

BLUE WATERS

Blue Waters Education Allocations Final Report



As a component of your application for a Blue Waters education allocation, you agreed to provide a report at the end of your project. Now that your project is complete, we would appreciate your submission of the following information within two weeks. Please send this report, and any supporting documents, to Scott Lathrop, lathrop@illinois.edu.

This information will be shared with the Blue Waters team and the National Science Foundation. Portions of the report (we will omit names of participants) will be posted on the Blue Waters portal for public access.

Project Information

Project Name	How to Build a Fast HPC n-Body Engine from Scratch
Names of project staff (instructors, TAs, etc) and their department and institutions	Eric Peterson Marmion Academy 1000 Butterfield Rd Aurora, IL 60502 epeterson@marmion.org Max Kelly Rose Hulman Institute of Technology 5500 Wabash Ave Terre Haute, IN 47803 maxwellrkelly@gmail.com Dr. Victor Pinks II Marmion Academy 1000 Butterfield Rd Aurora, IL 60502 vpinks@marmion.org
URL for the project	www.marmion.org
Provide links to or attach materials made available to participants (e.g. slides, articles, exercises, etc.) that may be made publicly available	
Provide links to or attach any photos (with captions to describe activities)	

Start date	9-8-2015
Completion date	5-24-2015

Information about the Participants

# Participants	# Faculty or staff	# students	# other (e.g. industry)	# under-represented (e.g. women, minorities)	# institutions represented by participants
14	2	12	0	0	1

Please describe the scope and purpose of this project. Also, please indicate if there were any changes implemented from the original proposed plan, and briefly describe why they were made.

Communicating and transferring computational science knowledge and literacy is a tremendously important concept for students at all levels of education to understand. Computational knowledge is especially important due to the tremendous impact that computer programming has had on all scientific and engineering disciplines. As technology evolves, so must our educational system in order for society to evolve as a whole. We undertook direct instruction of a computational science course, and have developed a curriculum that can be expanded upon to provide students entering technical disciplines with the background that they need to be successful. The course would provide insight to the C programming language as well as how computers function at a more basic level. Students would undertake projects that explores how to program simple tasks and operations and ultimately ends in a final project aimed at assessing the knowledge accumulated from the course. In the end, programming language concerns occupied more time than initially anticipated. Suggestions were made to change from C to Scientific Python so that the programming language would not detract from conceptual goals.

Please describe the learning outcomes of the participants. How did this project enhance the learning of the participants? What did the participants learn as a result of the use of Blue Waters system that they could not have learned using other systems?

Students had a context where they could learn about the significance of parallelism and that there are problems in nature such as couple n-body problems that are ideally suited for parallel programming.

Please describe lessons learned from the project. What would you do differently next time?

Throughout the course there were several issues that had to be overcome and others that could not be accounted for. Were this course to be taught in the future, we have listed several issues that we encountered and solutions that we feel would be most effective.

- We feel that the course instruction has been informative on how to best approach future computational science instruction. To improve and extend our instruction into the future, we feel that more emphasis be placed upon the applications of computational models, and less emphasis be placed upon computer programming instruction.
- Computer programming instruction requires a significant amount of time to adequately prepare the student, and thus is not a proper use of limited class time when the focus is to prepare students for the applications of computational science. It is therefore more appropriate to require the student to be comfortable with a programming language prior to entering the course, or to learn how to program outside of class time.
- Another option is to use a language that is simpler to use and requires less class time to attain familiarity with. Our primary candidate for a simple language included Scientific Python.
- Based on frustrations programming in a command-line environment, we recommend the use of an integrated development environment (IDE) when developing applications on a local system, and the use of command-line

tools only on remote systems.

- A more rigorous grading methodology should be used in order to properly motivate the students and encourage active student participation.

What would you recommend that the Blue Waters team do to enhance the success of education projects in the future?

I would recommend that Blue Waters utilize professional online tutoring companies to assist in developing a tutorial library. For example, we use www.solidprofessor.com for many courses and their approach is very effective and individualized.

Please provide a summary of any surveys or evaluations you conducted of the participants. Feel free to attach any related documents.

Please provide any anecdotal stories we may share with NSF and the public.

How would you rank the overall experience?

	Excellent	Very Good	Good	Fair	Poor	N/A
Education allocations process		<u>X</u>				
Blue Waters support		<u>X</u>				
Blue Waters computing system	<u>X</u>					
Blue Waters documentation		<u>X</u>				
Blue Waters training			<u>X</u>			

Do you plan to request an education allocation for other future events that will use BW?
Please describe the plans for future events, including the frequency (each semester, yearly, etc.).

Yes. We will regroup and plan to apply our lessons learned.

Please provide any other comments or suggestions.

Thank you very much for the opportunity to test our pedagogy. We believe that we can do a better job as we outlined above.