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# IDEAS: Inquiry-based Dynamic Earth Applications of Supercomputing, Seeing the Big Picture with Information Technology

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## Preview of Award 0737583 - Final Project Report

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### Cover

Federal Agency and Organization Element to Which Report is Submitted:	4900
Federal Grant or Other Identifying Number Assigned by Agency:	0737583
Project Title:	IDEAS: Inquiry-based Dynamic Earth Applications of Supercomputing, Seeing the Big Picture with Information Technology
PD/PI Name:	Bruce E Segee, Principal Investigator Peter O Koons, Co-Principal Investigator Yifeng Zhu, Co-Principal Investigator
Recipient Organization:	University of Maine
Project/Grant Period:	10/01/2007 - 09/30/2013
Reporting Period:	10/01/2012 - 09/30/2013
Submitting Official (if other than PD\PI):	Bruce E Segee Principal Investigator
Submission Date:	12/23/2013
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	Bruce E Segee

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## Accomplishments

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

The goals of the project were to increase the level and volume of information technologies in the classroom and to promote inquiry-based learning. The project was tightly integrated with the Maine Learning Technology Initiative that puts a laptop computer into the hands of every 7th and 8th grade student and teacher. It was also tightly integrated with the University of Maine Supercomputer. Through the use of technology, students were able to ask “what if” questions and find and visualize the answers to their questions. The focus of the inquiry was dynamic Earth modelling. This included geological evolution of the earth as well as weather and climate changes over time.

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

Major Activities: The major activities involved interacting with multiple cadres of middle school teachers. Interactions included day-long face to face meetings, video conferencing, and multiple day retreats. Teachers were trained in various age-level appropriate technologies and concepts and developed lesson plans and modules to go with these activities. In the final year we focused on sustainability, and focused on partnerships with the Maine Department of Education, 4H, the Advanced Computing group at the University of Maine, and the Foster Center for Student Innovation. We played major roles in the annual Maine Learning Technology Initiative Student Tech Team Conference, with over 1200 students and teachers attending, and the Annual State Invention Convention, with over 400 students participating

Specific Objectives:

Significant Results:

Key outcomes or

Other achievements:

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

The activities have been primarily geared toward professional development for middle school teachers with the goal of training the trainers. Professional development directly to students has been through activities beginning in the classroom and culminating at events at the University of Maine. These include the Annual MLTI laptop conference and the State of Maine Invention Convention.

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

Our work has been disseminated through publications, conference presentations and numerous classroom visits, both in person and via video conference. Our teachers are sharing knowledge, tools and techniques with other teachers in their schools as well as with their students. A major technology that we have exploited is the google collaboration tools, such as Google Docs and Google Sites. Particularly with large-scale adoption of Google for Education, this allows the tools to be easily disseminated.

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## Products

### Books

### Book Chapters

## Conference Papers and Presentations

R King, Y Zhu, B Segee (2012). *Multithreaded VNC Server for Use with Tiled Display Walls*. SC12 The International Conference for High Performance Computing, Networking, Storage, and Analysis. Salt Lake City. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

R. Flagg, J. Monk, Y. Zhu, and B. Segee (2013). *Optimizing Data Locality for Iterative Matrix Solvers on CUDA*. International Conference on Parallel & Distributed Processing Techniques & Applications. Las Vegas. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

J. Monk, K. Hanselman, R. King, Y. Zhu, and B. Segee (2012). *Solving Sudoku using Particle Swarm Optimization on CUDA*. International Conference on Parallel & Distributed Processing Techniques & Applications. Las Vegas. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

## Inventions

Nothing to report.

## Journals

## Licenses

Nothing to report.

## Other Products

Nothing to report.

## Other Publications

## Patents

Nothing to report.

## Technologies or Techniques

Nothing to report.

## Thesis/Dissertations

## Websites

*IDEAS Inquiry Based Dynamic Earth Applications of Supercomputing*

<https://sites.google.com/site/itestum/>

A repository of resources for teachers.

*The Climate Reanalyzer*

<http://ecm.um.maine.edu/>

With Climate Reanalyzer, one can explore state-of-the-art climate reanalysis, general circulation and weather forecast models, and a global archive of daily station data all within one intuitive framework. Climate is average weather, and therefore it is instructive to bring climate and weather datasets together in one place. Go ahead and browse the site. You will see how easy it is to jump from historical climatology to the current 7-day weather forecast. All with publication quality maps and graphs.

## Participants/Organizations

### What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Segee, Bruce	PD/PI	2

Koons, Peter	Co PD/PI	1
Zhu, Yifeng	Co PD/PI	1

### Full details of individuals who have worked on the project:

#### Bruce E Segee

**Email:** segee@maine.edu

**Most Senior Project Role:** PD/PI

**Nearest Person Month Worked:** 2

**Contribution to the Project:** Coordinated activities, scheduled events, planned for food, parking, etc. Additionally, Segee led workshops involving computer visualization and in-classroom visualization.

**Funding Support:** None (University salary)

**International Collaboration:** No

**International Travel:** No

#### Peter O Koons

**Email:** Peter.Koons@maine.edu

**Most Senior Project Role:** Co PD/PI

**Nearest Person Month Worked:** 1

**Contribution to the Project:** Koons provided geodynamics expertise for the development of climate models and activities. He led training sessions on the same.

**Funding Support:** None (University salary)

**International Collaboration:** No

**International Travel:** No

#### Yifeng Zhu

**Email:** zhu@eece.maine.edu

**Most Senior Project Role:** Co PD/PI

**Nearest Person Month Worked:** 1

**Contribution to the Project:** Zhu has led multiple workshops related to programming, and computer modeling.

**Funding Support:** None (University salary)

**International Collaboration:** No

**International Travel:** No

### What other organizations have been involved as partners?

Name	Type of Partner Organization	Location
Foster Student Innovation Center	Other Nonprofits	Orono, ME

Maine Department of Education

State or Local Government

Augusta, ME

Maine International Center for Digital Learning

Other Nonprofits

Lewiston, ME

The Mathworks

Industrial or Commercial Firms

Cambridge, MA

**Full details of organizations that have been involved as partners:****Foster Student Innovation Center****Organization Type:** Other Nonprofits**Organization Location:** Orono, ME**Partner's Contribution to the Project:**

Facilities

Collaborative Research

**More Detail on Partner and Contribution:****Maine Department of Education****Organization Type:** State or Local Government**Organization Location:** Augusta, ME**Partner's Contribution to the Project:**

Collaborative Research

**More Detail on Partner and Contribution:****Maine International Center for Digital Learning****Organization Type:** Other Nonprofits**Organization Location:** Lewiston, ME**Partner's Contribution to the Project:**

Collaborative Research

**More Detail on Partner and Contribution:****The Mathworks****Organization Type:** Industrial or Commercial Firms**Organization Location:** Cambridge, MA**Partner's Contribution to the Project:**

In-Kind Support

Collaborative Research

**More Detail on Partner and Contribution:****What other collaborators or contacts have been involved?**

YES

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## Impacts

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

Nothing to report.

### **What is the impact on other disciplines?**

The use of technology as a tool for connecting with teachers and students as well as a topic of education has had a significant impact through collaborations that we have formed with the Maine Department of Education, as well as 4H and the Foster Center of Student Innovation.

### **What is the impact on the development of human resources?**

We believe that through the use of inquiry-based learning and technology in the classroom will have a significant positive impact when these students reach college and ultimately the job market.

### **What is the impact on physical resources that form infrastructure?**

Nothing to report.

### **What is the impact on institutional resources that form infrastructure?**

Our work has had significant impact on the institutional infrastructure related to supercomputing and visualization. The current supercomputing and visualization systems at the University of Maine have been significantly impacted by the ITEST project. Similarly, collaborations have been formed that span the University and the State. These include interactions with 4H, Hour of Code, Invention Convention, Maine Learning Technology, Maine International Center for Digital Learning, Discovery Museum, Challenger Learning Center of Maine, and many others. The network of K-12 outreach has been significantly strengthened as a result of this project.

### **What is the impact on information resources that form infrastructure?**

Our work has had significant impact on the institutional infrastructure related to supercomputing and visualization. The current supercomputing and visualization systems at the University of Maine have been significantly impacted by the ITEST project.

### **What is the impact on technology transfer?**

This project has significantly improved technology transfer from the University to the K-12 schools, but more significantly has provided the framework for K-12 teachers to share technology and technology know-how with one another.

### **What is the impact on society beyond science and technology?**

The use of inquiry-based learning is an engaging way to bring science to the non-scientist. By providing the tools for people to answer their own questions it is possible to create a more science-based population. Rather than a list of facts to memorize, answers can be intuitively, and quite literally seen and hence more deeply understood.

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## Changes/Problems

### **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.

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**Special Requirements**

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