CincySTEM Urban Initiative: Experiential Learning in Science and Engineering Disciplines using Digital Backpacks

Cyberenabled, Collaborative Learning Environments:
Rethinking Time and Space for STEM Teaching
and Learning

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Hughes STEM High School

- Founded in 1853 (known as Hughes center at that time)
- Renovated and Transformed into a STEM high school in 2009
- One of the 13 high schools in the Cincinnati Public Schools (CPS) district
- Serves a large population of minority, low income, and special needs students in the district
- Offers STEM majors along with a strong liberal arts foundation
- One of the STEM platform schools in the Ohio STEM Learning Network (OSLN)

CincySTEM Urban Initiative

- Funded by NSF Innovative Technology Experiences for Students and Teachers (ITEST)
- Goal: Design and integrate Project-based Learning (PBL) into STEM courses in 9th & 10th grades
- The NSF ITEST Strategies grant funded purchase of digital backpacks called F-SETs

ITEST Learning Resource Center

CincySTEM Projects

Energy Kaizenator Project - Students study the fundamentals of energy audits

Global Climate Change - Students study the causes and effects of global warming and learn how to develop an action plan to encourage the community to think globally and act locally

Global Water Challenge - Students study issues surrounding the availability of potable water while exploring local water and sewer facilities and operations.

Human Genome Project - Students study the science of genetics and social science of genealogy.

Roller Coaster Project - Students study the laws of energy and physics to build a model roller coaster

1. Energy Kaizenator

- This project focuses on energy conservation in typical settings such as schools and homes
- Named after the Japanese Kaizen strategy that emphasizes on the process of gradual change leading to improvement in all areas of an organization or production
- Students learn how to audit energy “kaizens” to reduce costs and greenhouse gas emissions leading to efficient energy usage in schools and homes
- Students use the F-SET digital backpack equipment to calculate energy costs, consumption and cost-saving measures, and present their results on collaborative online workspaces

UNIVERSITY OF Cincinnati

2. Global Climate Change

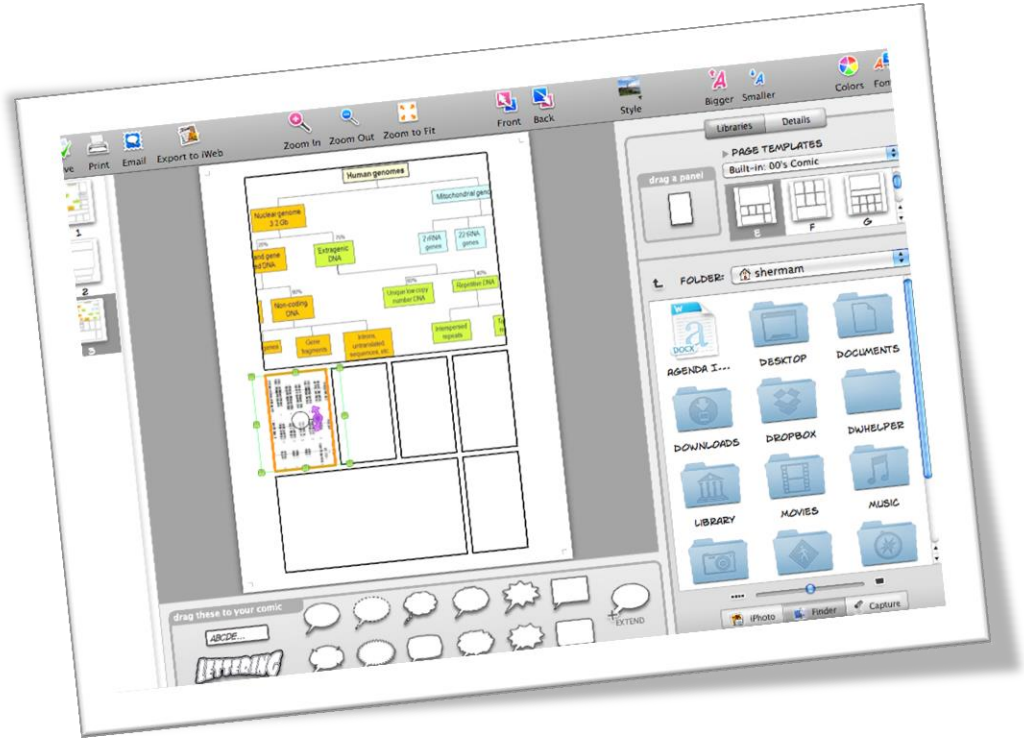
- students learn about the causes and effects of global warming and how to develop a community action plan that encourages people to think globally and act locally
- field trips to the local zoo and botanical garden help students learn about different biomes and understand the connections between the earth, plants, animals, and humans
- Students then create multimedia presentations in the form of podcasts, web pages, ebooks or videos

3. Global Water Challenge

- This project was carried out in collaboration with Procter and Gamble (P&G)
- Students visit and explore local water and sewer facilities to learn about issues surrounding the availability of potable water
- The F-SET equipment is then used for problem solving, designing, and presenting prototypes in order to address research questions related to potable water

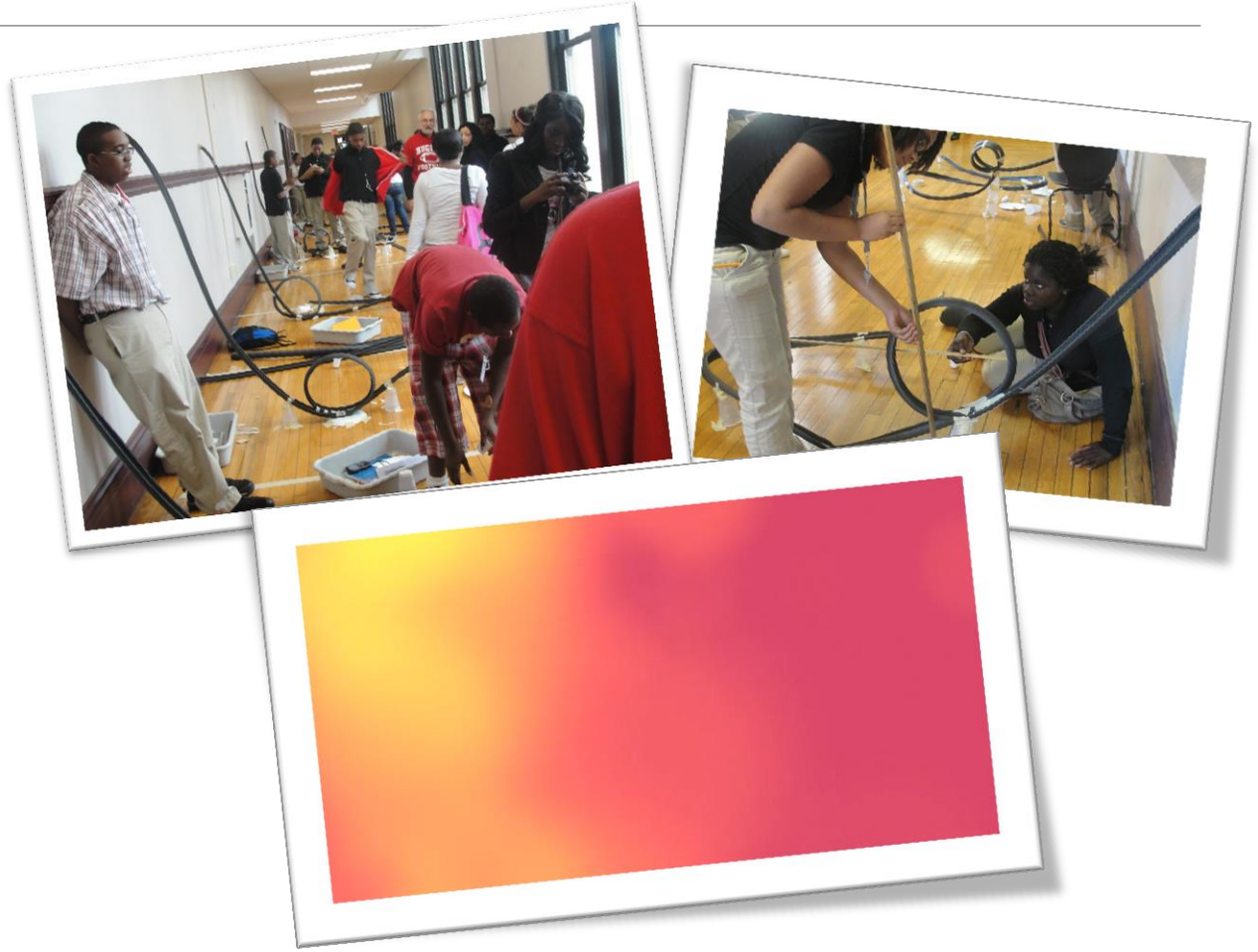
4. Human Genome

- In this project, students focus on the science of genetics and the social science of genealogy
- They use the knowledge about genetics and genealogy to conduct research and laboratory experiments, and then construct a graphic biography that illustrates their own genetics and genealogy
- Students used comic life to produce graphic novel



5. Roller Coaster

- This project is designed for students to study the laws of energy and physics as they built model roller coasters
- First, they design and test virtual rollercoasters using computer-aided simulation tools, and then build those rollercoasters in classroom using an iterative design process



Assessment Results

1. Focused on innovative and engaging pedagogy for science instruction
2. Looked at student achievement
3. **Reviewed the student self-results related to changes in attitudes and interest in STEM careers**
4. Analyzed the partner and teacher processes and implementation within these projects
5. Identified aspects of the projects and process that are sustained within the classrooms and school.

Assessment Results

1. Reviewed the student self-results related to changes in attitudes and interest in STEM careers

   Key questions asked:
   - The project made me more excited to come to science class;
   - This project helped me feel more confident about studying science, and;
   - This project made me more interested in careers in science, technology, engineering or mathematics.

	The project made me more excited to come to science class.			This project helped me feel more confident about studying science.			This project made me more interested in careers in STEM.		
Project	N	Mean*	Std. Dev.	N	Mean*	Std. Dev.	N	Mean*	Std. Dev.
Energy Kaizen (9th grade)									
Spring 2011	65	3.66	.889	66	3.62	.957	65	3.77	.981
Spring 2012	42	2.90	1.055	41	3.12	.980	42	3.21	1.094

Current Status

- Teachers and students continue to use resources developed as a result of the ITEST grant.

Lessons Learned

- Embracing student-centered and technology-rich pedagogies is challenging and perhaps different for each teacher.
- Partnership with industry, community, and higher education organizations had a significant impact on effective integration of CincySTEM projects.
  - A total of 17 Partners
- The majority of the CincySTEM aspects are sustainable with minimal funds for maintenance purposes.

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Questions?