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

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http://www.nyit.edu/cyberlearning

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Purpose of the Project

There are lots of ICTs being used by students outside of schools but they often do not have a chance to use them in schools. Teachers need to be trained to learn how ICTs can be used to facilitate scientific inquiry and develop their new literacies skills. The purpose of this study is to find out more about how students' science learning outcomes and experiences are transformed by technology-based innovations in science teaching. The team will conduct professional development for ninety 7th or 8th grade science teachers in Utah State University and New York City public schools starting summer 2011. **The professional development will provide teachers with the skills and knowledge of using technology to design curriculum activities in the science classroom.** The team will collect and analyze data from teachers (scientific inquiry teaching attitude, ICTs skills, new literacies confidence), students (science learning motivation, ICTs skills, new literacies confidence, GPA, state exam data), and classroom observations (RTOP). The team also expects to see the transferable use of ICTs to other topics.

NYIT/USU Professional Development Modules 3

The PD addresses three major skills:
(1) scientific inquiry, (2) new literacies, and (3) ICTs.

The team will provide workshops for three cohorts starting from Summer 2011. Each cohort includes 15 teachers each site, and the professional development will span for two years. Teachers will participate in four PD workshops, addressing the middle school science topics such as human impact on the living environment, photosynthesis, forces and motion, evolution theory and bio diversity.

NYIT/USU Information and Communication Technologies 4

ICTs adopted in this project include:

- *Word processing*
- *Spreadsheet*
- *Still images*
- *Video clips*
- *Web search engines*
- *Google form*
- *3D virtual environment (Unity, Google Earth)*
- *Social networking tools (Google Site, Edmodo)*
- *Cyber databases*
- *iPad/iPod Touch*
- *Probeware.*

NYIT/USU Scientific Inquiry 5

Teachers will reexamine the scientific inquiry process during the PD to be prepared to facilitate students' scientific inquiry skills:

1. Form scientifically testable questions and a hypothesis
2. Research plan
3. Collect data and evidences
4. Interpret and analyze data
5. Draw conclusions to examine hypothesis, form alternative explanations
6. Communicate findings to others

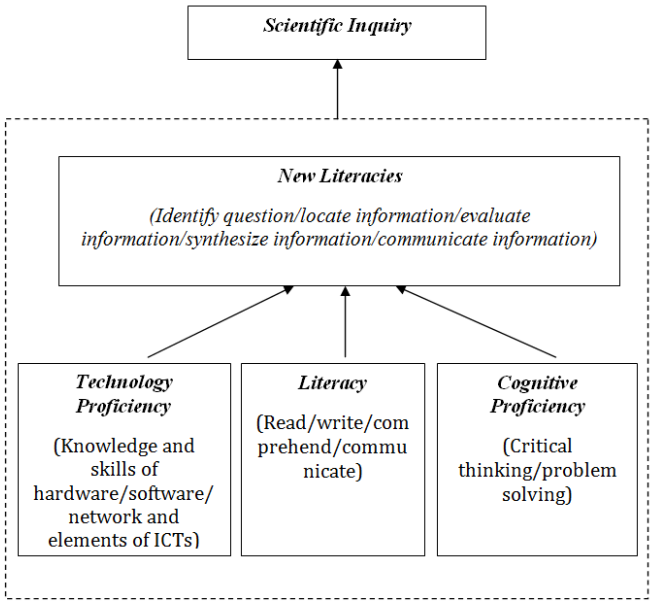
NYIT/USU New Literacies 6

ICTs can be used to facilitate students' scientific inquiry skills, thus, cultivate their new literacies skills.

It refers to the skills to use ICTs to

1. Identify questions
2. Locate information
3. Evaluate the information
4. Synthesize information to answer questions
5. Communicate the answers to others

NYIT/USU New Literacies Framework 7



(Hsu, Wang, & Runco, 2012)

NYIT/USU ICTs Support of each Module (NY) 8

	Module 1 (Water quality)	Module 2 (Photo-synthesis)	Module 3 (Evolution/ bio diversity)	Module 4 (Human body)
ICTs and technology				
Word processing	X	X	X	X
Spreadsheet	X	X	X	X
Web search engines	X	X	X	X
Social Networking	X	X	X	X
Still images/ video clips	X	**X**	X	X
Google Earth	X		**X**	
Cyber database	**X**		**X**	
Real time response system (Google Form polling)				**X**
iPad	**X**	X	X	X
Probeware	**X**			

NYIT/USU ICTs Support of each Module (Utah) 9

	Module 1 (Human Impact on Environment)	Module 2 (Forces and Motion)	Module 3 (Dependent Relationship of Organisms)	Module 4 (Changes in Matter)
ICTs and technology				
ICTs				
Word processing	X	X	X	X
Spreadsheet	X	X	X	X
Web search engines	X	X	X	X
Social Networking	X	X	X	X
Still images/ video clips	X	X		X
Google Earth/3 D Virtual Platform	X		X	X
Cyber database	X		X	
iPad/iPod	X	X		X
Probeware		X		

NYIT/USU Sample Research: Human Impact on Environment 10

- **Research question:**
  - The purpose of the experiment was to investigate the temperature and pH of pond water to help us determine the quality of water at this specific location.
- **Hypothesis:**
  - We hypothesize the pond water has a pH level less than 7 (more acidic than pure water pH 7) because it is a static body of water and can easily be affected by acidic rain (become more acidic).
- **Data and evidence:**

1. Collect data using iPad and Sparkview app. Take pictures of sites.
2. Place all information gathered by your research in Spreadsheet.
3. Document research process and data in lab book.
4. Add more evidence and observations to the lab notebook.
5. Use Edmodo to share your information.

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	A	B	C	D
1	Time (s)	Temperature (°F)	pH	
2	First run	66.2	6.6	
3	Second run	65	6.4	
4	Third run	66	6.8	
5	Average	65.733333333	6.6	
6				

Three tests of a pond Water Quality collecting pH and temperature data.

Temp and pH comparison : Sheet1

Date	Time	Location	Temp (c)	pH
5/20/2011	10:15:00	NYCOM pond	19.04	6.81
5/21/2011	4:30:00	Genesee River, Rochester	13.9	8
5/21/2011	5:00:00	Delaware River at Trenton NJ	15.3	7.5

Compare the pond pH and temperature data with data collected from other bodies of water using USGS cyber database.

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Hoop used for sampling

[redacted]Team9

Day1 Experiment

Hypothesis:

If humans impact an environment then there are less species.

Methods:

We studied in a specified location while looking at small parts of it randomly. We took pictures and described the plant species and observed the differences between two locations with different levels of human interference.

PHMs team 9 site info

	Study Area Name	Location	Description	Human Impact Ratings
1	Lawn	Lawn East of [redacted] Middle school, [redacted], USA	Grassy, Field	4
2	Field	Field Northeast and across the road of [redacted] Middle School, [redacted], USA	Field	8

Study Date:	Diameter of plots sampled:	Area per plot:	Number of plots per study area:	Total area sampled in each study area:
5/19/2011	84 cm	.5871 meters	4	8

Study Area Descriptions

Area1

Area2

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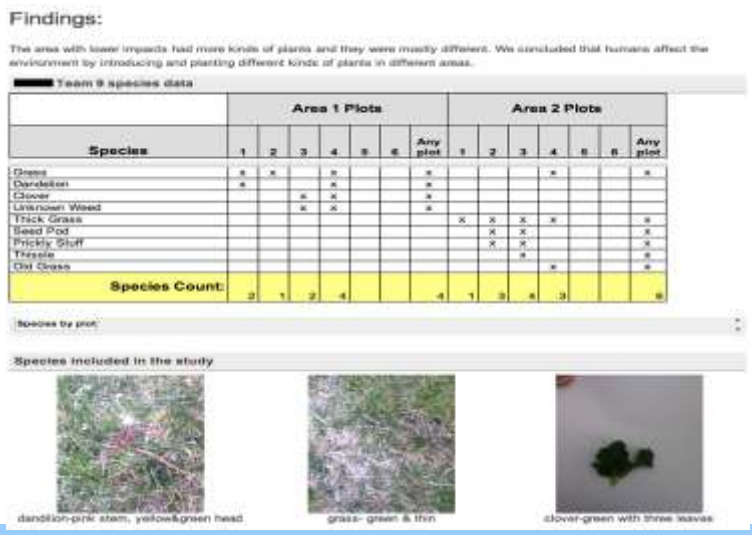
Use spreadsheet to log and present data, and use Google Site to communicate results.



Findings:

The area with lower impacts had more kinds of plants and they were mostly different. We concluded that humans affect the environment by introducing and planting different kinds of plants in different areas.

Team 9 species data

Species	Area 1 Plots							Area 2 Plots						
	1	2	3	4	5	6	Any plot	1	2	3	4	5	6	Any plot
Grass	x	x		x			x				x			x
Dandelion	x			x			x							
Clover			x	x			x							
Unknown Weed			x	x			x							
Track Grass								x	x	x	x			x
Seed Pod									x	x				x
Prickly Stuff									x	x				x
Thistle										x				x
Old Grass											x			x
Species Count:	2	1	2	4			4	1	3	4	3			6

Species by plot

Species included in the study

dandilion-pink stem, yellow&green head

grass- green & thin

clover-green with three leaves

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- iPad/probeware (mobile device): collect data on sites
- Spreadsheet: log data and create charts to make comparison, prediction and presentation
- Word processing: generate lab report and communicate research findings
- Images: document aquatic environment
- Web resources: search and evaluate information
- Map tool: identify locations
- Cyber database (USGS): collect data for comparison use
- Social networking site: share research findings and communicate results

NYIT/USU Sample Research: Photosynthesis 15

- **Research question:**
  - The purpose of the project is to examine the process of photosynthesis in plants. Specifically, we will examine the reactants necessary for photosynthesis to occur and why these reactants are so important for photosynthesis.
- **Hypothesis:**
  - If I limit the amount of sun (reactant) needed by a plant, photosynthesis will not occur at its optimal level and the plant will not grow (when compared to the control plant.)

Data and evidence:

1. Prepare 3 containers for planting seeds: Control, No Sun, No Air.
2. Plant seeds in 3 conditions using same amount of potting soil.
3. Document plant growth with images.
4. Log data using spreadsheet and create charts to compare data.
5. Complete lab book to report the research findings.
6. Share results on Edmodo.

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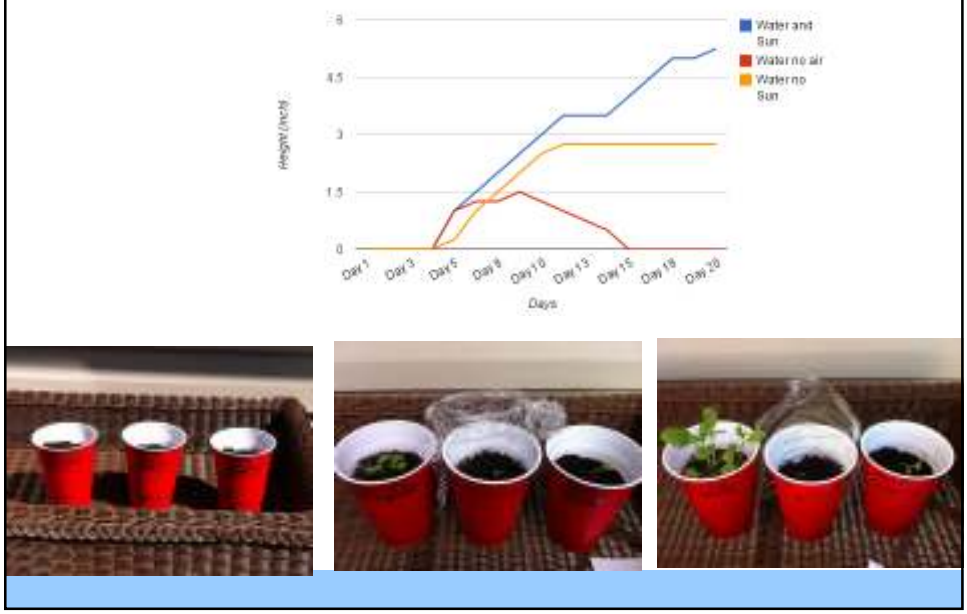

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- Image/video: collect data for comparison, document research process
- Spreadsheet: log data and create charts, make comparison, prediction and presentation
- Word processing: generate lab report and communicate research findings
- Web resources: search and evaluate information
- Social networking site: share research findings and communicate results

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- **Journal article**
  - Campbell, T., Longhurst, M., Duffy, A., & Wolf, P. Investigating Human Impact in the Environment with Faded Scaffolded Inquiry supported by Technologies. *Science Activities.* (In Press)
  - Hsu, H.-Y., Wang, S.-K. & Runco, L. Middle school science teachers' confidence and pedagogical practice of new literacies. *Journal of Science Education and Technology* (In Press)
- **Presentations**
  - Hsu, H.-Y., Wang, S.-K., Runco, L. Investigation of middle school science teachers' preparedness to practice new literacies (2012 April). Paper presented at the American Educational Research Association (AERA) 2012 International Conference. Vancouver, British Columbia, Canada.
  - Runco, L., Wang, S.-K. & Hsu, H.-Y. Teachers' self-efficacy in teaching science as inquiry and their classroom practices (2012 April). Poster presented at the American Educational Research Association (AERA) 2012 International Conference. Vancouver, British Columbia, Canada.
  - Runco, L., Wang, S.-K., Hsu, H.-Y., Roter, C. Cultivating new literacies through ICTs: using photosynthesis as an example. Paper presented at the National Science Teachers Association STEM Forum & Expo (2012 May, Atlantic City, NJ).
  - Wang, S.-K., Hsu, H.-Y., & Runco, L. Davis, M., Green, S., & Alforque, V. Use social networking tool to facilitate scientific skills and new literacies. Paper presented at the National Science Teachers Association STEM Forum & Expo (2012 May, Atlantic City, NJ).
  - 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.
  - 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.
  - Shelton, B, Olsen, J. & Campbell, T. Investigating Cyber-Enabled Learning Usage, Access, Achievement, and Beliefs (2012 March). Presentation at the American Educational Research Association (AERA) 2012 International Conference. Vancouver, British Columbia, Canada.