Preview of Award 1258854 - Annual Project Report

Cover

Federal Agency and Organization Element to Which Report is Submitted:	4900
Federal Grant or Other Identifying Number Assigned by Agency:	1258854
Project Title:	Collaborative Research: Cyber-enabled Learning: Digital Natives in Integrated Scientific Inquiry Classrooms.
PD/PI Name:	David T Campbell, Principal Investigator
Submitting Official (if other than PD\PI):	N/A
Submission Date:	N/A
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Project/Grant Period:	09/01/2012 - 08/31/2015
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Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	N/A

Accomplishments

*** What are the major goals of the project?**

List the major goals of the project as stated in the approved application or as approved by the agency. If the application lists milestones/target dates for important activities or phases of the project, identify these dates and show actual completion dates or the percentage of completion.

The overarching goal of the project is to determine whether teacher professional development and support for the use of cyber-enabled resources lead to meaningful student learning experiences, a reduction in gaps between informal and formal learning and improved student learning outcomes (science learning performance, science learning motivation, new literacy skills and ICT skills).

Our project advances knowledge and understanding in the field of science education by: challenging teacher assumptions through PD focused on bridging the informal/formal gap of cyber-enabled technology use and investigating how teachers can be supported to use these learning tools in classrooms (Assertion 1); eliminating the divide between the digitally enabled literacy skills students employ in informal settings and bring with them to the classroom and the skills typically cultivated in science classrooms (Assertion 2); and employing and investigating the impact of cyber-enabled technologies that students do see as relevant and useful in their lives (Assertion 3). From our research efforts, we will be able to better understand and document both the extent to which cyber-enabled technologies are adopted as tools for facilitating student learning and the extent to which, when adopted, they improve learning outcomes. In addition, a set of customizable cyber-enabled learning tools and modules centered on using ICTs will be made available for use in science classrooms. Ultimately, we will demonstrate:

- how transformative change in curriculum development and implementation occurs when teachers challenge assumptions about how students learn (Assertion 1).
- how student learning outcomes are affected when informal learning technologies are integrated with classroom activities (Assertion 2 & 3).

This report details work completed during year three of our project. The following was outlined as targeted research and education activities in Phase II (Years 2-4) in our funded proposal:

“During Phase II (Years 2-4), Cohorts 1 & 2 will take part in PD focused on inquiry instruction and cyber-enabled learning with ICTs. Cohort 1 will begin in Year 2 and complete in Year 3. Cohort 2, the delayed-treatment comparison group for Cohort 1, will begin in Year 3 and complete in Year 4. In Year 3, a third cohort of teachers will be selected to serve as a delayed-treatment comparison group for Cohort 2 and baseline data will be collected from those teachers.

Over the two-year periods that teacher participants are engaged, they will be involved in 240 contact hours of PD through summer and winter workshops and monthly follow-up meetings”.

*** What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?**

Major Activities:

Soon after finalizing the research and educational activities of Phase I (Year 1) (i.e., selecting district leaders, shaping curriculum modules focused on inquiry supported by ICTs, finalizing all project instruments, and collecting baseline data for participants in Cohort 1), module development was completed in Year 2 for first modules at both sites that also served as the focus of the summer professional development (PD) experiences. Subsequently, PD models were finalized at both sites using common templates to guide the day-to-day summer workshops. The first modules and the PD models were finalized at both sites and the two-week summer workshops were conducted in both UT and NY during the summer of Year 2 of the project (summer 2011). Student data from teacher participants in Cohort 1 was collected at the beginning of the 2011-2012 academic year for all project instruments. Module 2 was also finalized during the fall of 2011, as well as the Winter PD models for the three-day winter workshops. The winter workshops were held in UT (November, 2011) and NY (January, 2012) and were focused on engaging teachers in module 2 as learners as preparation for enacting these modules in classrooms with students. Teacher participants each enacted module 1 during the fall of 2011 and enacted module 2 with students prior to the end of the end of the 2011-2012 academic year. Additionally, the second set of matching student data collection was collected prior to the end of the 2011-2012 academic year. Survey data as well as classroom observations were also completed for each teacher participant prior before the end of the 2011-2012 academic year.

Cohort 2 was recruited at both sites and classroom observations were completed in the spring of 2012. Cohort 2 teachers also complete baseline survey data prior to the start of the summer 2013 workshops.

Module development was completed in Year 3 for second set of modules (Modules 3 & 4) at both sites that also served as the focus of the summer professional development (PD) experiences for participants in their second year of PD. Subsequently, PD models were finalized at both sites using common templates to guide the day-to-day summer workshops. The third module and the PD models were finalized at both sites and the two-week summer workshops were conducted in both UT and NY during the summer of Year 3 of the project (summer 2012). Student data from teacher participants in Cohort 1 & 2 was collected at the beginning of the 2012-2013 academic year for all project instruments. Module 4 was also finalized during the fall of 2012, as well as the Winter PD models for the

three-day winter workshops. The winter workshops were held in UT (November, 2012) and NY (December 2012 & January, 2013) and were focused on engaging teachers in module 4 as learners as preparation for enacting these modules in classrooms with students. Teacher participants in Cohort 1 each enacted module 1 and 2 during the fall of 2012 and will enact module 3 and 4 with students prior to the end of the 2012-2013 academic year. Because teachers in Cohort 2 are only completing their first year of PD during the 2012-2013 academic year, these teacher participants in Cohort 2 each enacted module 1 during the fall of 2012 and will enact module 3 with students prior to the end of the 2012-2013 academic year. Additionally, the student data collection will be collected prior to the end of the 2012-2013 academic year for Cohort 1 and 2 participants' students. Survey data as well as classroom observations will also be completed for each teacher participant in both Cohort 1 and 2 prior before the end of the 2011-2012 academic year.

Cohort 3 will be recruited by he end of the 2012-2013 academic year at both sites and classroom observations will be completed in the spring of 2013. Cohort 3 teachers also complete baseline survey data prior to the start of the summer 2013 workshops.

With respect to research activities, both quantitative and qualitative data has been collected and has served as the basis for both publication submissions and conference presentations. As additional data is collected at the end of the 2013 academic year, we are now at a stage of moving beyond baseline descriptions in our research and presentations to reporting the early impact of our professional development.

The external evaluator, Dr. Joan Pasley from Horizon Research Inc., has met with us regularly and observed the professional development at both sites. She has also completed an evaluation of the quality of the professional development we delivered, the project research plan in comparisons to standards in the field, the extent to which the selected cyber-enabled learning resources and Information

Communication Technologies coordinated to support teachers' and students' opportunity to learn important science content, and the extent to which the project uses findings from our own research to inform revisions to the professional development. A report from HRI as well as our PI responses is included as an attachment in this section.

In addition, to what has been reported here, we are also including the report we submitted to our Advisory Panel prior to our spring 2013 meeting that outlines even more specifics regarding research and education activities we completed this year. The Advisory Panel Report and our PI responses to their report are included as an attachment to this report in this section.

Collectively, we believe we have continued to meet our timelines outlined in our original proposal with respect to educational and research activities and are pleased with where we currently are with respect to the educational and research activities. At the same time, we also see the great benefits that can come form mid-course corrections and improvements and continue to focus our efforts on using the emergent findings, from our research, HRI's report, and the advisory report to maximize the impact of our project.

Specific Objectives: n/a-see major goals and major activities

Significant Results: This project is designed to assess the impact of collaboratively developed and

broadly disseminated learning activities deliberately designed to leverage informal use of cyber-enabled technologies.

The following results, organized by project research questions, were identified based on analyses of Cohort 1 data with Cohort 2 serving as the delayed-treatment for comparison in many of these analyses.

Research Question 1: To what extent does professional development (PD) focused on cyber-enabled cognitive tools and scientific inquiry as a central pedagogical approach support teachers' practice and development and close the gap between formal and informal student cyber-enabled learning?

Here, classroom observations were completed to compare instruction using the Reformed Teaching Observation Protocol (RTOP) and the Technology Use in Science Instruction (TUSI) classroom observation instruments once yearly each spring. Overall, significant increases were found for both instruments and on all constructs when comparing Pre-Cohort 1 data, data collected prior to engaging in PD, to end of Year 1 data (Post-Cohort 1). Data tables for each of these analyses are found on pages 29-31 of the attached "Year 3 Quantitative Data and Interpretations Final" document.

In examining the gap between informal and formal learning, we compared how often students used specific technologies at home in comparison to at school. An assumption in our proposal was that students had more opportunities in using technology at home than at schools. This assumption was confirmed in the pre intervention surveys. New York (NY) students' frequency of using technology was higher at home in most of the tools compared with at school. Utah (UT) students' frequency of using technology was higher at home in the social communication, information retrieval and entertainment tools. They had higher frequency in using productivity tools at school compared with at home. At the post-intervention survey (after their teachers experiences 1 year of PD), UT students' comparison of frequency in using technology at home and at school was similar to what was found before the intervention. They used social communication and information retrieval more often at home than at school, and used productivity tools at school more often than at home. As for NY students, the frequency of using technology at home was higher than at school in all applications, due to the heavy use of social networking site. Many teachers conducted activities using social networking sites to have students continue the learning activities at home.

While we have been able to find evidence of the professional development supporting teachers practice through classroom observations, closing the gap between informal and formal technology use is more complex than we believe we originally proposed as we are finding that some gaps that are emerging represent teachers and students overcoming barriers.

Research Question 2: To what degree does closer alignment between informal and formal use of cyber-enabled technologies influence student attitudes about science?

Here, we collected data to allow us to speak to how changes in student attitudes about science are correlated with their changes in formal and informal technology use.

After our original analysis of whether students' motivation toward learning science revealed no significant changes in motivation when comparing pre- to post-intervention as measured by the Science Motivation Toward Learning Science

(SMTLS) instrument (see analyses on pages 16-17 of the attached “Year 3 Quantitative Data and Interpretations Final” document), sorting students into groups according to their initial interest in science reported on the pre-intervention survey (i.e. low, med, high), allowed us to better understand these overall findings. As can be seen in the “Addendum Tables and Interpretation”. The most significant findings from this analysis was found with respect to the Low PRE group as they improved on almost all scales of SMTSL, ICT and NLS. Correlations are almost always positive but not consistently significant. Where they these correlations are significant, the values are often above 0.20 – 0.25, indicating the strength of the association is quite good.

At this stage, when we consider these findings, those associated with the low PRE group are most positive as it seems to reveal that the intervention is positively influencing groups of students who previously were uninterested or unmotivated by science. And, the correlations found when comparing these increases in motivation with increased in ICTs and NLS provide some insight into the possible role that technologies are playing to support increased motivation.

Research Question 3: To what degree does closer alignment between informal and formal use of cyber-enabled technologies influence student science achievement?

We examined this with respect to changes in informal and formal technology use and initial findings regarding the impact of the project on student science achievement.

Prior to the PD, teachers' vision of technology integration was teacher-centered. They preferred to use technology to research and create school related materials, and demonstrate/present information to the students. After a year of participation in the project, teachers' views changed to a more student-centered focus as they gave students more opportunities to use technology to create or communicate information.

When we considered the impact of the project on student achievement, we investigated how overall student achievement of students in participant teachers Cohort 1 classes compare to student achievement of students in participant teachers in Cohort 2 classes (data for Cohort 2 shared reflected pre-project/delayed treatment baseline data). Students of teachers in Cohort 1 performed significantly better than students from Cohort 2 overall on the state standardized exam (see advisory board report and supporting tables). Additionally we found that these significant differences between Cohort 1 and Cohort 2 students' achievement were most influenced by non-white and low-income students

Research Question 4: How does the use of cyber-enabled technologies influence students’ new literacy skills?

Here, we examined whether differences could be found between pre- and post-intervention surveys with respect to ICT capabilities and NLS. As can be seen on pages 1-4 of the attached “Year 3 Quantitative Data and Interpretations Final” when considering ICT capabilities, significant increases in overall capabilities from pre- to post-interventions surveys were found for both teachers and students. As we compared teacher and student NLS from pre- to post-intervention, like with ICT capabilities, we also found significant increases for both teachers and students.

Given the survey results reported here and the qualitative analyses reported in our attached “Advisory Board Report”, we have been able to identify how the use of

cyber-enabled technologies influence students' new literacy skills in positive ways as significant increases in ICT capabilities are found alongside significant increases in new literacies skills. In addition, our qualitative research has allowed us to identify how different teachers enact the modules and how high priority is given to some aspects of new literacies and scientific literacy targeted in the project, while low priority is given to others.

Key outcomes or Other achievements: n/a-see significant results.

*** What opportunities for training and professional development has the project provided?**

Through our project to-date, 50 teachers (24 UT/26 NY) have received between 120-240 hours of professional development (Cohort 1 teacher participants received 240 hours, while Cohort 2 teacher participants received 120 hours). Additionally, teacher leaders from both NY (3) and UT (4) have received training and professional development through their leadership roles both in co-planning and co-leading professional development. And, 9 graduate assistants (6 UT/ 3 NY) have received authentic training in research and professional development in various roles in the project since it started in 2010.

Finally, as part of contributing to training and development of peer researchers nationally and internationally, the PI and Co-PIs have made several presentations and led workshops stemming from the project at national conferences. The following are a list of all presentations that were made since the start of the project:

*Olsen, J., Shelton, B. & Campbell, T. (2013, April). S'cape the Ordinary: Metacognitive-Supported Activity for Inquiry Learning in Virtual Environments. Presentation at the American Educational Research Association (AERA) 2013 International Conference. San Francisco, California.

*Campbell, T., Dowdle, G., Barrow, J., Stewart, A., Shelton, B.E., Duffy, A. M., Longhurst, M., & Wolf, P. G. (2013, April). Cyber-enabled learning in Unity: Scientific inquiry and gaming supported by assessment. Presentation at the 2013 National Science Teachers Association (NSTA) National Convention. San Antonio, Texas.

Wang, S.-K., Hsu, H.-Y., & Runco, L. (2013, April). The impact of professional development on middle school science teachers' inquiry and new literacies practices. Presentation at the 2013 Annual Conference of the American Educational Research Association, San Francisco, CA.

Hsu, H.-Y., Wang, S.-K., & Runco, L. (2013, April). Middle school science teachers' confidence in technology integration (new literacies) and their classroom practices. Presentation at the 2013 Annual Conference of the American Educational Research Association, San Francisco, CA.

Wang, S.-K., Hsu, H.-Y., & Runco, L. (2013, April). Influence of teachers' self-efficacy in inquiry-based instruction and their classroom practices on students' learning motivation. Presentation at the 2013 Annual Conference of the American Educational Research Association, San Francisco, CA.

Hsu, H.-Y., Runco, L., & Wang, S-K. (2013, April). Enhancing scientific inquiry and practicing new literacies skills

through ICTs: Testing the classroom practice feasibility. Presentation at the 2013 Annual Conference of the American Educational Research Association, San Francisco, CA.

*Edward, P., Gienau, J. & Wang, S-K. (2013, March). Using cyber databases and Google Earth to conduct inquiry in learning evolution theory. Paper presented at the 2013 New York State Association for Computers and Technologies in Education Hudson Valley Conference.

*Hsu, H.-Y., & Posada, J. (2013, March). Using mobile devices to conduct water quality research. Workshop conducted at the 2013 New York State Association for Computers and Technologies in Education Hudson Valley Conference.

*Hsu, H.-Y., Wang, S.-K., & Roter, C. (2012, May). Cultivating New Literacies Through ICTs: Using Photosynthesis as an Example. Paper presented at the 2012 National Science Teachers Association STEM Forum & Expo in Atlantic City from May 17 to 19.

*Alforque, V., Davis, M., Green, S., Wang, S.-K., & Hsu, H.-Y. (2012, May). Use a Social Networking Tool to Facilitate Scientific Skills and New Literacies. Paper presented at the 2012 National Science Teachers Association STEM Forum & Expo in Atlantic City from May 17 to 19.

*Shelton, B, Olsen, J. & Campbell, T. Investigating Cyber-Enabled Learning Usage, Access, Achievement, and Beliefs (2012 April). Presentation at the American Educational Research Association (AERA) 2012 International Conference. Vancouver, British Columbia, Canada.

Hsu, H.-Y., Wang, S.-K. & Runco, L. (2012, April). Investigation of Middle School Science Teachers' Preparedness to Practice New Literacies. Paper presented at the Annual Conference of the American Educational Research Association, Vancouver, Canada.

Runco, L., Wang, S.-K. & Hsu, H.-Y. (2012, April). Teachers'self-efficacy in teaching science as inquiry and their classroom practices. Poster presented at the Annual Conference of the American Educational Research Association, Vancouver, Canada.

*Shelton, B, Olsen, J. & Campbell, T. S'cape from Formality: Embedded and Automatic Assessments within Simulation Games (2012 December). Presentation at the Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC) 2012 International Conference. Orlando, Florida.

Campbell T. Collaborative Projects: Coordination or Collaboration. (2012, June). Presentation at the Annual 2012 National Science Foundation Discovery Research K-12 Principal Investigator Meeting. Washington, D.C.

Campbell T., Longhurst, M., Wang, S., Hsu, H., & Runco, L. Cyber-enabled Learning: Beginning with a Baseline. (2012,

June). Presentation at the Annual 2012 National Science Foundation Discovery Research K-12 Principal Investigator Meeting. Washington, D.C.

*Duffy, A., Campbell, T., & Wolf, P. The Virutal Populations Genetics (VPG) Simulation System: An Example of Learning 'With' Cyber-Enabled Technologies in Science Classrooms. (2011, March). Presentation at the 2011 National Science Teachers Association Research Dissemination Conference. San Francisco, California.

Wang, S.-K. & Hsu, H.-Y. (2012, March). Enhancing scientific inquiry and practicing new literacies skills through ICTs and mobile devices. Paper presented at the Mobile Learning IADIS International Conference in Berlin, Germany.

*Campbell, T., Duffy, A., & Wolf, P. OpenSim as an example of Cyber-enabled Technologies for facilitating Science as Inquiry. (2011, March). Presentation at the 2011 Cyberlearning Tools for STEM Education (CyTSE) conference. Berkeley, California.

*Signifies work completed with teacher leaders, teachers, or students.

* How have the results been disseminated to communities of interest?

The results of the project have been disseminated to communities of interest for the purpose of enhancing public understanding and increasing interest in learning and careers in science, technology, and the humanities through our work with students in both UT and NY. To date, teacher participants in our project have instructed more than 3000 students with modules and instructional and technological approaches beyond the modules, learned from professional development, that positions students to engage in science with technology that more accurately reflects the work of STEM professionals. This not only introduces these student to possible careers activities in these fields, but also can more broadly inform the public as these students share about their engagement in these classrooms with their parents. Finally, while we have not been able to show increased interest across all groups of students in our project (i.e., initial high, med, and low interest in science), likely due to a ceiling effect with our science motivational instrument, we have been able to detect increases in motivation in science for students who initially express a low interest after they have had a teacher participant for a year of instruction (see significant results section above). Additionally, The Utah site shared the research findings with the participating school district leaders. The New York site held an institute to share the research findings with administrators from the participating schools. Please refer to the project website for the detailed dissemination. The publications and workshops are listed in the products section.

* What do you plan to do during the next reporting period to accomplish the goals?

To accomplish the goals during the next reporting period, Cohorts 2 and 3 will be engaged in years 2 and 1 of PD respectively. This will be accomplished through the summer and winter PD sessions, as well as the monthly project meetings. Additionally, the project leadership team will continually use the current findings reported in this report, as well findings from project related research to continually refine the modules, cyber-enabled technologies, and PD models to meet Cohort 2 and 3 teachers' needs.

With respect to research activities, both quantitative and qualitative data collection will continue and serve as the basis for both publication submissions and conference presentations.

And, to support our continued work in both professional development and research, we will continue to meet consistently with HRI, our external evaluator.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
Pre-Meeting Project Report to Advisory Panel Year 3.pdf	Pre-Advisory Panel Meeting Report	David Campbell	04/25/2013
Year 3 Quantitative Data and Interpretations and Addended Data and Interpretation.pdf	Year 3 Advisory Report Data Tables and Addended Data and Analyses	David Campbell	04/25/2013
Advisory Panel Guidance with PI Responses.pdf	Advisory Panel Guidance after Yearly Meeting	David Campbell	04/25/2013
HRI External Evaluation CYBER Year 3 report with PI reponse (v2).pdf	HRI External Evaluation Report with PI Reponses	David Campbell	04/26/2013

Products

Journals

Duffy, A. M., Wolf, P. G., Barrow, J., Longhurst, M., & Campbell, T. (4/1/13). Ecological investigations within an interactive plant community simulation. *Science Scope.*. 36 (8), 42-51.

Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Campbell, T., Dowdle, G., Olsen, J., & Longhurst, M. (4/1/13). Gaming as a platform for developing science practices.. *Science Activities: Classroom Projects and Curriculum Ideas*. In Pres (In Pres), In Pres.

Status = ACCEPTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Wang, S.-K., Hsu, H.-Y., & Green, S. (3/1/13). Using social networking site to facilitate teaching and learning in science classroom. *Science Scope*. 36 (7), 74-80.

Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Campbell, T., Longhurst, M., Duffy, A. M, Wolf, P. G., & Shelton, B. E. (1/12/13). Science Teaching Orientations and Technology-enhanced Tools for Student Learning in Science.. *Research in Science Education*. In Pres (In Pres), In Pres.

Status = AWAITING_PUBLICATION; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1007/s11165-012-9342-x

Campbell, T., Longhurst, M., Duffy, A. M., Wolf, P. G., & Nagy, R. (11/1/12). Investigating human impact in the environment with faded scaffolded inquiry supported by technologies. *Science Activities: Classroom Projects and Curriculum Ideas*. 49 (4), 99-107.

Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Campbell T. & Abd-Hamid, N. (10/4/12). Technology Use in the Science Instruction (TUSI): Technology and Science Education Reform. *Journal of Science Education and Technology*. In Pres (In Pres), In Pres.

Status = AWAITING_PUBLICATION; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1007/s10956-012-9415-7

Hsu, Hui-Yin, Wang, S.-K. & Runco, L. (7/1/12). MIddle School Science Teachers' Confidence and Pedagogical Practice of New Literacies. *Journal of Science Education and Technology*. In Pres (In Pres), In Pres.

Status = AWAITING_PUBLICATION; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1007/s10956-012-9395-7

Campbell T., Wang, S., Hsu, H., Duffy, A., & Wolf, P. (10/1/10). Learning with web tools, simulations, and other technologies in science classrooms. *Journal of Science Education and Technology*. 19 (5), 505-511.

Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1007/s10956-010-9217-8

Campbell, T., ZuWallack, B. A., Longhurst, M., Shelton, B. E., & Wolf, P. G. (1/14/13). Reexamining science teaching orientations and the use of technology enhanced tools for student learning.. *International Journal of Science Education*. 0 (0), o.

Status = SUBMITTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Hsu, H.-Y., & Wang, S.-K. (2/1/13). Conduct Inquiry Activities through Credible Cyber Databases and ICTs: Using Human Impact on Water Quality as a Sample Lesson. *Science Scope*. 0 (0), 0.

Status = SUBMITTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Wang, S.K. & Hsu, H.-Y. (2/1/13). Influence of teachers' self-efficacy in inquiry-based instruction and their classroom practices on students' science learning motivation. *Science Education*. 0 (0), 0.

Status = SUBMITTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Wang, S.-K. & Hsu, H.-Y. (2/1/13). The Impact of Professional Development on Science Teachers' Inquiry and New Literacy Practices: Using ICTs as Cognitive Tools.. *Educational Technology Research & Development*.. 0 (0), 0.

Status = SUBMITTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Books

Book Chapters

Thesis/Dissertations

Conference Papers and Presentations

Longhurst, M., Campbell, T., Duffy, A. M., Wolf, P. G., & Shelton, B. E. (1/10/13). *Reexamining Science Teaching Orientations and Use of Technology-enhanced Tools for Student Learning: One Year Later. Proceedings of the 2012*. International Conference of the Association for Science Teacher Education (ASTE). Charleston, South Carolina.

Status = OTHER; Acknowledgement of Federal Support = Yes

Edward, P., Gienau, J. & Wang, S-K. (3/1/13). *Using cyber databases and Google Earth to conduct inquiry in learning evolution theory*. 2013 New York State Association for Computers and Technologies in Education Hudson Valley Conference. New York.

Status = OTHER; Acknowledgement of Federal Support = Yes

Hsu, H.-Y., & Posada, J. (3/1/13). *Using mobile devices to conduct water quality research*. 2013 New York State Association for Computers and Technologies in Education Hudson Valley Conference. New York.

Status = OTHER; Acknowledgement of Federal Support = Yes

Hsu, H.-Y., Wang, S.-K., & Roter, C. (5/17/12). *Cultivating New Literacies Through ICTs: Using Photosynthesis as an Example*. 2012 National Science Teachers Association STEM Forum & Expo. Atlantic City, New Jersey.

Status = OTHER; Acknowledgement of Federal Support = Yes

Alforque, V., Davis, M., Green, S., Wang, S.-K., & Hsu, H.-Y. (5/17/12). *Use a Social Networking Tool to Facilitate Scientific Skills and New Literacies*. 2012 National Science Teachers Association STEM Forum & Expo. Atlantic City, New Jersey.

Status = OTHER; Acknowledgement of Federal Support = Yes

Shelton, B, Olsen, J. & Campbell, T. (4/20/12). *Investigating Cyber-Enabled Learning Usage, Access, Achievement, and Beliefs*. American Educational Research Association (AERA) 2012 International Conference. Vancouver, British Columbia, Canada.

Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Hsu, H.-Y., Wang, S.-K. & Runco, L. (4/20/12). *Investigation of Middle School Science Teachers' Preparedness to Practice New Literacies*. Annual Conference of the American Educational Research Association. Vancouver, British Columbia, Canada.

Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Runco, L., Wang, S.-K. & Hsu, H.-Y. (4/20/12). *Teachers'self-efficacy in teaching science as inquiry and their classroom practices*. Annual Conference of the American Educational Research Association. Vancouver, British Columbia, Canada.

Status = OTHER; Acknowledgement of Federal Support = Yes

Shelton, B, Olsen, J. & Campbell, T. (12/1/12). *T. S'cape from Formality: Embedded and Automatic Assessments within Simulation Games*. Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC) 2012 International Conference. Orlando, Florida.

Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Campbell, T. (6/7/12). *Collaborative Projects: Coordination or Collaboration*. Annual 2012 National Science Foundation Discovery Research K-12 Principal Investigator Meeting. Washington, DC.

Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Campbell T., Longhurst, M., Wang, S., Hsu, H., & Runco, L. (6/7/12). *Cyber-enabled Learning: Beginning with a Baseline*. Annual 2012 National Science Foundation Discovery Research K-12 Principal Investigator Meeting. Washington, DC.

Status = OTHER; Acknowledgement of Federal Support = Yes

Duffy, A., Campbell, T., & Wolf, P. (3/18/11). *The Virutal Populations Genetics (VPG) Simulation System: An Example of Learning 'With' Cyber-Enabled Technologies in Science Classrooms.*. 2011 National Science Teachers Association Research Dissemination Conference. San Francisco, California.

Status = OTHER; Acknowledgement of Federal Support = Yes

Wang, S.-K. & Hsu, H.-Y. (3/8/12). *Enhancing scientific inquiry and practicing new literacies skills through ICTs and mobile devices.*. Mobile Learning IADIS International Conference. Berlin, Germany.

Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Campbell, T., Duffy, A., & Wolf, P. (3/20/11). *OpenSim as an example of Cyber-enabled Technologies for facilitating Science as Inquiry*. 2011 Cyberlearning Tools for STEM Education (CyTSE) conference. Berkeley, California.

Status = OTHER; Acknowledgement of Federal Support = Yes

Campbell, T., Dowdle, G., Barrow, J., Stewart, A., Shelton, B.E., Duffy, A. M., Longhurst, M., & Wolf, P.

G. (4/10/13). *Cyber-enabled learning in Unity: Scientific inquiry and gaming supported by assessment*. 2013 National Science Teachers Association (NSTA) National Convention. San Antonio, Texas.

Status = OTHER; Acknowledgement of Federal Support = Yes

Wang, S.-K., Hsu, H.-Y., & Runco, L. (4/27/13). *The impact of professional development on middle school science teachers' inquiry and new literacies practices*. 2013 Annual Conference of the American Educational Research Association. San Francisco, California.

Status = SUBMITTED; Acknowledgement of Federal Support = Yes

Hsu, H.-Y., Wang, S.-K., & Runco, L. (4/27/13). *Middle school science teachers' confidence in technology integration (new literacies) and their classroom practices*. 2013 Annual Conference of the American Educational Research Association. San Francisco, California.

Status = SUBMITTED; Acknowledgement of Federal Support = Yes

Wang, S.-K., Hsu, H.-Y., & Runco, L. (4/27/13). *Influence of teachers' self-efficacy in inquiry-based instruction and their classroom practices on students' learning motivation*. 2013 Annual Conference of the American Educational Research Association. San Francisco, California.

Status = SUBMITTED; Acknowledgement of Federal Support = Yes

Hsu, H.-Y., Runco, L., & Wang, S-K. (4/27/13). *Enhancing scientific inquiry and practicing new literacies skills through ICTs: Testing the classroom practice feasibility*. 2013 Annual Conference of the American Educational Research Association. San Francisco, California.

Status = SUBMITTED; Acknowledgement of Federal Support = Yes

Olsen, J., Shelton, B. & Campbell, T. (4/27/13). *S'cape the Ordinary: Metacognitive-Supported Activity for Inquiry Learning in Virtual Environments*. American Educational Research Association (AERA) 2013 International Conference. San Francisco, California.

Status = SUBMITTED; Acknowledgement of Federal Support = Yes

Other Publications

Technologies or Techniques

Virtual Population Community Simulation (VPCSim). VPCsim is a gamelike, browser-based, interactive resource for simulating and visualizing plant communities over many generations in a threedimensional virtual environment with mountainous terrain (1 km2). Simulated plants live, reproduce, or die based on interactions with each other and the environment. The organisms respond to environmental variables including elevation, light, temperature, precipitation, and competition with neighbors. Users select which plant species are included in the community (up to 5 species from 14 options representing common North American plants), manipulate environmental parameters (water, light, temperature, and human disturbance), and observe the effects that those changes have on the number of individuals of each species, their average age, their total biomass, and distribution patterns over a 200-year period. All aspects of the virtual habitat can be controlled through a web form (Figure 4e), allowing a variety of simulations with varying degrees of complexity. Visualization tools allow users to view historical information about each species (Figure 4d), track short- and long-term changes in the plant community, compare samples in both space and time, and view large-scale patterns that emerge directly on the landscape (Figure 4a, b, and c). The documentation built into the simulation system provides enough background on the plant species for users to begin to formulate hypotheses about why particular species respond to particular environments while still requiring them to seek out additional information sources (Figure 4f).

Operating system Browser

Windows XP or newer

Mac OS X 10.5 or newer

(not iOS or Linux)

Safari, Firefox, or Chrome

(not Internet Explorer)

Unity Web Player plug-in

VPCsim requires a free, onetime browser plug-in download. If the plug-in is not present, VPCsim will provide a link to the download site. For information, visit http://unity3d.com/webplayer.

VPCSim was created by at Utah State University and is found at http://vpcsim.usu.edu. This is a free simulation that was developed as the anchor for Module 3 in Utah. The 45 teacher participants in the project will each use this with multiple classes of students during and beyond the project, gauranteeing use by more than 3000 students during the project. Additionally it as been shared with teachers nationally through conference presentations like the National Science Teachers Conference and through publication of the 3rd module in Science Scope (Duffy, et al., 2013). Finally, it is featured on the project website which is openly available on the web at cyberlearning.usu.edu.

Reference

Duffy, A. M., Wolf, P. G., Barrow, J., Longhurst, M., & **Campbell, T**. (2013, April/May). Ecological investigations within an interactive plant community simulation. *Science Scope*. 36(8), 42-51.

S'cape. S'cape is a game designed to assist in the development and evaluation of students' understandings of core concepts. This platform uses novel architecture combining educational and gaming principles to engage learners in a first person explorer game addressing various levels of complexity about the nature of changes in matter. Four sequential levels or rooms engage students in the following:.

- Level One: Focuses on energy and physical changes.
- Level Two: Focuses on physical and chemical properties.
- Level Three: Focuses on the physical and chemical changes; as evidenced through cooking an egg.
- Level Four: Focuses on the factors influencing physical and chemical changes; combinations of chemical and physical changes.

After students successfully problem solve to escape each individual room they enter an interrogation room where an automated assessment feature is used to have students complete questions about their escape. In addition, each interrogation room has a replay feature so that students can review all their actions during their escape to assist in answering the questions. This is the recording "through their own eyes" as they experienced the environment to allow for deeper reflection and thoughtful responses to the questions based on those experiences. If students are able to articulate how they escaped based on principle underlying the nature of changes in matter, they move on to the next room or after level four, they escape. If students are not successful in articulating how they escaped from a specific room, they are placed back in the room and required to play the room again.

Operating system Browser

Windows XP or newer

Mac OS X 10.5 or newer

(not iOS or Linux)

Safari, Firefox, or Chrome

(not Internet Explorer)

Unity Web Player plug-in

S'cape requires a free, onetime browser plug-in download. If the plug-in is not present, VPCsim will provide a link to the download site. For information, visit http://unity3d.com/webplayer.

S'cape was created by at Utah State University and is found at http://idias.usu.edu/WebPlayer/WebPlayer.html. This is a free simulation that was developed as the anchor for Module 4 in Utah. The 45 teacher participants in the project will each use this with multiple classes of students during and beyond the project, gauranteeing use by more than 3000 students during the project. Additionally it as been shared with teachers nationally through conference presentations like the National Science Teachers Conference and through publication of the 4th module in *Science Activities: Classroom Projects and Curriculum Ideas* (Campbell, et al., 2013). Finally, it is featured on the project website which is openly available on the web at cyberlearning.usu.edu.

Reference

Campbell, T., Dowdle, G., Olsen, J., & Longhurst, M. (in press). Gaming as a platform for developing science practices. *Science Activities: Classroom Projects and Curriculum Ideas.*

Patents
Nothing to report.

Inventions
Nothing to report.

Licenses
Nothing to report.

Websites

Title: Integrating Science Instruction and Technology A National Science Foundation: Discovery Research K-12 Project

URL: http://cyberlearning.usu.edu/

Description: This is the UT Collaborators Project Website intended for broad dessimination of resources beyond project participants.

Title: Cyber Enabled Learning: Digital Natives in Integrated Scientific Inquiry Classrooms

URL: http://www.nyit.edu/cyberlearning/

Description: This is the NY Collaborators Project Website intended for broad dessimination of resources beyond project participants.

Title: Integrating Science Inquiry & Technology

URL: http://isit.usu.edu/

Description: This website is used as a hub for resources for PD participants.

Other Products
Nothing to report.

Participants

Research Experience for Undergraduates (REU) funding

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Daniel Coster	Co PD/PI	1

Brett E. Shelton	Co PD/PI	1
Max Longhurst	Faculty	2
Paul G. Wolf	Co PD/PI	1
David T Campbell	PD/PI	2

What other organizations have been involved as partners?

Name	Location
Davis School District	Farmington, UT
Jordan School District	West Jordan, UT

Have other collaborators or contacts been involved? N

Impacts

What is the impact on the development of the principal discipline(s) of the project?

Because the overarching goal of the project is to determine whether teacher professional development and support for the use of cyber-enabled resources lead to meaningful student learning experiences, a reduction in gaps between informal and formal learning and improved student outcomes, we believe that this area is where our project is beginning to have an impact within the science education and instructional technology/educational technology disciplines.

To date, we believe our impact in this area has come mainly through our scholarship (see products section of this report) that is consistently being published yearly in the project in research journals like Research in Science Education and the Journal of Science Education and Technology. In these areas, we have helped illuminate the reciprocal benefits and challenges of providing professional development for teachers that inextricably links ICTs, new literacies, and scientific literacy and the benefits and challenges of engaging students in within this same framework. Additionally, our project has impacted these disciplines through leading workshops, making presentations at national and international conferences and publishing in practitioner journals so that teachers beyond those participating in our project will benefit from our experiences, research, and efforts.

What is the impact on other disciplines?

Nothing to report.

What is the impact on the development of human resources?

In Phase I (Year 1) and early in Phase II (Year 2 & 3) of the our project, we have been able to mentor numerous graduate students by providing them opportunities to engage in research and teaching science. The following are students who have been mentored this year:

Utah State University

Research Assistant: Aaron Duffy-Biology

Research Assistant: Atul Thapliyal–Computer Science/ITLS

Research Assistant: Yuanzhi Li-Quantitative Research Mathematics and Statistics

Research Assistant: Jeff Olsen–Qualitative Research/ITLS

Research Assistant: Jared Gee–Science Education

Research Assistant: Tamra Luke

New York Institute of Technology

Research Assistant (Education): Edward Powers, John Gienau, Markella Karousis, and Katerina Skiadas.

What is the impact on physical resources that form infrastructure?
Nothing to report.

What is the impact on institutional resources that form infrastructure?
Nothing to report.

What is the impact on information resources that form infrastructure?
Nothing to report.

What is the impact on technology transfer?
Nothing to report.

What is the impact on society beyond science and technology?

While this is related to the impact we reported in the discipline, it is also very applicable to the impact we see our project having on society beyond science and technology. Our work in the project is focused on student outcomes. While many of these are targeted student outcomes in formal settings, these are only seen as markers for the more far reaching outcomes we see for engaging ALL students in science teaching and learning that concurrently fosters students new literacies. In the end, we expect that our project is impacting society as it focuses on engaging students in the practices of science, like scientific inquiry, and developing new literacies skills for the 21st century. While in our project, we project that our teacher participants will provide instruction for more than 3000 students initially and that this number will increase each year after their participation when they continue to use learned principles of instruction and technology throughout their careers. Through this, we expect that society is benefitting as these students, future scientists and non-scientist alike, engage in socioscientific issues related to science and are asked to make informed decisions as citizens, either in the form of electoral decisions or personal decisions. And, through ensuring that new literacies are also fostered for these students, we believe they are better prepared for STEM and non-STEM related careers, first with enhanced college readiness, and then with innovative skills focused on societies more common literacy needs and modalities of the day.

Changes

Changes in approach and reason for change
Nothing to report.

Actual or Anticipated problems or delays and actions or plans to resolve them
Nothing to report.

Changes that have a significant impact on expenditures
Nothing to report.

Significant changes in use or care of human subjects
Nothing to report.

Significant changes in use or care of vertebrate animals
Nothing to report.

Significant changes in use or care of biohazards
Nothing to report.

Special Requirements

Responses to any special reporting requirements specified in the award terms and conditions, as well as any award specific reporting requirements.

N/A