, such as curriculum, teachers' teaching, and pupil interaction influenced students' motivation in science learning.	6	0.85

Cyber-enabled Learning:
Digital Natives in Integrated Scientific Inquiry Classrooms
USU/NYIT Collaborative DRK-12 Project Year One Advisory Report

Introduction

This report was created to offer advisory panel members a concise overview of the work that we have completed since this project was funded September 01, 2010. In addition to this document, we are also including the original funded research proposal and two subsequent responses submitted to the NSF Program Officer during the negotiation prior to funding. During our advisory panel meeting we intend to share a brief overview of the proposal that was funded. This will be followed by a discussion of the work completed and outlined in this document and Q & A SKYPE sessions with subgroup project leaders. Through this process, we expect that you will better understand our project and our efforts to date. We will then ask that you provide us with a collaboratively written 2-3 page report where you describe your impressions of our project, the progress we have made to date, and suggestions for moving forward. Time and a template will be provided for this on Thursday afternoon. Please plan to review this document prior to our meeting and to reference the other documents provided as needed (i.e. the original funded research proposal and two subsequent responses submitted to the NSF Program Officer during the negotiation of the funding of our project).

Subgroup Summaries

The following subgroups formed to take full advantage of the vast expertise and resources we have available on this project and to ensure that project timelines are met. Each sub-group has designated leaders. The members of each subgroup are outlined below before bulleted descriptions of the work completed to date and future work planned is reported. Additional information and resources from each of these groups can be provided as requested.

Qualitative Research Group (Summary submitted to draw from for report)

Leader Dr. Brett Shelton-Co-PI Instructional Technology and Learning Sciences (ITLS)-USU
Jeff Olsen-Qualitative Research Assistant ITLS-USU
Dr. Todd Campbell-PI Secondary Science Education-USU
Dr. Hui-Yin Hsu-Co-PI Literacy-NYIT
Dr. Shiang-Kwei-PI-Instructional Technology-NYIT

Work that has occurred this year and outcomes to date

- Identification of group members and qualitative research assistant (Jeff Olsen).
- Careful review of proposal, quantitative research design and instruments to inform proposal and to be sure qualitative research design cohesively connects with quantitative research to provide a more holistic perspective of project outcomes.
- Initial draft of qualitative research design. Where purpose of study is established in alignment with proposal, literature bases established to contextualize the research, theoretical lens identified, and methodology (i.e. research questions, data sources, data analyses) is explicated (See Appendix A)
- Initial meeting with Horizon Research Inc (HRI), external evaluator, for early draft feedback.
- Jeff Olsen, met with teacher leader group to begin to establish relationships. Looking at expanding the team in NY and figuring out how to get it all coordinated. Technology package for collecting data has not been solidified. Open to suggestions from NY. External evaluator felt they were on the right track. Working hard to pull somthing together using the baseline data by the end of this summer that will work for the conference the following summer.

Future work that is in the pipeline with outcomes arranged along a timeline to align to project needs

- Continuing to refine research design and coordination of research responsibilities across the UT/NY sites.
- Start data collection during 2011 summer workshops.

Quantitative Research Group

Co-Leader Dr. Todd Campbell-PI Secondary Science Education-USU
Co-Leader Dr. Dan Coster-Co-PI Mathematics and Statistics-USU
Co-Leader Dr. Shiang-Kwei-PI-Instructional Technology-NYIT
Yuanzhi Li-Quantitative Research Assistant Mathematics and Statistics-USU
Atul Thapliyal- Research Assistant Computer Science-USU

Work that has occurred this year and outcomes to date

- Identification of research instruments to answer each research question
- Conversion of instruments to electronic format
- Piloting of instruments with 200 students in UT and 50 teachers recruited for Cohorts 1 & 2 (teacher surveys are expected to be completed by April 1)
- Instrument Construct Key completed to guide Quantitative Analyses of instruments

Future work that is in the pipeline with outcomes arranged along a timeline to align to project needs

- Completion of Quantitative Analyses of Student Instruments by April 1
- Cognitive Interviews with student group informed by quantitative analyses and early feedback from students (completed by April 15)
- Completion of Quantitative Analyses of Teacher Instruments by April 15
- Cognitive Interviews with teacher group informed by quantitative analyses and early feedback from students (completed by May 1)
- Baseline data collected from Cohorts 1&2 Teachers (mid-May) [collected 1 time each year thereafter]
- Student Baseline data collected (beginning of 2011-2012 academic year)

USU Classroom Observation Group

Leader Max Longhurst-Project Director Teacher Education and Leadership-USU
Dr. Todd Campbell-PI Secondary Science Education-USU

NYIT Classroom Observation Group

Leader Dr. Shiang-Kwei-PI-Instructional Technology-NYIT
Dr. Hui-Yin Hsu-Co-PI Literacy-NYIT
Project Leader (TBA)-NYIT

Work that has occurred this year and outcomes to date

- Four (4) raters identified-retired or veteran science teachers (2 UT/2 NY).

Future work that is in the pipeline with outcomes arranged along a timeline to align to project needs

- Joint NY/UT rater training with classroom observation protocols (April 4th target)
- Year 1 Cohort 1 Baseline data collected (April 15- May 31)

Module 1 & 2 (Year 1) PD Group

Leader	Dr. Shiang-Kwei-PI-Instructional Technology-NYIT
Leader	Dr. Hui-Yin Hsu-Co-PI Literacy-NYIT
Leader	Dr. Todd Campbell-PI Secondary Science Education-USU
Leader	Max Longhurst-Project Director Teacher Education and Leadership-USU
	Dr. Paul Wolf-Co-PI Biology-USU
	Aaron Duffy-Biology Research Assistant-USU
	Dr. Lisa Runco- Co-PI Biology-NYIT

Work that has occurred this year and outcomes to date

- Research Basis/Theoretical Framework/Intervention Parameters (See Appendix B)
- Early draft of Module 1 Year 1

Future work that is in the pipeline with outcomes arranged along a timeline to align to project needs

- Module 1 Year 1 developed (Completed by April 16)
- Module 2 Year 1 (Completed by June 1)
- Module 2 Year 2 (completed by April 16 year 2012)

ScienceSim Module Group

Leader	Aaron Duffy-Biology Research Assistant-USU
	Dr. Paul Wolf-Co-PI Biology-USU
	Dr. Brett Shelton-Co-PI Instructional Technology and Learning Sciences (ITLS)-USU
	Atul Thapliyal- Research Assistant Computer Science-USU
	Max Longhurst-Project Director Teacher Education and Leadership-USU

Work that has occurred this year and outcomes to date

- OpenSim 3-D platform Virtual Population Genetics converted to plant communities with human interaction to align with UT and NY Standards.
- Piloted OpenSim plant communities with human interaction in Hands-On Demo Session at CyberLearning with STEM Tools Conference and in (2) two hour workshop sessions at NSTA Research Dissemination Conference (See Appendix C)

Future work that is in the pipeline with outcomes arranged along a timeline to align to project needs

- Develop module to be sure clear set of goals in place to prevent unnecessary changes overtime.
- Ensure a cycle of feedback is in place through development phase with peers, teacher leaders, teachers, and students.

Professional Development Group

Week 1 PD

Leader	Dr. Paul Wolf-Co-PI Biology-USU
Leader	Dr. Lisa Runco- Co-PI Biology-NYIT

Week 2 PD

Leader	Dr. Todd Campbell-PI Secondary Science Education-USU
Leader	Dr. Shiang-Kwei-PI-Instructional Technology-NYIT
Leader	Dr. Hui-Yin Hsu-Co-PI Literacy-NYIT
Leader	Max Longhurst-Project Director Teacher Education and Leadership-USU

Work that has occurred this year and outcomes to date

- Initial tentative PD weekly schedules completed (See Appendix D)
- Initial Draft of Module 1 Year 1 which will serve to link PD weeks 1 & 2

Future work that is in the pipeline with outcomes arranged along a timeline to align to project needs

- Week 1 & Week 2 PD schedules finalized (prior to June 1)

Note: Appendixes A-D referenced in this report are not included here, but can be shared as needed upon request.

Cyber-enabled Learning:
Digital Natives in Integrated Scientific InquiryClassrooms

USU/NYIT Collaborative DRK-12 Project

Year One Advisory Panel Feedback *and PIs' Response*

Introduction

The External Advisory Panel (EAP) for the NSF Funded DRK12 Project, *Cyber-enabled Learning: Digital Natives in Integrated Scientific Inquiry Classrooms* (NSF-1020086) met on March 24, 2011 with the PI, Co-PI's and project management to review the status of the effort. The meeting was held on the campus of the New York Institute of Technology in Old Westbury, NY. The EAP appreciates the opportunity to learn further about this important work and provide feedback on the progress that we anticipate will be used to improve the project. Through this report, the EAP offers its comments on, questions of, and recommendations for the project. This summary begins with general impressions, includes a list of the project activities completed thus far, and offers comments and suggestions for the project management team to consider as they move forward.

This document contains both the original report and a response to the External Advisory Panel (EAP) Feedback for the NSF Funded DRK12 Project, Cyber-enabled Learning: Digital Natives in Integrated Scientific Inquiry Classrooms (NSF-1020086). As a result of our meeting on March 24, 2011 on the campus of the New York Institute of Technology in Old Westbury, NY, we are now more than ever convinced that we have assembled a complimentary group of experts to provide feedback and guidance for our project. Our meeting with this group was both reassuring as we shared the work that we completed to date, while also extremely helpful as the panel inquired about many facets of the project we have been working on and about additional areas that we could benefit from beginning to consider in more detail. In the end, we are grateful to have such a fine group of professionals as part of our advisory panel. To make sure that our comments are concise and aligned with the panel's comments/feedback, this report is being written as an amended version of the advisory panel report with our responses as appropriate embedded, italicized, and underlined.

Overall impressions of the project

This project is a unique example of the integration of scientific research and teacher professional development that is focused on 21st Century skills and New Media literacies. However, a clearer definition of these skills and a conceptual framework for literacy are needed.

We acknowledge the need for clearer definitions of 21st Century skills and New Literacies and believe we are able to meet this call through the constructs that are examined within the quantitative assessments we are currently piloting with teacher and student groups. We define both 21st Century and New Literacies organically (inextricable linked) with 1) New Literacies using the following constructs: identifying questions/recognizing relevant information, locating/managing information, evaluating information, synthesizing information to answer questions, communicating answers to others [constructs derived from previous work of ETS

(Educational Testing Service): ICT Literacy Assessment & the British National ICT assessment] and 2) ICT Capabilities using the following constructs: problem solving, communication and metacognition, basic ICT capabilities, analysis and production capabilities, information and internet-related capabilities [constructs previously articulated by Markauskaite, (2007)]

The project is targeted at an important need for fostering 21st Century learning and new literacies, information and science literacies. The goals of the project are timely and critical. As designed, the partnership with the participating school districts supports the project activities, and the need for this collaboration is obvious. Priority for developing teaching practices that promote inquiry-based learning of science is clear.

We agree that this is a strength of our project and believe that our close collaboration with district leaders from the start of our funding will enable us to meet the needs of teachers in classrooms as we seek to develop and test transformative science inquiry experiences with technologies.

Use of the backward scaffolding process in the professional development (PD) design is consistent with the described needs and current best practices. The still unfolding PD will provide the authentic science experiences that are often lacking for in-service teachers. Design of the quantitative component of the research design is strong. At this point, the qualitative research plan seems to be less well developed than the quantitative plan. The method of phenomenology is appropriate and encouraging.

Development and finalization of the qualitative research design is continuing, but is expected to be ready so that the qualitative investigation can begin as the first cohort of teacher participants start summer professional development in 2011.

All of the needed expertise appears to be present and there is evidence of strong collaboration. The research team is comprised of individuals with obvious complementary skills. They have established a shared vision, a productive level of collaboration and are highly motivated for success.

The broader impact of the project lies in the dissemination of the generalizable research findings and creation of valuable resources accessible to in-service teachers and teacher educators.

Important progress made to date

A quantitative research design that aligns with the research questions has been articulated. An appropriate plan for professional development is emerging. Identification and recruitment of participants for cohorts 1 & 2 has been accomplished. There is clear evidence of support from partner school districts.

Suggestions/considerations moving forward

We question whether the measures of student science content knowledge align with the stated learning outcomes for the project. Do content measures exist that are more consistent with the proposed learning environment (i.e. beyond multiple choice testing)? For example, what measures exist that could be used to assess student achievement in developing a robust mental model of scientific process?

We believe that student created artifacts collected during the enactment of the four central modules developed in the project can provide even richer measures of the extent to which students develop robust mental models of scientific process (i.e. as part of each module, students will complete self-directed inquires in the third iteration of the Backward Faded Scaffolded Inquiry (BFSI) framework adopted). As we work to develop appropriate qualitative strategies focused on understanding students' mental models of scientific processes and their development over time, we envision these two methodologies complementing each other to help us move past the valid critique of more common attempts of assessing science processes solely with multiple choice standardized assessments.

The nature of the technology component of the intervention remains somewhat vague. The role of the OpenSim online resource is especially unclear and potentially distractive from the primary stated goals of the project. This ambiguity raises questions about the specifics of the technologies used, the activities, and the types of hardware that will be provided to teachers.

This feedback is particularly important as it speaks to the need for the project leadership to make explicit the connections between technologies included and the rationale for the inclusion. The following shape our framework for including technology as part of the project:

- *Those that lend themselves to 'learning with' technologies in science as inquiry constructivist framed instruction instead of 'learning from' technologies that are more common in transmission framed instruction (examples that we see aligned with 'learning with' technologies in science as inquiry classrooms are OpenSim where students can manipulate variables to collect data and make conclusion as they developer richer understandings of science process and science concepts and probeware where students can collect data from their local environments to complete scientific inquiries)*
- *Informally used technologies capable of enhancing students' inquiry learning in science classrooms while concurrently developing students' new literacies (examples of this might be using relevant information resources online [new literacy constructs: recognizing relevant information, locating/managing information, evaluating information, synthesizing information to answer questions] to shape and finalize inquiries or using secure social media outlets such as Edmodo to communicate conclusions emerging from inquiries [new literacy construct: communicating answers to others].*

So, OpenSim and probeware are being included in the project and provided as a resource for teachers because of their promise and alignment with the 'learning with' technologies in science as inquiry framed instruction. Conversely internet information and social media portals are being included because of their promise for developing students' new literacies.

We would like to see better alignment between the model of inquiry, the teaching and learning strategies, technologies, the affordances of each technology, and the literacy constructs. Without this information, we find it difficult to understand how the project team will identify specific effects of the different components of the project.

We see alignment in the principles guiding our work in each of these areas in ways similar to the examples shared in previous response to questions about the nature of technology components. But, we also recognize the need to ensure we explicitly work to connect our learning objectives for teachers and students to specific technologies and aspects of modules enacted by teachers and experienced by students as well as the professional development model experienced by teachers.

To address this recommendation, we are working ensure that each component of our professional development model and subsequently our modules (these two aspects of the project will be well aligned with teachers experiencing many of the learning opportunities in professional development (PD) planed for students in modules) are carefully scrutinized so that constructs of scientific processes and new literacies are explicitly framing each aspect of these interventions (as an example, as teachers engage in data collection with probeware in local watersheds in NY, cognizant efforts are directed toward developing teachers capacity in 1) understanding of 'learning with' technologies, 2) learner engaging in scientifically oriented questions and learner giving priority to evidence in responding to questions [key scientific inquiry constructs], and 3) managing information [new literacies construct]).

Also, we are currently working with Dr. Joan Pasley, our external evaluator, to clarify a logic model that, in addition to helping Dr. Pasley ensure her understanding of our project aligns with our intentions, will also serve to help focus and reveal how we see the model of inquiry, the teaching and learning strategies, technologies, the affordances of each technology, and the literacy constructs aligning and shaping each component of the project.

We find that the word 'gap' used in both research questions is ill-defined and inconsistent with the stated hypothesis. A theoretical framework for new literacies should be used to better define what constitutes the concept of a gap and thus how 'closing this gap' might be assessed.

Based on this guidance and consistent with what we have already identified as central constructs of new literacies in the development of our quantitative measures, we define new literacies aligned with the following definition:

> *The new literacies of the Internet and other ICTs include the skills, strategies, and dispositions necessary to successfully use and adapt to the rapidly changing information and communication technologies and contexts that continuously emerge in our world and influence all areas of our personal and professional lives. These new literacies allow us to use the Internet and other ICTs to identify important questions, locate information, critically evaluate the usefulness of that information, synthesize information to answer those questions, and then communicate the answers to others (Leu, Kinzer, Coiro, & Cammack, 2004)*

Aligned with what Leu, Kinzer, Coiro, and Cammack (2004), share, this definition as well as our framework in the project are purposefully measured so that they are not overly invested in technologies, but instead are overly invested in the notion that technologies of today will be replaced by technologies of the future at an ever-increasing rate. With this notion, we see this *framework capable as a starting point for supporting teachers and students as they "encounter yet unimagined ICTs as they move through school and develop currently unenvisioned new literacies" (Leu, Kinzer, Coiro, & Cammack, 2004).*

So, our project will focus on developing teacher and student capacities with each of the new literacies constructs (identifying questions/recognizing relevant information, locating/managing information, evaluating information, synthesizing information to answer questions, communicating answers to others), because we see these as central to the human condition, even in the presence of unimagined possibilities with technologies.

Given this framework for technologies in concert with the National Science Education Standards framework we are using for science as inquiry, the following are more specifics details about the 'gaps' we have identified and how we are planning to measure our impact in closing these 'gaps':

Gaps:

1. *Science classroom instruction does not address the development of students' understandings of the processes and nature of science.*

Measurement: Reformed Teaching Observation Protocol (RTOP)-standards aligned/inquiry framed classroom observation protocol, Teaching Science as Inquiry (TSI)-self reporting self efficacy and outcome expectancy instrument, Artifacts collected during the enactment of the four central modules developed in the project can provide even richer measures of the extent to which students develop robust mental models of scientific process and student articulated understandings of the nature of science.

2. *The role of technology in science classrooms is currently framed by a "learning from" paradigm aligned with transmission models of instruction (e.g. powerpoint as a lecture guide or videos explaining science concepts) instead "learning with" paradigm of technologies as cognitive tools (e.g. probewares for collecting data or simulations for manipulating variable to investigate outcomes).*

Measurement: Technology Integration instrument-"learning with"/new literacies aligned classroom observation instrument, Technology Use in Science Instruction (TUSI)-"learning with" technology/reform aligned classroom observation protocol, teacher interviews and student artifacts collected as part of qualitative research design.

3. *Students are engaged in rich activities using informal technology (ICTs) outside of schools, but these same experiences are not happening inside of classrooms in ways that can enhance science as inquiry experiences and cultivation of students' new literacies.*

Measurement: Formal/Informal technology usage survey-teacher and student self reporting surveys developed as part of the quantitative research design, in-depth qualitative naturalistic investigation with teacher interviews, classroom visits, and teacher and student artifacts.

4. *Science classroom instruction does not address the development of students' new literacies.*

Measurement: New literacies scenarios instrument-teacher and student new literacies scenarios for testing teachers and students self reported new literacies capacities, ICT teacher and student capabilities instrument for better understanding what technologies these populations use, and Technology Integration instrument new literacies aligned classroom observation instrument

Reference

Leu, D.J., Jr., Kinzer, C.K., Coiro, J., & Cammack, D.W. (2004). Toward a theory of new literacies emerging from the Internet and other information and communication technologies. In R.B. Ruddell, & N. Unrau (Eds.), Theoretical models and processes of reading (5th ed., pp. 1570-1613). Newark, DE: International Reading Association. Available: http://www.readingonline.org/newliteracies/lit_index.asp?HREF=leu/

We would like to see a proactive attempt to define and measure changes in teacher and student skills of finding and evaluating the content and credibility of information sources. The potential to enhance students' information literacy appears to be one of the strongest benefits anticipated for the project.

We agree with this assertion. We already feel that we have measures in place as part of our quantitative instrumentation (surveys) to assess the extent to which we are fostering students' further development of skills in finding and evaluating the content and credibility of information sources (i.e. within New Literacies Testing Scenarios items that measure the Identifying questions/Recognizing relevant information construct and in our Technology Integration classroom observation measures). Additionally, we are also planning to collect artifacts and data from students as part of the qualitative research design that can also help us better understand and iteratively improve our capacity in this area throughout the project (e.g. one data source from the qualitative research we see informing this component of the project is student created artifacts collected during the enactment of the four central modules developed in the project can provide measures of how students are identifying and discerning whether cyber-located information available is capable of informing their work).

The panel encourages the team to stay focused on the NSES essential features of inquiry as a mechanism for acquiring content knowledge, but think flexibly about how those features are demonstrated, particularly with respect to space, time, and the formalities of school science.

We very much appreciate this guidance. We believe the use of social media such as Edmodo and other communication based technologies such as weblogs and wikis will allow us to capture the extent to which the formalities of school science are blurred or even lost as students continue their investigations across informal and formal settings because they are motivated to do so. So, our qualitative research design will, among other things, be focused on explicating not only the extent to which experiences learning in informal and formal settings is being aligned, but also the extent to which learning in these settings is being merged (a possible example of this might be detected as students make contacts with experts who can inform work going on inside *the classroom and post information/understandings gained through these interactions . . . especially as these type of actions are initiated by students).*

We support the development of a collaborative virtual space for use as a communication vehicle for project operations as well as for all forms of the intervention. The discourse artifacts stored at this site would provide important information about the development of community. As a portal, the server logs could also be used to capture behavioral data.

This guidance may be among the most important. Because of our engagement with the advisory panel, we have considered more and more areas where our work can lead the way in re-conceptualizing learning (science, informal/formal, and new literacies) into the future, especially learning that is informed by all technology has to offer. Based on this guidance, we will ensure that the electronic communications, reflections from teachers and students, and teacher and student sample artifacts occurring as part of the project are archived so that more and more research questions can be explored as we expect additional ones to arise as we arrive at answers our project research questions.

Summary

In summary, we note that the level of activity that the project has stimulated to date is impressive. The effort has been particularly effective in finalizing the quantitative research plan and establishing teacher participants for cohorts 1 & 2. It is clear that the project has strong leadership, collaboration, and a commitment to success. We encourage the team to continue their efforts by refining the intervention through clarification and alignment of the components and measures and by supporting all aspects of the project with a collaborative virtual space.

Respectfully submitted,

Susan Brustein
Kent J. Crippen, Ph.D.
Shelley Phelan, Ph.D.
Thomas C. Reeves, Ph.D.

External Advisory Panel Members

Cyber-enabled Learning: Digital Natives in Integrated Scientific Inquiry Classrooms

External Evaluation Report
Year One *and PI's Responses*

Joan D. Pasley
William O. Fulkerson

April 2011

Submitted to: Todd Campbell, Principal Investigator
Utah State University
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Submitted by: Horizon Research, Inc.
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INTRODUCTION

Horizon Research, Inc (HRI) of Chapel Hill, NC is conducting the external evaluation of the *Cyber-enabled Learning: Digital Natives in Integrated Scientific Inquiry Classrooms* project. The project is studying whether teacher professional development and support for the use of cyber-enabled resources leads to meaningful student learning experiences, a reduction in the gaps between informal and formal uses of technology and learning, and improved student outcomes. To date, project activities have focused on:

- Finalizing the research design for addressing the project's research questions;
- Selecting, piloting, and revising instruments to measure impact of the project's interventions on teacher and student outcomes;
- Establishing teacher leadership teams in Utah and New York to assist project staff in identifying cyber-enabled resources and information communication technologies to use in the professional development;
- Recruiting the first two cohorts of teachers who will participate in project activities;
- Collecting baseline data for Cohorts 1 and 2 teachers; and
- Designing the Year One professional development session.

As would be expected of a project in its initial planning stages, there is relatively little evaluation data to report. The first part of this annual report describes the evaluation plan and evaluation activities conducted thus far. In the second part, the feedback provided to the project on its research design and instrumentation will be summarized.

This document contains both the original review and a response to the external evaluator's, HRI's, feedback. Based on the very positive interactions we have had meeting with HRI since September 1, 2011, when our project was funded, we are convinced that our project is much better at this point, simply because of HRI's capacity to serve as a critical reviewer constantly and formatively asking questions that have kept us very cognizant of the critique other researchers might levee in the future. Throughout the year as we met bi-monthly, HRI was both reassuring as we shared the work that we completed to date, while also extremely helpful as a constant available resource as we considered design and instrumentation decisions and needed immediate feedback to inform our decisions. We are grateful that we have selected such a highly reputable and regarded organization to serve as the external evaluator for our project.

To ensure that our comments are concise and aligned with HRI's review, this report is being written as an amended version of the HRI review with our responses as appropriate embedded, italicized, and underlined.

DESCRIPTION OF EVALUATION PLAN

The external evaluation differs from one that would be implemented for a typical teacher enhancement project due to the comprehensive research program the project includes; i.e., the types of data the project is collecting for its own purposes include, and go beyond, those typically collected in an external evaluation. Consequently, the evaluation is designed to complement the project's research, with particular emphasis on formative feedback. The summative component of the evaluation will review and provide feedback on the project's research products.

Formative Evaluation

The formative component of the evaluation is focused on monitoring and providing feedback on the quality of project activities, including both its intervention and research activities. The goal of this feedback is to facilitate reflection and allow the project to make mid-course corrections where needed. Questions guiding the formative evaluation are:

1. To what extent does the project's research design adhere to standards for the field? What are the threats to internal validity and generalizability?

2. What is the quality of the professional development focused on inquiry and cyber-enabled learning?

3. To what extent are the selected cyber-enabled learning resources and information/communication technologies (ICTs) coordinated to support teachers' and students' opportunity to learn important science content?

4. What are the participants' perceptions of the quality of the professional development they receive?

5. To what extent does the project use findings from its own research to inform revisions to the professional development?

During the first year of the Cyber-enabled Learning project, HRI reviewed and provided feedback on the project's research design and instrumentation. HRI will conduct a similar review as well as review initial research findings in subsequent years, and make recommendations for strengthening the research design. In addition, HRI regularly met with the project leadership for updates on project work and attended the meeting of the External Advisory Board. In the project's second year (and in subsequent years of the project), HRI will provide design feedback on the professional development plan, observe the professional development sessions in both Utah and New York, administer a post-professional development questionnaire to participants, and interview a sample of participants. The post- professional development questionnaire and interview will focus on participants' perceptions of the quality of the professional development, potential impacts on their instructional practices, and suggestions for improvements. Findings from these data collection activities will be reported to the project along with a set of recommendations for improving the quality of professional development offered in the project.

Summative Evaluation

The summative evaluation component will focus on the project's research design and findings, assessing the extent to which claims based on the research appear to be justified. Accordingly, the guiding question for the summative evaluation is:

> To what extent do the research activities and products from those activities adhere to standards for the field?

In the final year of the project, HRI will arrange for two kinds of review of the project's research products: (1) Two HRI staff members, trained in applying standards of evidence,[1] will analyze the project's culminating research products, assessing both the rigor of research design and the strength of the evidence used to make claims; and (2) HRI will identify two science education researchers who will review these research products as though they were being submitted to a refereed journal. The reviewers' feedback will focus on ways to strengthen these products as they are being prepared for publication.

FEEDBACK ON PROJECT ACTIVITIES TO DATE

Feedback provided on project activities has focused on HRI's initial review of the research design. HRI utilized a modified version of the KMD Standards of Evidence review process to consider possible threats to the internal and external validity of the proposed research. HRI also examined feasibility and total data collection burden for participants. The review process involved analysis of the sampling procedures, planned data collection and analysis, and instrumentation.[2] Given that there are often trade-offs in designing and conducting social science research, HRI's recommendations were intended to raise issues for the project to consider in finalizing the research design within the constraints of their study. A summary of the feedback in each of these areas follows.

Sampling

The original plan was to identify a sample of teachers who were willing to participate in the project. In addition, the project planned to select a sample that would consist of

[1] As part of its Knowledge Management and Dissemination (KMD) for the MSPs project (EHR – 0445398), HRI has developed a procedure for evaluating the rigor of research designs and the strength of evidence used to justify study claims. HRI has also written an accompanying codebook and training program for study reviewers: Heck, D. & Minner, D. (2009). *Codebook for standards of evidence for empirical research.* Chapel Hill, NC: Horizon Research, Inc.

[2] At the time of this review, the project's design for more in-depth qualitative research had not yet been finalized.

selected/participating teachers and their students and delayed treatment matched comparison groups of teachers and their students.

> ***Recommendation:*** In order to reduce the threat of selection bias, i.e., teachers who were more willing to participate could be different from the comparison group, the project should consider identifying a larger pool of teachers who would be willing to participate in the project and then randomly selecting the first cohort from that pool, using subsequent cohorts as comparison groups. Although findings would generalize only to teachers who are willing to participate in the project's professional development, the threat of selection bias would be reduced.
>
> *Response: Based on this guidance, measures were put in place to mitigate selection bias. As an example, in Utah 30 teachers for both Cohorts 1 & 2 were identified and then random selections of schools was completed so that teachers were then assigned to Cohorts 1 & Cohorts 2 based on the school building where they taught. In NY, recruitment has proven more challenging and all teachers responding to date have been placed in Cohort 1 to ensure that baseline classroom observations could be completed by the end of the 2010-2011 academic year. Teachers in cohort 2 are being actively recruited and are expected to be in place prior to the start of summer PD so that all baseline data for Cohorts 1 & 2 are collected (note: Cohort 2 is serving as the delayed control for Cohort 1, so they will not receive summer PD in the summer of 2011, but we will be able to collect two years of baseline data for Cohort 2 prior to PD, with the exception of classroom observations this spring). In the end, while we do recognize the need to reduce selection bias, because of the difficulty in recruiting teachers at the secondary level, we were limited in how we could address this concern. One consideration in both NY and UT is that since more than 60% of 8th grade teachers in each district are expected to participate in the project before all three Cohorts are filled, selection bias is thought to be less of a concern.*
>
> ***Recommendation:*** If random assignment is not feasible, the project should consider matching schools instead of matching students and teachers. Matching schools with similar characteristics would increase the quality of the match. In addition, it would also help reduce potential contamination of the comparison group (e.g., a treatment teacher sharing materials with a comparison teacher in the same school).
>
> *Response: Based on this guidance, to the extent possible teachers are participating in school groups, so that all teachers from a particular school are assigned to the same cohort.*

Data Collection

In order to examine impact of the professional development focused on cyber-enabled tools, the project planned to administer four instruments to teachers and six instruments to their students. In addition, classroom observations would be conducted utilizing the *Reformed Teaching Observation Protocol* and the *Technology Use in Science Instruction*

Protocol. The project planned to administer pre-assessments to sixth grade students and then administer assessments over three years, at the end of the seventh, eighth, and ninth grades. Observations of classroom instruction were to be conducted by researchers associated with the project.

> ***Recommendation:*** The amount of data collection proposed by the project appears to be quite burdensome for teachers and students alike. Given that people may be less likely to provide thoughtful responses when responding to a large number of items, the project should consider whether all instruments (and items within an instrumental) are essential. Once the instruments are finalized, the project may want to inform teachers of all of the data collection required for participation ahead of time to lessen the likelihood of attrition due to data collection burden.
>
> *Response: Based on this guidance, the amount of instruments planned for students was reduced to four. The number of teacher instruments remained at four. To be sure that the instruments were not overly burdensome, a 30-40 minute time frame was targeted and through our initial pilot attained. In addition, based on the pilot data emerging from the instruments, the constructs within each for the most part were highly reliable. In addition, both the teacher and participant districts were informed of the number and length of the surveys as suggested as part of the IRB approval process.*
>
> ***Recommendation:*** The project could eliminate the burden of administering a pre-assessment by using a reading or mathematics test score as a covariate to control for initial differences between the treatment and comparison groups.
>
> *Instead of using reading and mathematics test scores as covariate to control initial differences, the sampling strategy was simplified in agreement with participating districts so that student data could be collected at three time points (pre 8th grade, post 8th grade, and post 9th grade). Because a case can be made for little difference between post 7th grade measures and pre 8th grade measures, in effect, we feel that this strategy will allow us to follow these students from a baseline time point (pre 8th grade) through two additional years (post 8th grade & post 9th grade). So, in the end, while this was an appreciated alternative, it wasn't thought necessary with only three time points planned in the quantitative design.*
>
> ***Recommendation:*** The plan to use a researcher associated with the project to perform classroom observations may not ensure adequate objectivity. The project should consider having a third party do a blind review of the observation data to ensure validity of the observation data.
>
> *Response: Based on this feedback, classroom raters were recruited from outside the project and will be completing blind review so that they have not been briefed extensively about the project and so that they are not aware of whether they are*

observing an intervention or control classroom when completing these visits/ratings.

Data Analysis

Detailed analysis plans had not yet been finalized by the time of the research review.

> ***Recommendation:*** The project should consider writing their regression equation prior to gathering data to ensure they will have all the data needed, at all time points, and be able to use the desired models. Because the project expects to use multi-level modeling, it also may be useful to list all the factors that will be included in each level of the analysis. In addition, given the number of outcomes being examined, the project should consider whether some method of controlling for Type I error should be used.
>
> *Response: Based on this guidance, Dr. Dan Coster, USU Statistician and Project Co-PI, has completed an initial model that will soon be shared with HRI for review and further comments.*

Instrument Review

The project has selected a series of instruments with which to measure impacts on classroom instruction and students' understanding of and attitudes toward science. Feedback was provided on a number of the instruments.

> ***Recommendation:*** The *Technology Use in Science Instruction (TUSI)* instrument is an observation protocol intended to measure the extent to which technology integration in science classrooms is aligned with inquiry-based instruction. The project planned to use this instrument to observe teachers when they are implementing one of the project's modules as well as to observe non-treatment teachers who will not use the modules. Considering that technology use may not be observable in non-treatment teachers' instruction, this comparison may not be meaningful. The project may want to consider limiting the use of the TUSI to treatment teachers only, examining the change of their use of technology over time and/or fidelity of their implementation of the modules.
>
> *Response: Initially observations are being made with the TUSI and the RTOP for baseline data collection. While we agree that it is possible and even likely that technology use may not be observable in non-treatment teachers' instruction, we do think having data to support whether this is or is not the case is important. In addition, because of the delayed treatment design, we see this as initial baseline data as the teachers enter the project as part of this design. But, we are planning to examine the change of teachers' use of technology over time and/or fidelity of their implementation of the modules as suggested.*
>
> ***Recommendation:*** The *Principles of Scientific Inquiry (PSI)* student and teacher instruments were designed to provide self-report data about student and teacher experiences in the classroom, and how these experiences reflect inquiry-based

instruction. The directions of the PSI may need some clarification as to whether the respondent should answer in regard to a particular investigation or for science instruction in that class generally. In addition, some items on the student instrument could be difficult for students to understand and interpret correctly. For example, one item asks students to indicate how frequently they justify the appropriateness of the procedures that are employed when conducting investigations. The project may want to simplify the wording, perhaps after conducting cognitive interviews to see how students interpret the items.

Response: Based on this guidance, the need to reduce the number of instruments being completed by participants, and the existence of other measures for examining the extent to which science as inquiry is framing classroom instruction (i.e. Teaching Science as Inquiry, RTOP, & TUSI), the PSI instruments were removed from the instrumentation packet and will not be used in this project.

Recommendation: The *Information and Communication Technology surveys (ICT-capabilities)* are intended to explore the structure of teachers' and students' ICT literacy. The instrument is comprised of 36 statements in two areas: (1) cognitive skills (e.g., "I can present a solution in a variety of forms and to different audiences."), and (2) ICT capabilities (e.g., "I can create a basic web page"). There is a 0–5 point scale (where 0 is "Don't have this ability," 1 is "Not at all confident," 2 is "Not very confident," 3 is "Moderately confident," 4 is "Quite confident," and 5 is "Totally confident"). The difference between response options 0 ("Don't have this ability") and 1 ("Not at all confident") is not clear, which could impact the validity of the items that use these response options.

Also, several individual items on the instrument appear to include two distinct constructs (e.g., I *understand* and *respect* copyright laws, privacy and other legal or social issues surrounding the use of information and ICT). The project should review the entire instrument for questions that include multiple constructs, and consider modifying them.

In addition, the cognitive skills portion of the instrument seemed somewhat dense and may be difficult for students and teachers to understand. The project should consider simplifying the wording, perhaps after conducting cognitive interviews with students and teachers to see how they interpret the items and what clarifications are needed.

Response: Based on this thorough review and these concerns, adjustments were made in the ICT instrument, so that the Likert Scale was changed from 0-5 [0 =Strongly Disagree & 5 = Strongly Agree]. In addition, all items were aligned so they contain stems that focus on students capacity, not confidence in abilities (e.g. I can . . .).

Also, careful review of each item occurred again so that all items where multiple construct concerns were identified have now been revised or eliminated.

Finally, through piloting and follow-up questionnaires feedback from pilot participants has led to a few clarifications within the introduction to questions (e.g. ICTs are clearly defined). In addition, the positive results of piloting with teachers and student groups as well as their feedback make us more confident that teachers and students are able to understand the instrument items.

Recommendation: The *New Literacy Instrument* is being used to examine how the use of cyber-enabled technologies influences students' new literacy skills. In this instrument, students are presented with a number of scenarios or tasks and are asked to rate their confidence in their ability to complete specific components of that task. The rating scale is:

- I do not know how to do it;
- I am somewhat familiar with how to do it;
- I can do it if I follow step-by-step directions;
- I can do it without the need to follow step-by-step directions; and
- I am very familiar with how to do it and can teach others to use it.

The rating scale is potentially problematic as it is unclear whether the instrument measures confidence as indicated by the project. For example, people may not know how to do a specific task but be confident in their ability to figure it out. The project may want to clarify the instructions and/or rating scale.

Response: Clarifications in the directions were added so that teacher and students are asked "Can you use Google Docs to . . .". Through this clarification we believe it is now clear that they are being asked about whether they can use the specific technology identified, instead of their confidence to figure it out.

Recommendation: For all instruments, the project should consider gathering more evidence of their validity through cognitive interviews, student-teacher comparisons, etc. during the piloting phase of the instruments. This data collection could lead to strengthening the validity of the instruments, thus benefitting the research community at large.

Response: While plans were put in place originally to complete cognitive interviews, because participants were asked to complete feedback forms as they completed the pilot where they were asked to identify any confusing questions or concerns, and since the items reliably clustered as anticipated within constructs the face-to-face cognitive interviews were not completed. But, comparisons between teacher and student instruments were made and overall the common instruments across teacher and student groups do measure both groups quite consistently.

SUMMARY

The Cyber-enabled Learning project has accomplished a considerable amount during its first year, including reviewing and piloting instruments and modifying to components of the proposed research to strengthen the research design.

Initial plans for the two-week, summer workshop and the three-day, winter workshop have been drafted and shared with the External Advisory Board. The project is in the process of collecting baseline data from participants and students in Cohorts 1 and 2, and continues to revise their instruments and workshop plans based on feedback from the teacher leadership team, cognitive interviews, the advisory board, and HRI.

Final Response: As noted earlier, we are very much appreciative of the feedback we have received from HRI. Even in cases where recommendations were not adopted aligned with HRI guidance, in most cases adjustments have been made based on each thoughtful recommendation.