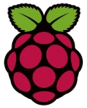
Assessing Teaching OpenMP on the Raspberry Pi



Suzanne J. Matthews - West Point
Joel C. Adams – Calvin College
Richard A. Brown – St. Olaf College
Elizabeth Shoop – Macalester College

Workshops

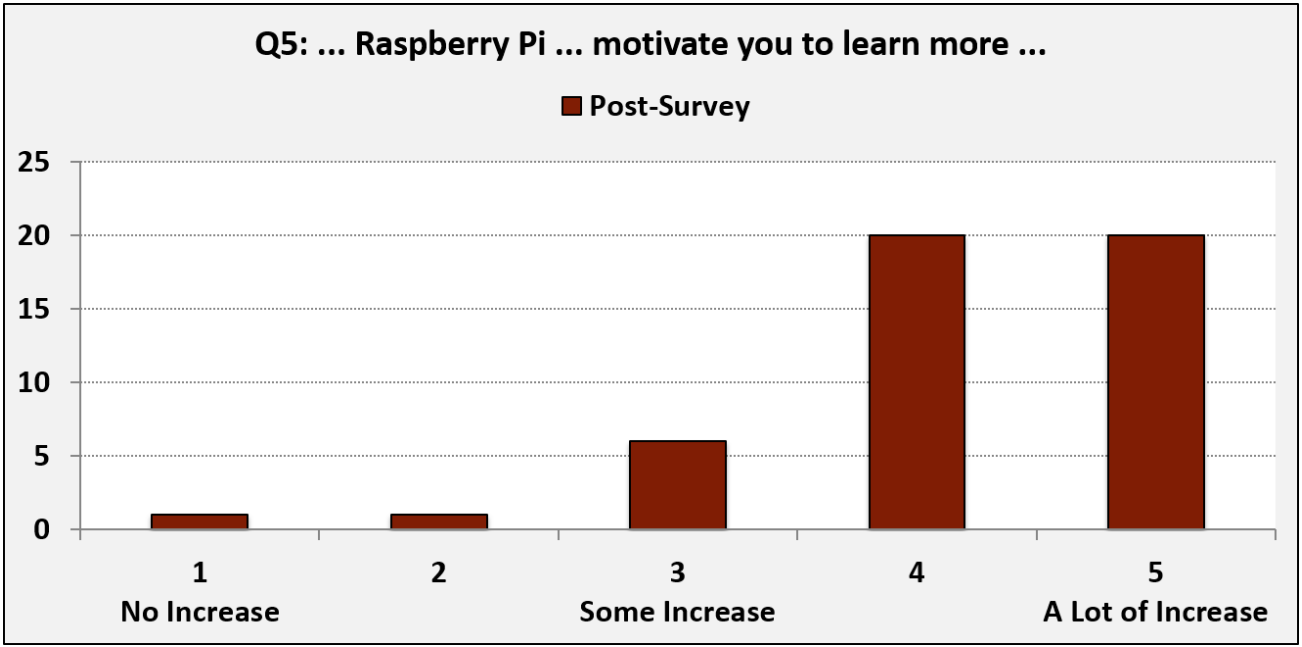
Three 90-minute workshops (Tapia'16, CSE'17, SIGCSE'17)

- 15 minute intro on Raspberry Pi + multicore fundamentals
- 50 minutes patternlet exploration
- 20 minutes on drug design exemplar
- 5 minute discussion + wrap-up

Assessment

	Pre-Survey			Post-Survey			p-values
	T	C	S	T	C	S	
Questions/ Number of Responses	33	16	17	32	16	17	
1. How confident are you that you can describe how to decompose a problem using multiple threads and implement it using a parallel loop?	2.15	2.38	2.88	3.66	4.18	4.06	T: 3.129×10^{-8} C: 1.653×10^{-4} S: 4.556×10^{-3}
2. How confident are you that you could describe the advantages and disadvantages of using parallel programming on shared memory multicore machines to someone familiar with programming?	2.55	3.06	3.17	3.94	4.38	4.18	T: 1.071×10^{-6} C: 6.742×10^{-4} S: 2.753×10^{-2}
3. How confident are you that you can define speedup and describe it to someone familiar with programming?	2.27	2.81	3.12	4.03	4.5	4.23	T: 5.912×10^{-7} C: 1.965×10^{-4} S: 2.081×10^{-2}
4. How confident are you that you can describe what a race condition is and how to avoid it when writing parallel programs that use shared memory?	2.48	2.81	3.12	3.83	4.5	4.17	T: 2.349×10^{-5} C: 6.933×10^{-4} S: 7.663×10^{-3}
5. To what extent did using an inexpensive multicore computer (e.g. the Raspberry Pi) to run parallel programs motivate you to learn more about parallel computing in the future?	n/a	n/a	n/a	4.22	4.13	3.88	n/a

Assessment


Q5: ... Raspberry Pi ... motivate you to learn more ...
Post-Survey
25
20
15
10
5
0
1
No Increase
2
3
Some Increase
4
5
A Lot of Increase

Sample Open-Ended Responses

+ *The impact of it is incredible, would love to learn more.*

+ *I love the Pis! Wonderfully motivating. Gets students closer to the hardware and powerful enough to motivate studying parallelism.*

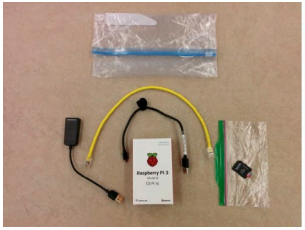
+ *Not having to have an expensive system to try this on is really motivating.*

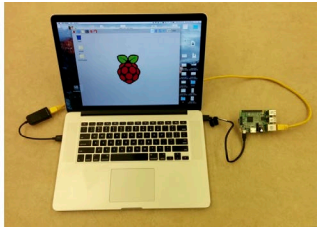
- *I think it's easier on a workstation.*

+ *I am already very motivated because I plan to teach the course . . . But my expectation is using an inexpensive system will motivate the STUDENTS to do so and I am really interested in how much of that is true.*

Conclusions

- Single board computers such as the Raspberry Pi promote “hands-on experiential” learning for parallel computing.
  - All our materials (including Pi image) are freely available online at: csinparallel.org.
  - Supports alternative laptop connection setup.
- SBCs offer a cost-effective way to teach students about especially multicore concepts.
  - Improvements in SoC technology will give rise to newer, inexpensive SBCs.





Backup Slides

TeenTechNY

WPMS Hour of Code