Engelman, S., McKlin, T., & Ericson, B., & Guzdial, M. (2011). Georgia Computes! Roll-Up Analysis: Student Workshops August 2009 to August 2010. (GaComputes! Technical Report). Atlanta: The Findings Group, LLC.

GA COMPUTES!
ROLL-UP ANALYSIS: STUDENT WORKSHOPS
AUGUST 2009-AUGUST 2010

The following analysis studies student attitudes before and after taking workshops through Georgia Computes! Four types of events were offered to elementary, middle and high school students during 2009-2010:

1. Girl Scouts Events: Four-hour programs for Girl Scouts in Alice, PicoCrickets, Pleo Robot, Robot Basics, Robot Extreme, Scratch, and Scribbler.
2. After School Programs (Cool Girls): Four-hour programs offered after school during the academic school year in Alice, Pleo Robot, PicoCrickets, LEGO NXT, and Scratch.
3. Summer Camps: 4-5 days camps at Georgia Tech for elementary, middle and high school students on Alice, PicoCrickets, PLEO, LEGO NXT, Scratch, CS Unplugged, and Media Computation.
4. Seeded Summer Camps: Georgia Computes! provides funding and training to other colleges and universities in Georgia to host their own summer camps for K-12 students in Alice, PicoCrickets, Scratch, LEGO NXT, Web Design, Flash animation, GameMaker, Mindstorms, 3D Animation, IPhone/Android Application, Game Art and Design, and Python Programming

At each event, questionnaires were administered before and after the event to measure any changes in attitudes toward computing. Those items are:

1. Computers are fun
2. Programming is hard
3. Girls can do computing
4. Boys can do computing
5. Computer jobs are boring.
6. I am good at computing.
7. I like computing
8. I know more than my friends about computers.

MAJOR FINDINGS

- Overall: Students who participated in GAComputes! workshops (2009-2010) experienced significant growth in their positive attitude towards computing.
  - Specifically, students made significant gains from pre to post in their reported self-efficacy in computing ("I am good at computing" and "I know more than my friends about computing"), their perception of computing as fun and likeable, and their view that computing is less difficult than they initially conceived ("Programming is hard").
  - Surprisingly, students' perceptions that computer jobs are boring significantly increased as a result of their participation in the workshop, and students' perceptions that girls can do computing significantly decreased. Thus, despite reporting that they feel more competent at computing and that they perceive computing as more enjoyable and less difficult than initially expected, students appear to hold slightly negative stereotypes about computing.

- Events: Students who participated in Girl Scouts, Summer Camps, and Seeded Summer Camps (2009-2010) experienced significant growth in their positive attitude towards computing. Despite modest improvements in positive attitudes towards computing, students who participated in Cool Computing (After School program) did not show significant gains from pre to post on any of the 8 assessment items.
  - Compared to the other programs, Girl Scout participants exhibited the most significant improvements in positive attitudes from pre to post.
  - Despite feeling more confident in their computing abilities, Girl Scout participants perceived girls as *less* likely to be able to do computing following the workshop. Seeded Summer Camp participants show the same pattern: despite increases in computing self-efficacy ("I know more than my friends about computing") and computing likeability ("I like computing."), perceptions of females' abilities to do computing significantly *decreased* following the workshop
  - In general, it appears that while GAComputes! workshops improve participants' computing ability and perceptions of computing as fun , additional focus may be needed in improving students' gender stereotypes regarding computing.

- Gender:
  - Overall, female students experienced significantly more growth in positive attitudes toward computing than male students. Both females and males report significant improvements in computing self-efficacy ("I am good at computing"), liking computing, and viewing computing as less difficult than initially conceived.
  - Once again, we see that negative gender stereotypes increased following workshop participation for both female and male students. What steps can GAComputes! take to improve gender stereotypes within the domain of computing?

- Race/Ethnicity:
  - Overall, White and multiracial students experienced a significant increase in positive attitudes towards computing. Black students show significant improvements in their computing self-efficacy (e.g., I am good at computing) and their perceptions of programming as being hard. Both Blacks and White students show significant decrements in their view that girls can do computing following the workshop.

DEMOGRAPHIC INFORMATION

PRE/POST

Pre	Post
997	966

EVENTS:

	Pre	Post
After School Program (Cool girls)	125	123
Girl Scouts	360	341
Summer camps	164	164
Seeded Summer camps	348	348

RACE/ETHNICITY:

	Pre	Post
Asian	49	47
Black	398	389
Hispanic	69	71
Native American/Alaskan	8	6
White	406	392
Multiracial	50	50

GRADE-LEVEL:

	Pre	Post
Elementary School (ES)	477	456
Middle School (MS)	444	434
High School (HS)	76	76

GENDER:

	Pre	Post
Female	651	629
Male	330	317

Table 1. Overall analysis Q1-Q8												
		n	Mean		t-test	Effect size		Strongly Disagree (1)	Disagree (2)	In Between (3)	Agree (4)	Strongly Agree (5)
1. Computers are fun.	pre	877	4.50		.067†	.002		1%	0%	8%	31%	60%
	post	805	4.54					1%	1%	7%	23%	68%
2. Programming is hard.	pre	872	3.11		.000**	.020		8%	13%	49%	21%	9%
	post	803	2.80					15%	23%	37%	15%	9%
3. Girls can do computing.	pre	770	4.40		.000**	.010		2%	3%	8%	28%	59%
	post	654	4.18					6%	5%	9%	25%	55%
4. Boys can do computing.	pre	767	4.27		.284	.001		4%	2%	10%	32%	53%
	post	652	4.26					2%	4%	12%	29%	53%
5. Computer jobs are boring.	pre	873	2.18		.000**	.012		33%	32%	25%	6%	5%
	post	799	2.39					30%	29%	22%	10%	9%
6. I am good at computing.	pre	867	3.56		.000**	.020		4%	6%	39%	32%	19%
	post	799	3.85					1%	5%	31%	34%	29%
7. I like computing.	pre	866	4.15		.000**	.010		2%	3%	17%	35%	43%
	post	789	4.34					1%	2%	12%	32%	53%
8. I know more than my friends about computing	pre	871	3.32		.002**	.007		4%	17%	39%	22%	18%
	post	785	3.53					5%	10%	36%	25%	24%

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

TABLE 2. Overall analysis: OVERALL MEAN ALPHA = .66						
		n	Mean		t-test	Effect Size
Overall Mean[a]	Pre	877		3.846	0.004**	0.005
	Post	805		3.925		

[a] Mean of Q1-Q8; reverse coded Q2 & Q5 Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

Overall, students who participated in GAComputes! workshops (2009-2010) experienced significant growth in their positive attitude towards computing. Specifically, students made significant gains from pre to post in their reported self-efficacy in computing ("I am good at computing" and "I know more than my friends about computing"), their perception of computing as fun and likeable, and their view that computing is less difficult than they initially conceived. Surprisingly, students' perceptions that computer jobs are boring significantly increased as a result of their participation in the workshop, and students' perceptions that girls can do computing significantly decreased. Thus, despite reporting that they feel more competent at computing and that they perceive computing as more enjoyable and less difficult than initially expected, students appear to hold negative stereotypes about computing.

Table 3. Overall analysis Q1-Q8: Events

		n		Mean	t-test	Effect size		Strongly Disagree (1)	2	3	4	Strongly Agree (5)
1. Computers are fun.		pre	125	4.70				0%	0%	2%	25%	73%
	After School Program	post	117	4.74	.574	.002		0%	2%	2%	18%	79%
	Girl Scouts**	pre	329	4.43				1%	0%	10%	32%	57%
		post	284	4.68	.000**	.032		0%	0%	5%	22%	73%
	Summer Camps	pre	160	4.57				0%	0%	7%	29%	64%
		post	160	4.55	.795	.000		0%	1%	6%	29%	64%
	Seeded Summer Camps †	pre	263	4.44				1%	1%	7%	35%	56%
		post	244	4.28	.062†	.007		5%	3%	11%	23%	59%
2. Programming is hard.		pre	124	2.87				17%	14%	47%	10%	12%
	After School Program	post	117	2.95	.619	.001		15%	18%	38%	13%	15%
	Girl Scouts**	pre	327	3.13				7%	14%	47%	22%	9%
		post	282	2.62	.000**	.054		19%	27%	34%	13%	7%
	Summer Camps†	pre	160	3.16				8%	9%	49%	26%	8%
		post	160	2.93	.051†	.012		14%	15%	44%	19%	8%
	Seeded Summer Camps**	pre	261	3.16				5%	13%	51%	23%	8%
		post	244	2.85	.001**	.022		11%	27%	37%	15%	10%
3. Girls can do computing.		pre	120	4.43				2%	1%	7%	34%	57%
	After School Program	post	94	4.48	.671	.001		1%	0%	9%	31%	60%
	Girl Scouts**	pre	244	4.45				4%	3%	7%	18%	69%
		post	208	3.98	.000**	.038		12%	9%	6%	18%	56%
	Summer Camps	pre	159	4.48				1%	3%	7%	26%	64%
		post	160	4.48	.974	.000		1%	3%	8%	28%	62%
	Seeded Summer Camps**	pre	247	4.27				2%	3%	10%	38%	48%
		post	192	3.99	.007**	.017		7%	7%	12%	29%	45%
4. Boys can do computing.		pre	119	3.92				8%	2%	18%	35%	37%
	After School Program	post	92	4.08	.322	.005		3%	5%	14%	35%	42%
	Girl Scouts	pre	242	4.15				6%	4%	10%	29%	51%
		post	209	4.29	.158	.004		2%	4%	11%	26%	56%
	Summer Camps	pre	159	4.56				1%	1%	6%	28%	65%
		post	160	4.56	.963	.000		0%	1%	7%	29%	64%
	Seeded Summer Camps**	pre	247	4.37				2%	2%	7%	35%	54%
		post	191	4.06	.001**	.025		4%	5%	16%	30%	45%

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

Continued Table 3. Overall analysis Q1-Q8: Events

		n		Mean	t-test	Effect size		Strongly Disagree (1)	2	3	4	Strongly Agree (5)
5. Computer jobs are boring.	After School Program	pre	124	1.73				56%	24%	13%	3%	3%
		post	117	1.86	.315	.004		48%	32%	13%	2%	6%
	Girl Scouts	pre	328	2.48				24%	28%	30%	9%	8%
		post	281	2.65	.109	.004		25%	27%	20%	13%	15%
	Summer Camps	pre	160	2.03				38%	33%	22%	4%	3%
		post	159	2.01	.910	.000		36%	33%	27%	3%	1%
	Seeded Summer Camps**	pre	261	2.10				30%	39%	25%	3%	3%
		post	242	2.57	.000**	.044		23%	29%	26%	14%	9%
6. I am good at computing.	After School Program*	pre	123	3.84				5%	5%	28%	27%	36%
		post	115	4.11	.046*	.017		1%	3%	28%	19%	49%
	Girl Scouts**	pre	327	3.45				6%	6%	41%	30%	17%
		post	284	3.75	.001**	.022		2%	6%	33%	35%	25%
	Summer Camps**	pre	158	3.59				4%	7%	35%	34%	20%
		post	158	3.88	.007**	.023		0%	4%	34%	32%	30%
	Seeded Summer Camps**	pre	259	3.55				2%	5%	44%	36%	14%
		post	242	3.83	.001**	.025		1%	5%	28%	43%	24%
7. I like computing.	After School Program	pre	122	4.50				2%	0%	6%	29%	63%
		post	113	4.57	.545	.002		3%	2%	4%	20%	72%
	Girl Scouts**	pre	326	3.97				2%	6%	20%	36%	36%
		post	280	4.38	.000**	.047		1%	1%	11%	33%	54%
	Summer Camps	pre	157	4.26				1%	1%	20%	30%	49%
		post	158	4.36	.284	.004		1%	1%	13%	31%	54%
	Seeded Summer Camps	pre	261	4.16				1%	2%	17%	41%	39%
		post	238	4.17	.845	.000		1%	3%	16%	37%	42%
8. I know more than my friends about computing	After School Program	pre	125	3.07				6%	22%	41%	18%	12%
		post	117	3.08	.974	.000		11%	21%	35%	14%	19%
	Girl Scouts**	pre	326	3.33				6%	16%	38%	18%	21%
		post	283	3.60	.004**	.014		4%	10%	35%	24%	27%
	Summer Camps*	pre	160	3.28				3%	15%	45%	24%	13%
		post	159	3.53	.022*	.016		4%	6%	42%	30%	19%
	Seeded Summer Camps*	pre	260	3.45				2%	15%	37%	28%	18%
		post	226	3.66	.026*	.010		3%	8%	35%	28%	26%

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

TABLE 3. Overall analysis: Events- OVERALL MEAN ALPHA = .66							
		n		Mean		t-test	Effect size
Overall Mean[a]	After School Program	pre	125	3.98		.710	.001
		post	117	4.00			
	Girl Scouts**	pre	329	3.73		.000**	.024
		post	284	3.92			
	Summer Camps†	pre	160	3.94		.054†	.012
		post	160	4.02			
	Seeded Summer Camps	pre	263	3.86		.251	.003
		post	244	3.81			

[a] Mean of Q1-Q8; reverse coded Q2 & Q5 Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

Students who participated in Girl Scouts, Summer Camps, and Seeded Summer Camps (2009-2010) experienced significant growth in their positive attitude towards computing. Despite modest improvements in positive attitudes towards computing, students who participated in Cool Computing (After School program) did not show significant gains from pre to post on any of the 8 assessment items.

Girl Scouts: Compared to the other programs, Girl Scout participants exhibited the most significant improvements in positive attitudes from pre to post. Self-efficacy regarding computing ("I am good at computing" and "I know more than my friends about computing") increased, as well as perceptions of computing as fun and likeable. Surprisingly, after participating in the workshops, students report more negative gender stereotypes regarding computing (See Q3 "Girls can do computing"). That is, despite feeling more confident in their computing abilities, Girl Scout participants perceived girls as *less* likely to be able to do computing following the workshop. How can GAComputes! more effectively address participants negative gender stereotypes regarding computing?

Summer Camps: Summer Camp participants at Georgia Tech reported significant improvements in their computing self-efficacy: After their participation, students were significantly more likely to report that they were "good at computing" and knew more than their friends about computing. Likewise, perceptions of computing as being hard significantly decreased after the summer camp, suggesting that participants' views of their own computing abilities may have improved.

Seeded Summer Camps: Seeded Summer Camp participants reported significant improvements in computing self-efficacy ("I know more than my friends about computing") and computing likeability ("I like computing."). Likewise, perceptions of programing as being hard significantly decreased from pre to post. Interestingly, perceptions of both girls' and boys' ability to do computing (see Q3 and Q4) *decreased* following the program. In general, it appears that while GAComputes! workshops improve participants' computing ability and perceptions of computing as fun , additional focus may be needed in improving students' gender stereotypes regarding computing.

Table 4. Overall analysis Q1-Q8: Gender

			n	Mean	t-test	Effect size		Strongly Disagree (1)	2	3	4	Strongly Agree (5)
1. Computers are fun.	female	pre	605	4.53				0%	0%	8%	30%	62%
		post	547	4.61	.101	.003		1%	1%	5%	22%	70%
	male	pre	257	4.46				1%	1%	7%	35%	56%
		post	241	4.40	.407	.524		3%	3%	9%	22%	63%
2. Programming is hard.	female**	pre	602	3.09				9%	13%	49%	20%	10%
		post	545	2.74	.000**	.023		17%	23%	38%	14%	8%
	male**	pre	255	3.17				6%	13%	48%	26%	8%
		post	241	2.95	.010**	.016		12%	22%	37%	19%	11%
3. Girls can do computing.	female**	pre	513	4.51				2%	2%	6%	23%	67%
		post	445	4.27	.001**	.012		6%	5%	6%	22%	61%
	male*	pre	244	4.19				2%	5%	11%	38%	45%
		post	206	4.00	.024*	.012		5%	7%	14%	32%	42%
4. Boys can do computing.	female	pre	510	4.18				5%	3%	11%	30%	51%
		post	443	4.27	.118	.003		2%	4%	11%	30%	53%
	male	pre	244	4.50				1%	0%	6%	34%	59%
		post	206	4.24	.390	.002		2%	3%	14%	28%	52%
5. Computer jobs are boring.	female**	pre	602	2.21				33%	30%	25%	6%	6%
		post	544	2.36	.002**	.010		31%	30%	20%	9%	10%
	male**	pre	257	2.10				33%	35%	25%	4%	4%
		post	239	2.47	.005**	.019		27%	26%	27%	12%	8%
6. I am good at computing.	female**	pre	596	3.57				5%	6%	39%	30%	21%
		post	543	3.84	.000**	.015		1%	5%	32%	32%	30%
	male **	pre	256	3.53				3%	7%	39%	35%	16%
		post	240	3.88	.000**	.031		1%	5%	28%	40%	27%
7. I like computing.	female**	pre	599	4.15				2%	3%	18%	33%	44%
		post	537	4.36	.001**	.011		1%	1%	12%	30%	55%
	male†	pre	252	4.17				1%	2%	16%	39%	41%
		post	237	4.30	.075†	.008		1%	2%	13%	35%	49%
8. I know more than my friends about computing	female	pre	601	3.28				5%	17%	40%	20%	18%
		post	543	3.44	.141	.002		6%	12%	37%	22%	23%
	male**	pre	255	3.42				2%	16%	39%	26%	17%
		post	225	3.75	.000**	.031		1%	5%	37%	32%	25%

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

TABLE 5. Overall analysis: Gender- OVERALL MEAN ALPHA = .66							
			n	Mean		t-test	Effect size
Overall Mean[a]	female**	pre	605	3.84		.001**	.009
		post	547	3.95			
	male	pre	257	3.86		.797	.000
		post	241	3.88			

[a] Mean of Q1-Q8; reverse coded Q2 & Q5

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

Overall, female students experienced significantly more growth in positive attitudes toward computing than male students. Both females and males report significant improvements in computing self-efficacy ("I am good at computing"), liking computing, and viewing computing as less difficult than initially conceived. However, once again, we see that negative gender stereotypes increased following workshop participation for both female and male students. What steps can GAComputes! take to improve gender stereotypes within the domain of computing?

Table 6. Overall analysis Q1-Q8: Race/Ethnicity													
			n	Mean	t-test	Effect size		Strongly Disagree (1)	2	3	4	Strongly Agree (5)
1. Computers are fun.	Asian	pre	44	4.36				5%	0%	5%	36%	55%
		post	39	4.36	.840	.001		8%	3%	5%	15%	69%
	Black	pre	371	4.55				1%	0%	7%	27%	65%
		post	348	4.52	.716	.000		1%	2%	7%	23%	67%
	Hispanic	pre	64	4.45				2%	0%	9%	30%	59%
		post	62	4.61	.371	.011		0%	0%	5%	29%	66%
	Native Am.	pre	6	4.67				0%	0%	0%	33%	67%
		post	4	4.25	.133	.583		0%	0%	25%	25%	50%
	White*	pre	328	4.46				0%	0%	8%	36%	55%
		post	299	4.55	.016*	.012		1%	2%	8%	22%	68%
	Multiracial	pre	48	4.56				0%	0%	6%	31%	63%
		post	46	4.70	.477	.007		2%	0%	0%	22%	76%
2. Programming is hard.	Asian†	pre	44	2.82				7%	27%	48%	14%	5%
		post	39	2.38	.080†	.043		21%	31%	41%	5%	3%
	Black**	pre	370	3.05				10%	12%	49%	22%	7%
		post	348	2.85	.004**	.013		15%	19%	41%	15%	9%
	Hispanic	pre	63	3.14				5%	11%	54%	25%	5%
		post	61	2.80	.147	.030		5%	38%	34%	18%	5%
	Native Am.	pre	6	3.33				17%	0%	17%	67%	0%
		post	4	2.75	.923	.004		50%	0%	0%	25%	25%
	White**	pre	326	3.17				6%	12%	50%	21%	10%
		post	298	2.73	.000**	.037		17%	24%	35%	17%	7%
	Multiracial	pre	47	3.40				13%	11%	28%	21%	28%
		post	46	3.22	.814	.001		11%	24%	28%	7%	30%
3. Girls can do computing.	Asian	pre	41	4.17				5%	10%	5%	24%	56%
		post	34	3.82	.309	.015		15%	6%	12%	18%	50%
	Black†	pre	345	4.46				1%	1%	8%	28%	61%
		post	306	4.30	.073†	.005		4%	4%	8%	25%	58%
	Hispanic	pre	39	4.31				5%	0%	10%	28%	56%
		post	36	4.39	.973	.000		0%	3%	11%	31%	56%
	Native Am.	pre	4	3.25				25%	25%	0%	0%	50%
		post	2	3.50	.638	.083		0%	0%	50%	50%	0%
	White**	pre	286	4.40				2%	3%	7%	28%	60%
		post	241	4.05	.000**	.026		7%	8%	8%	26%	51%
	Multiracial	pre	42	4.36				5%	0%	7%	31%	57%
		post	33	4.27	.773	.001		9%	0%	9%	18%	64%

Continued Table 6. Overall analysis Q1-Q8: Race/Ethnicity													
			n	Mean	t-test	Effect size		Strongly Disagree (1)	2	3	4	Strongly Agree (5)
4. Boys can do computing.	Asian	pre	41	4.29				5%	5%	7%	22%	61%
		post	33	4.27	.937	.000		3%	0%	18%	24%	55%
	Black	pre	341	4.25				4%	3%	11%	31%	52%
		post	306	4.26	.352	.001		2%	4%	11%	31%	52%
	Hispanic	pre	39	4.15				5%	3%	5%	46%	41%
		post	36	4.03	.310	.015		3%	3%	14%	50%	31%
	Native Am.	pre	4	5.00				0%	0%	0%	0%	100%
		post	2	5.00	1.000	.000		0%	0%	0%	0%	100%
	White	pre	286	4.33				3%	2%	8%	33%	54%
		post	240	4.27	.540	.001		2%	5%	11%	28%	54%
	Multiracial	pre	43	4.14				12%	0%	9%	21%	58%
		post	33	4.30	.444	.009		6%	0%	18%	9%	67%
5. Computer jobs are boring.	Asian*	pre	44	2.23				23%	43%	27%	2%	5%
		post	39	2.85	.018*	.077		15%	31%	26%	10%	18%
	Black*	pre	369	2.05				39%	29%	23%	5%	4%
		post	346	2.27	.020*	.009		32%	30%	23%	8%	7%
	Hispanic	pre	63	2.35				30%	30%	24%	6%	10%
		post	62	2.32	.572	.005		29%	32%	21%	13%	5%
	Native Am.	pre	6	1.67				33%	67%	0%	0%	0%
		post	4	2.00	.219	.444		75%	0%	0%	0%	25%
	White**	pre	328	2.27				29%	33%	26%	6%	6%
		post	296	2.49	.001**	.022		29%	27%	21%	13%	10%
	Multiracial	pre	48	2.40				27%	25%	33%	10%	4%
		post	45	2.11	.435	.008		36%	33%	22%	2%	7%
6. I am good at computing.	Asian	pre	44	3.55				5%	0%	48%	32%	16%
		post	39	3.72	.665	.003		3%	3%	31%	49%	15%
	Black**	pre	364	3.63				3%	7%	37%	29%	24%
		post	344	3.84	.009**	.011		0%	6%	33%	30%	31%
	Hispanic	pre	64	3.55				5%	5%	38%	38%	16%
		post	61	3.79	.220	.021		2%	5%	31%	38%	25%
	Native Am.	pre	5	3.60				0%	0%	40%	60%	0%
		post	4	4.00	.495	.167		0%	0%	50%	0%	50%
	White**	pre	326	3.52				4%	5%	43%	34%	15%
		post	298	3.85	.000**	.029		2%	3%	29%	38%	27%
	Multiracial*	pre	48	3.33				13%	15%	25%	23%	25%
		post	46	4.00	.048*	.055		2%	4%	24%	30%	39%

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

Continued Table 6. Overall analysis Q1-Q8: Race/Ethnicity													
			n	Mean		t-test	Effect size		Strongly Disagree (1)	2	3	4	Strongly Agree (5)
7. I like computing.	Asian	pre	44	4.18		.379	.011		5%	2%	9%	39%	45%
		post	39	4.00					5%	0%	26%	28%	41%
	Black	pre	365	4.23		.215	.002		2%	2%	16%	33%	48%
		post	341	4.33					1%	2%	13%	31%	52%
	Hispanic	pre	64	4.28		.284	.016		0%	2%	14%	39%	45%
		post	61	4.39					3%	0%	8%	31%	57%
	Native Am.	pre	6	4.17		1.000	.000		0%	0%	17%	50%	33%
		post	4	4.50					0%	0%	25%	0%	75%
	White**	pre	324	4.01		.000**	.043		2%	4%	21%	38%	35%
		post	294	4.36					0%	2%	11%	35%	52%
	Multiracial	pre	47	4.28		.964	.000		0%	4%	17%	26%	53%
		post	43	4.49					5%	0%	5%	23%	67%
8. I know more than my friends about computing.	Asian	pre	44	3.57		.451	.008		0%	11%	41%	27%	20%
		post	38	3.84					0%	5%	32%	37%	26%
	Black*	pre	369	3.28		.032*	.007		3%	19%	40%	21%	16%
		post	341	3.46					5%	13%	37%	23%	22%
	Hispanic	pre	64	3.23		.585	.004		3%	19%	42%	23%	13%
		post	62	3.45					3%	11%	37%	34%	15%
	Native Am.	pre	6	3.17		.591	.107		0%	33%	33%	17%	17%
		post	4	3.75					0%	0%	50%	25%	25%
	White*	pre	325	3.40		.019*	.011		4%	15%	38%	24%	19%
		post	287	3.64					3%	8%	37%	25%	27%
	Multiracial	pre	47	3.04		.690	.002		19%	9%	43%	9%	21%
		post	46	3.24					20%	7%	30%	17%	26%

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

TABLE 7. Overall analysis: Race/Ethnicity- OVERALL MEAN							
Pre and Post			N	Mean		t-test	Effect size
Overall Mean[a]	Asian	pre	44	3.871		.867	.000
		post	39	3.847			
	Black	pre	371	3.905		.467	.001
		post	348	3.934			
	Hispanic	pre	64	3.761		.114	.020
		post	62	3.915			
	Native American	pre	6	3.832		.418	.083
		post	4	4.000			
	White*	pre	328	3.811		.011*	.010
		post	299	3.930			
	Multiracial†	pre	48	3.717		.065†	.037
		post	46	3.933			

[a] Mean of Q1-Q8; reverse coded Q2 & Q5

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

Overall, White and multiracial students experienced a significant increase in positive attitudes towards computing. Black students show significant improvements in their computing self-efficacy (e.g., I am good at computing) and their perceptions of programming as being hard. Both Blacks and White students show significant decrements in their view that girls can do computing.

Table 8. Overall analysis Q1-Q8: Grade-level													
		n		Mean		t-test	effect size		Strongly Disagree (1)	2	3	4	Strongly Agree (5)
1. Computers are fun.	ES**	pre	424	4.52		.000**	.021		1%	0%	7%	30%	62%
		post	384	4.71					0%	1%	4%	19%	76%
	MS	pre	385	4.46		.296	.001		1%	0%	9%	32%	58%
		post	357	4.39					3%	2%	10%	24%	62%
	HS†	pre	68	4.57		.055†	.028		0%	0%	4%	34%	62%
		post	64	4.33					2%	3%	6%	39%	50%
2. Programming is hard.	ES**	pre	419	3.09		.000**	.023		10%	12%	48%	21%	10%
		post	382	2.74					20%	21%	34%	17%	9%
	MS**	pre	385	3.11		.001**	.016		7%	14%	50%	20%	9%
		post	357	2.85					11%	25%	40%	13%	10%
	HS†	pre	68	3.16		.062†	.026		4%	12%	50%	31%	3%
		post	64	2.86					9%	23%	45%	16%	6%
3. Girls can do computing.	ES**	pre	344	4.28		.000**	.020		4%	3%	8%	32%	53%
		post	293	3.95					10%	6%	10%	27%	46%
	MS	pre	358	4.47		.269	.002		1%	2%	8%	28%	61%
		post	297	4.39					3%	3%	7%	26%	61%
	HS*	pre	68	4.63		.027*	.037		1%	3%	3%	16%	76%
		post	64	4.23					3%	13%	6%	14%	64%
4. Boys can do computing.	ES*	pre	342	4.05		.011*	.010		6%	3%	13%	35%	43%
		post	292	4.26					1%	4%	12%	30%	51%
	MS*	pre	357	4.40		.025*	.008		2%	2%	8%	30%	58%
		post	296	4.23					4%	4%	11%	28%	53%
	HS**	pre	68	4.71		.006**	.058		0%	0%	1%	26%	72%
		post	64	4.38					2%	0%	13%	31%	55%
5. Computer jobs are boring	ES*	pre	421	2.15		.045*	.005		38%	28%	21%	6%	6%
		post	379	2.33					37%	25%	17%	9%	12%
	MS**	pre	384	2.19		.007**	.010		29%	34%	28%	5%	4%
		post	356	2.41					24%	33%	27%	10%	6%
	HS†	pre	68	2.26		.091†	.022		22%	40%	31%	4%	3%
		post	64	2.58					19%	33%	27%	16%	6%

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

ES= Elementary School MS= Middle School HS= High School

Continued Table 8. Overall analysis Q1-Q8: Grade-level													
		n		Mean		t-test	effect size		Strongly Disagree (1)	2	3	4	Strongly Agree (5)
6. I am good at computing.	ES**	pre	418	3.57		.000**	.023		6%	5%	35%	32%	22%
		post	380	3.89					2%	5%	28%	32%	33%
	MS**	pre	382	3.59		.000**	.020		1%	7%	41%	33%	18%
		post	355	3.85					1%	5%	32%	35%	27%
	HS*	pre	67	3.30		.023*	.040		4%	7%	52%	25%	10%
		post	64	3.64					0%	5%	39%	44%	13%
7. I like computing.	ES**	pre	415	4.20		.000**	.033		2%	3%	13%	37%	46%
		post	371	4.52					1%	1%	6%	26%	65%
	MS	pre	383	4.15		.458	.001		1%	3%	20%	33%	43%
		post	354	4.20					1%	2%	18%	34%	45%
	HS	pre	68	3.91		.264	.010		1%	1%	29%	40%	28%
		post	64	4.08					2%	2%	16%	50%	31%
8. I know more than my friends about computing.	ES**	pre	422	3.27		.002**	.011		5%	19%	38%	20%	18%
		post	383	3.51					6%	11%	33%	23%	26%
	MS†	pre	381	3.37		.065†	.005		4%	14%	40%	25%	17%
		post	338	3.51					4%	10%	39%	25%	22%
	HS†	pre	68	3.40		.080†	.023		1%	15%	44%	22%	18%
		post	64	3.69					2%	3%	41%	34%	20%

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10
ES= Elementary School MS= Middle School HS= High School

Table 9. Overall analysis: Grade-level- OVERALL MEAN							
		n		Mean		t-test	effect size
Overall Mean[a]	ES**	pre	424	3.81		.000**	.021
		post	384	3.96			
	MS	pre	385	3.88		.674	.001
		post	357	3.89			
	HS†	pre	68	3.89		.758	.001
		post	64	3.86			

[a] Mean of Q1-Q8; reverse coded Q2 & Q5

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

Overall, students in elementary school showed significantly greater improvements in positive attitudes toward computing than students in middle school and high school. However, all students report being significantly better at computing ("I am good at computing") and perceiving programming as less difficult than initially conceived ("Programming is hard") as a result of their participation in the workshops. Among elementary and high school students, we, once again, find a shift towards negative gender stereotypes: following participation in the workshops, elementary and high school students were less likely to agree that girls can do computing.

Table 10. Overall analysis Q1-Q8: Dosage

		n		Mean		t-test	effect size		Strongly Disagree (1)	2	3	4	Strongly Agree (5)
1. Computers are fun.	4 hours**	pre	454	4.51		.000**	.020		1%	0%	8%	30%	61%
		post	401	4.69					0%	0%	4%	21%	75%
	4 days	pre	71	4.66		.670	.001		0%	0%	6%	23%	72%
		post	71	4.62					0%	0%	6%	27%	68%
	5 days†	pre	352	4.45		.093†	.004		1%	1%	7%	35%	57%
		post	333	4.34					3%	3%	10%	25%	59%
2. Programming is hard.	4 hours**	pre	451	3.06		.000**	.023		10%	14%	47%	19%	10%
		post	399	2.71					18%	24%	35%	13%	9%
	4 days	pre	71	3.11		.252	.009		10%	7%	55%	18%	10%
		post	71	2.90					17%	11%	46%	15%	10%
	5 days**	pre	350	3.17		.000**	.020		5%	13%	49%	25%	8%
		post	333	2.88					11%	24%	38%	17%	9%
3. Girls can do computing.	4 hours**	pre	364	4.45		.000**	.020		3%	2%	7%	23%	65%
		post	302	4.13					8%	6%	7%	22%	57%
	4 days	pre	70	4.61		.993	.000		1%	0%	6%	21%	71%
		post	65	4.62					2%	2%	3%	22%	72%
	5 days*	pre	336	4.29		.031*	.007		1%	4%	9%	35%	50%
		post	287	4.12					5%	6%	11%	30%	48%
4. Boys can do computing.	4 hours†	pre	361	4.07		.075†	.005		7%	3%	13%	31%	46%
		post	301	4.23					3%	5%	12%	29%	52%
	4 days	pre	70	4.54		.575	.002		1%	1%	9%	19%	70%
		post	65	4.62					0%	2%	5%	25%	69%
	5 days**	pre	336	4.42		.003**	.014		1%	2%	6%	35%	56%
		post	286	4.21					3%	3%	13%	31%	50%
5. Computer jobs are boring	4 hours	pre	452	2.28		.101	.003		33%	27%	26%	7%	7%
		post	398	2.42					32%	28%	18%	10%	12%
	4 days	pre	71	1.93		.678	.001		44%	28%	23%	3%	3%
		post	71	2.00					38%	32%	24%	3%	3%
	5 days**	pre	350	2.10		.000**	.022		31%	38%	24%	4%	3%
		post	330	2.43					26%	30%	27%	11%	6%

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

Continued Table 10. Overall analysis Q1-Q8: Dosage													
		n		Mean		t-test	effect size		Strongly Disagree (1)	2	3	4	Strongly Agree (5)
6. I am good at computing.	4 hours**	pre	450	3.56		.000**	.021		6%	6%	38%	29%	22%
		post	399	3.85					2%	5%	32%	30%	32%
	4 days	pre	70	3.67		.102	.019		3%	1%	44%	29%	23%
		post	70	3.93					0%	4%	31%	31%	33%
	5 days**	pre	347	3.54		.000**	.025		2%	7%	40%	36%	15%
		post	330	3.83					1%	5%	30%	40%	25%
7. I like computing.	4 hours**	pre	448	4.12		.000**	.029		2%	4%	16%	34%	43%
		post	393	4.43					2%	1%	9%	29%	59%
	4 days	pre	70	4.41		.878	.000		0%	0%	17%	24%	59%
		post	71	4.39					0%	1%	13%	31%	55%
	5 days	pre	348	4.15		.346	.001		1%	2%	18%	39%	40%
		post	325	4.22					1%	2%	16%	35%	45%
8. I know more than my friends about computing.	4 hours*	pre	451	3.26		.018*	.007		6%	18%	39%	18%	19%
		post	400	3.45					6%	13%	35%	21%	25%
	4 days	pre	71	3.24		.372	.006		4%	15%	46%	20%	14%
		post	70	3.40					7%	9%	40%	26%	19%
	5 days**	pre	349	3.42		.002**	.014		2%	15%	38%	28%	17%
		post	315	3.66					3%	7%	37%	29%	24%

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

Table 11. Overall analysis: Dosage- OVERALL MEAN							
		n		Mean		t-test	effect size
Overall Mean[a]	4 hours	pre	454	3.80		.000**	.015
		post	401	3.95			
	4 days	pre	71	4.01		.494	.003
		post	71	4.07			
	5 days	pre	352	3.87		.989	.000
		post	333	3.87			

[a] Mean of Q1-Q8; reverse coded Q2 & Q5

Effect size = .01 ~ small; .06 ~ medium, .14 ~ large *p<.05 **p<.01 †approaching significance at p<.10

Overall, students who attended four hour workshops reported significantly greater improvements in positive attitudes toward computing than students who attended 4 day and 5 day workshops.