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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

## 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, 000087591  
Peter O Koons, 000087531  
Yifeng Zhu, 000396103**

Submitting Official: **Bruce E Segee  
Principal Investigator**

Submission Date: **12/23/2013**

Recipient Organization: **University of Maine**

Project/Grant Period: **10/1/2007 - 9/30/2013**

Reporting Period: **10/1/2012 - 9/30/2013**

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

### 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.

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

**Uploaded Files**

See supporting files:

None reported

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**Products**

**Conference Papers and Presentations**

**Conference Paper/Presentation 1 of 3**

<b>Solving Sudoku using Particle Swarm Optimization on CUDA</b>	
Authors:	J. Monk, K. Hanselman, R. King, Y. Zhu, and B. Segee
Conference Name:	International Conference on Parallel & Distributed Processing Techniques & Applications
Conference Location:	Las Vegas
Conference Year:	2012
Publication Status:	Published
Acknowledgement of Federal Support:	Yes

**Conference Paper/Presentation 2 of 3**

<b>Multithreaded VNC Server for Use with Tiled Display Walls</b>	
Authors:	R King, Y Zhu, B Segee
Conference Name:	SC12 The International Conference for High Performance Computing, Networking, Storage, and Analysis
Conference Location:	Salt Lake City
Conference Year:	2012
Publication Status:	Published
Acknowledgement of Federal Support:	Yes

### Conference Paper/Presentation 3 of 3

#### Optimizing Data Locality for Iterative Matrix Solvers on CUDA

Authors: R. Flagg, J. Monk, Y. Zhu, and B. Segee

Conference Name: International Conference on Parallel & Distributed Processing Techniques & Applications

Conference Location: Las Vegas

Conference Year: 2013

Publication Status: Published

Acknowledgement of Federal Support: Yes

### Websites

#### Website 1 of 2

##### The Climate Reanalyzer

Description:

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.

#### Website 2 of 2

##### IDEAS Inquiry Based Dynamic Earth Applications of Supercomputing

Description: A repository of resources for teachers.

### Uploaded Files

See supporting files:

None reported

### Participants

#### Research Experience for Undergraduates (REU) funding

REU Comments:

#### What individuals have worked on the project?

Name	Most Senior Project Role	Email Address	Nearest Person Month Worked
Yifeng Zhu	Co-PD/PI	zhu@eece.maine.edu	1
Bruce E Segee	PD/PI	segee@maine.edu	2

Name	Most Senior Project Role	Email Address	Nearest Person Month Worked
Peter O Koons	Co-PD/PI	Peter.Koons@maine.edu	1

**Participant 1 of 3**

<b>Yifeng Zhu , zhu@eece.maine.edu</b>	
Nearest Persons Months Worked:	1
Funding Support:	None (University salary)
International Country(ies) of Collaboration:	N/A
Foreign Travel:	N/A
REU: Year of Schooling Completed:	
REU: Home Institution:	
REU: Government Fiscal Year(s) Participant was Supported:	
Contribution: Zhu has led multiple workshops related to programming, and computer modeling.	

**Participant 2 of 3**

<b>Bruce E Segee , segee@maine.edu</b>	
Nearest Persons Months Worked:	2
Funding Support:	None (University salary)
International Country(ies) of Collaboration:	N/A
Foreign Travel:	N/A
REU: Year of Schooling Completed:	
REU: Home Institution:	
REU: Government Fiscal Year(s) Participant was Supported:	
Contribution: Coordinated activities, scheduled events, planned for food, parking. etc. Additionally, Segee led workshops involving computer visualization and in-classroom visualization.	

**Participant 3 of 3**

<b>Peter O Koons , Peter.Koons@maine.edu</b>	
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Nearest Persons Months Worked:	1
Funding Support:	None (University salary)
International Country(ies) of Collaboration:	N/A
Foreign Travel:	N/A
REU: Year of Schooling Completed:	
REU: Home Institution:	
REU: Government Fiscal Year(s) Participant was Supported:	
Contribution: Koons provided geodynamics expertise for the development of climate models and activities. He led training sessions on the same.	

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

Name	Location	Type of Partner Organization
Maine Department of Education	Augusta, ME	State/Local
Maine International Center for Digital Learning	Lewiston, ME	Non-profit
Foster Student Innovation Center	Orono, ME	Non-profit
The Mathworks	Cambridge, MA	Industrial/Commercial

**Organization 1 of 4**

<b>Maine Department of Education, Augusta, ME, State/Local</b>	
Partner's Contribution to the Project:	Collaborative Research
N/A	

**Organization 2 of 4**

<b>Maine International Center for Digital Learning, Lewiston, ME, Non-profit</b>	
Partner's Contribution to the Project:	Collaborative Research
N/A	

**Organization 3 of 4**

<b>Foster Student Innovation Center, Orono, ME, Non-profit</b>	
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Partner's Contribution to the Project:

Facilities  
Collaborative Research

N/A

**Organization 4 of 4**

**The Mathworks, Cambridge, MA, Industrial/Commercial**

Partner's Contribution to the Project:

In-kind Support  
Collaborative Research

N/A

**Have other collaborators or contacts been involved? YES**

**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

### **Changes in approach and reasons 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