

# **2009 Evaluation Update**

**The Southwest Center for Microsystems  
Education**

**NSF # 0830384**

**By:  
David M. Hata  
SCME External Evaluator**

**May 14, 2009**

**2009 Evaluation and Assessment Update  
for  
The Southwest Center for Microsystems Education  
NSF # 0830384**

This evaluation report covers the period February 15, 2008, to May 1, 2009, but also includes cumulative data for The Southwest Center for Microsystems Education since its inception in 2004. This evaluation update is divided into the following parts:

1. SCME Mission and Goals
2. 2008 - 09 Faculty Enhancement Activities
3. Spring Semester 2008 Survey Results
4. Fall Semester 2008 Survey Results
5. Cumulative Survey Results, 2004 - 2008

### **SCME Mission and Goals**

SCME Mission Statement:

“The Southwest Center for Microsystems Education will serve as a sustainable resource center that identifies Microsystems technologist competencies, creates and disseminates educational materials and models, and provides professional development activities to develop a skilled microsystems workforce that can support research and development and manufacturing environments.”

SCME Goals:

- Increase educational capacity to produce technologists skilled in assisting microsystems research, design, and commercialization activities.
- Increase the general public’s awareness of the microsystems industry.

### **2008-09 Faculty Enhancement Activities**

The following are faculty workshops sponsored by SCME from January 1, 2008, to December 31, 2008:

- Pressure Sensor Workshop July, 2008
- “Demonstrating Microsystems in the Classroom” at SAME-TEC Conference July, 2008
- Pressure Sensor Workshop November, 2008
- “Introduction to Microsystems” November, 2008

## Spring Semester 2008 Survey Results

Fifty-five SCME workshop participants returned the 2008 Spring Semester Survey. Of the 55 respondents, 15 were faculty from post-secondary educational institutions who had used MEMS workshop material in their classes during the Spring semester. This instruction took place in ten states: AL, AZ, CA, FL, MA, MI, NY, OK, WA, and WI. Two hundred sixty-five students received MEMS instruction for a total of 2,449 student-hours of instruction. The number of students, number of instructional hours, and total student-hours by state are summarized in Table 1.

Table 1.  
Summary of Community College-Level MEMS Instruction by State  
for Spring Semester 2008.

State	Number of Students	Number of Instructional Hours	Total number of student-hours of instruction
Alabama	10	2	20
Arizona	10	20	200
California	32	6	96
Florida	76	20	380
Massachusetts	32	5	160
Michigan	14	1	14
New York	21	33	423
Oklahoma	9	4	36
Washington	48	110	860
Wisconsin	13	20	260
<b>Total:</b>	<b>265</b>	<b>221</b>	<b>2449</b>

The MEMS workshop material was integrated into a wide variety of subjects. The following are the titles of courses in which this material was integrated:

- Career Planning
- Nano/Microsystems
- Automation Systems
- Fundamentals of Robotics
- Electronic Devices I and II
- Logic Circuits I and II
- Nano Electronics
- Fundamentals of Nanoscience II
- MEMS-Based Nanotechnology
- Semiconductor I and II

Solid State Devices  
 Topics in Nanotechnology  
 Microcontroller Architecture  
 Engr 003 Science at Work

Five of the fifty-five survey respondents were high school teachers who integrated MEMS workshop material into their classes. Four of the five high school teachers were from New Mexico and one was from Vermont. In total, 208 high school students received a total of 2,244 student-hours of MEMS instruction. The names of the high school courses included:

Gifted Science  
 Computer Repair  
 Pre-K  
 MEMS  
 Geology  
 Robotics

One of the fifty-five survey respondents who used MEMS workshop material in their courses was from a four-year institution in Pennsylvania. A total of 6 four-year students received 9 hours of MEMS instruction for a total of 54 student-hours of MEMS instruction.

**Fall Semester 2008 Survey Results**

Sixty-eight SCME workshop participants returned the 2008 Fall Semester Survey. Of the 68 respondents, 17 were faculty from post-secondary educational institutions who had used MEMS workshop material in their classes during Spring semester. This instruction took place in ten states: AL, AZ, CA, FL, MA, ND, NY, OK, WA, and WI. One hundred ninety-nine students received MEMS instruction for a total of 1,444 student-hours of instruction. The number of students, number of instructional hours, and total student-hours by state are summarized in Table 2.

Table 2.  
 Summary of Community College-Level MEMS Instruction by State  
 for Fall Semester 2008.

State	Number of Students	Number of Instructional Hours	Total number of student-hours of instruction
Alabama	41	5	89
Arizona	15	5	30
California	20	1	20
Florida	18	4	72
Massachusetts	38	14	172
North Dakota	8	24	96

New York	8	3	24
Oklahoma	14	4	56
Washington	27	95	245
Wisconsin	10	64	640
<b>Total:</b>	<b>199</b>	<b>219</b>	<b>1444</b>

The MEMS workshop material was integrated into a wide variety of subjects. The following are the titles of courses in which this material was integrated:

- Applied Materials
- TEC 171
- Nano/Micro Systems
- Semiconductors
- Programming for Microcomputers
- Robotics & Automation
- Semiconductor Fabrication
- Nanoelectronics
- Introduction to Photonics
- Semiconductor I
- Technical Physics
- Microcontroller Fundamentals
- Semiconductor & Nanotechnology
- Sensors & Data Acquisition
- Introduction to Engineering
- Thin Film Technology

Five of the sixty-eight survey respondents were high school teachers who integrated MEMS workshop material into their classes. Three of the five high school teachers were from New Mexico, one from Vermont, and one from New York. In total, 235 high school students received a total of 2,089 student-hours of MEMS instruction. The names of the courses in which MEMS material was used include:

- Electronics
- Computer Repair
- MEMS I
- Geology
- Robotics
- Artificial Intelligence
- Digital Electronics

One of the sixty-eight survey respondents who used MEMS workshop material in their courses was from a four-year institution in Florida. A total of 20 four-year students received 42 hours of MEMS instruction for a total of 840 students-hours. The course title was “MEMS Devices & Applications.”

Student Demographics for Spring Semester 2008 and Fall Semester 2008

The student demographics for community colleges for Spring semester 2008 and Fall semester 2008 show similar results. As shown in Tables 3 and 4, the student population is primarily male (87%) and Caucasian (70%).

Table 3.  
Student Demographics, Community College, Spring 2008

State	Male	Female	Caucasian	Hispanic	Asian	African American	Native American	Other
AL	10	0	9	1	0	0	0	0
AZ	8	2	4	6	0	0	0	0
CA	19	13	12	4	11	1	1	3
FL	66	10	59	7	0	2	0	8
MA	29	0	15	2	2	6	0	4
ND	14	0	14	0	0	0	0	0
NY	20	1	13	1	1	6	0	0
OK	9	0	7	0	0	1	1	0
WA	40	8	39	2	5	0	0	2
WI	12	1	13	0	0	0	0	0
Totals:	227	35	185	23	19	16	2	17
%	87%	13%	71%	9%	7%	6%	1%	6%

Table 4.  
Student Demographics, Community College, Fall 2008

State	Male	Female	Caucasian	Hispanic	Asian	African American	Native American	Other
AL	31	10	29	4	0	8	0	0
AZ	13	2	7	5	0	1	2	0
CA	18	2	10	4	2	1	0	3
FL	16	2	12	3	0	3	0	0
MA	37	1	22	4	4	6	0	2
ND	4	4	8	0	0	0	0	0
NY	8	0	6	0	1	1	0	0
OK	4	0	3	0	0	1	0	0
WA	24	3	26	1	0	0	0	0
WI	9	1	10	0	0	0	0	0
Totals:	164	25	133	21	7	21	2	5
%	87%	13%	70%	11%	4%	11%	1%	3%

On the other hand, the student demographics for high school students show a male-to-female ratio of approximately 60:40. The student population is mainly Hispanic (>70%) with Caucasian students making up approximately 20 – 25%. See Tables 5 and 6.

Table 5.  
Student Demographics, High School, Spring 2008

State	Male	Female	Caucasian	Hispanic	Asian	African American	Native American	Other
NM	112	86	20	137	1	5	2	1
VT	12	3	15	0	0	0	0	0
Totals:	124	89	35	137	1	5	2	1
%	58%	42%	19%	76%	0.2%	3%	1%	0.2%

Table 6.  
Student Demographics, High School, Fall 2008

State	Male	Female	Caucasian	Hispanic	Asian	African American	Native American	Other
NM	192	130	21	207	2	4	3	0
VT	14	3	17	0	0	0	0	0
NY	27	5	33	0	0	0	0	0
Totals:	233	138	71	207	2	4	3	0
%	63%	37%	25%	72%	0.7%	1.3%	1%	0%

### Cumulative Survey Results, 2004 - 2008

SCME, through one-day workshops, two-day workshops, and one-week workshops, has provided professional development activities in MEMS instruction since 2005. Sixty-four of these workshop participants have integrated SCME MEMS workshop material into the classes that they teach and delivered MEMS instruction to 2,991 students for a total of 28, 098 student-hours of instruction. Of the 64 teachers using MEMS workshop material, 41 are community college instructors, 18 teach at secondary education schools, and 5 are four-year professors.

Table 7 provides instructional data by semester for community colleges. For each semester, the number of instructors reporting use of MEMS workshop material in their courses, the number of students receiving this instruction, the number of instructional hours delivered, and the total number of student-hours of instruction are given.

Table 7.  
Community College Use of Workshop Materials

<b>Fall Semester</b>	<b>2005-06</b>	<b>2006-07</b>	<b>2007-08</b>	<b>2008-09</b>
Number of Instructors	10	17	20	16
Number of Students	155	228	387	199
Hours of Instruction	49	200	297	219
Total Student-Hours	490	1960	3676	1444

<b>Spring Semester</b>	<b>2005-06</b>	<b>2006-07</b>	<b>2007-08</b>	<b>2008-09</b>
Number of Instructors	4	7	14	
Number of Students	25	141	265	
Hours of Instruction	104	138	221	
Total Student-Hours	767	1387	2449	

Table 7 provides instructional data by semester for secondary schools. For each semester, the number of instructors reporting use of MEMS workshop material in their courses, the number of students receiving this instruction, the number of instructional hours delivered, and the total number of student-hours of instruction are given.

Table 8.  
High School Use of Workshop Materials

<b>Fall Semester</b>	<b>2005-06</b>	<b>2006-07</b>	<b>2007-08</b>	<b>2008-09</b>
Number of Instructors	3	10	5	5
Number of Students	117	196	225	235
Hours of Instruction	41	162	55	93
Total Student-Hours	1055	2875	5223	2089

<b>Fall Semester</b>	<b>2005-06</b>	<b>2006-07</b>	<b>2007-08</b>	<b>2008-09</b>
Number of Instructors	4	6	5	
Number of Students	219	273	220	
Hours of Instruction	29	27	87	
Total Student-Hours	759	633	2244	



Figure 1 shows, in bar graph format, the total number of students hours for community colleges and high schools by semester. The number of student-hours peaked during Fall semester of 2007.

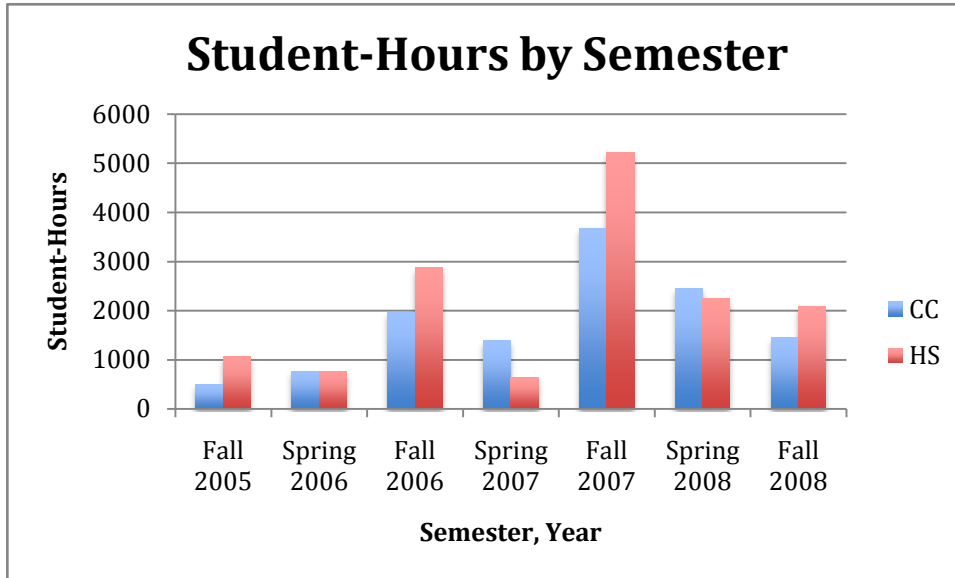


Figure 1. Graph of “Student-Hours” versus “Semester,Year.”

SCME is a regional ATE center, but has a national impact. The following graphs shown in Figure 2, 3, 4, and 5 show this national impact.

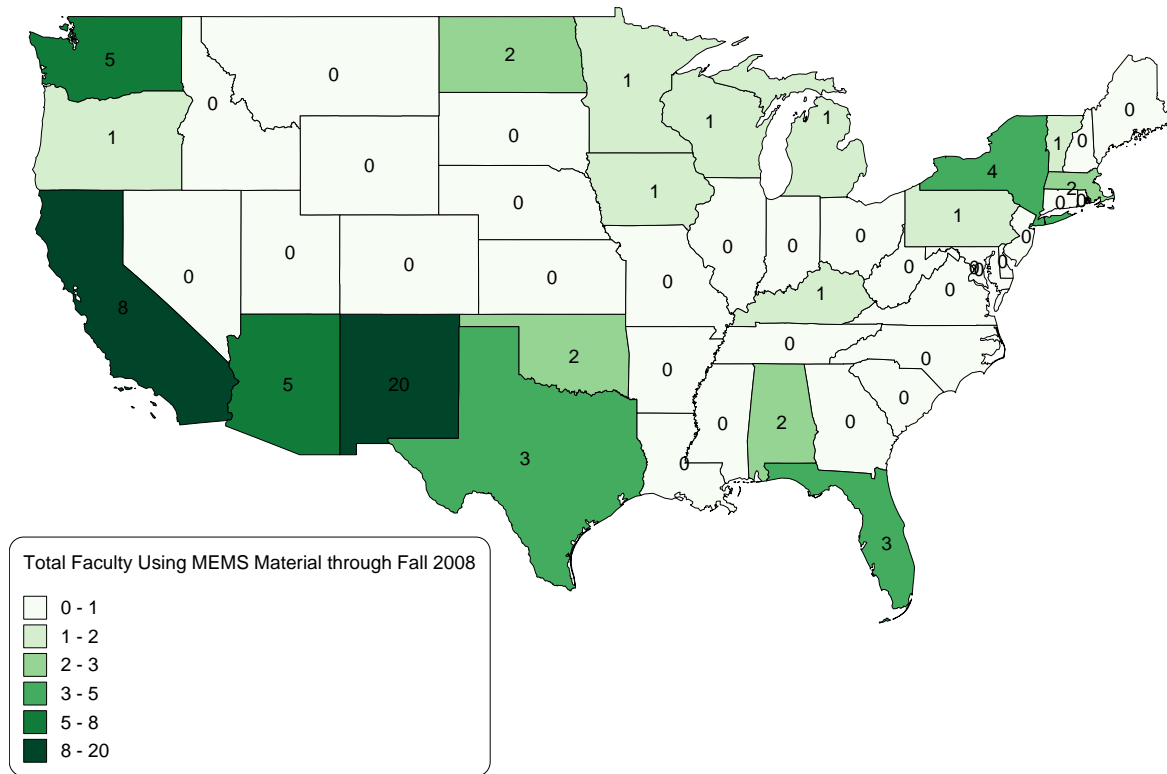


Figure 2. Map showing the distribution by state of teachers using SCME workshop material.

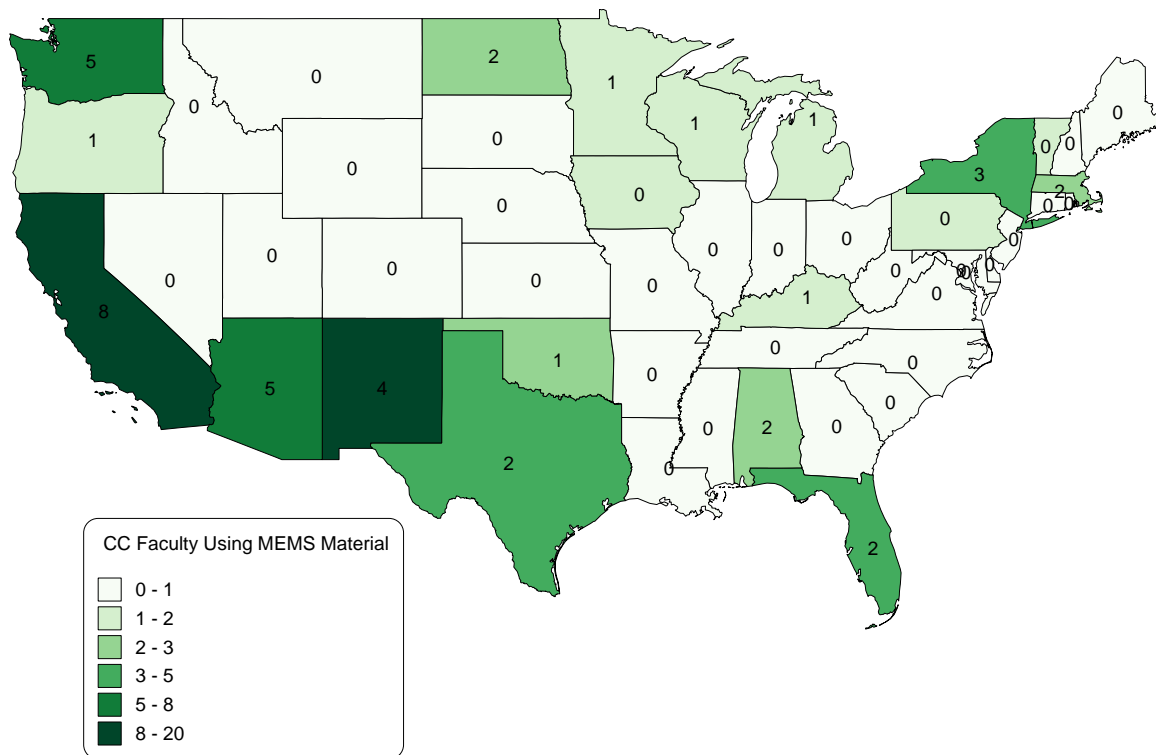


Figure 3. Map showing the distribution of CC faculty using SCME workshop material.

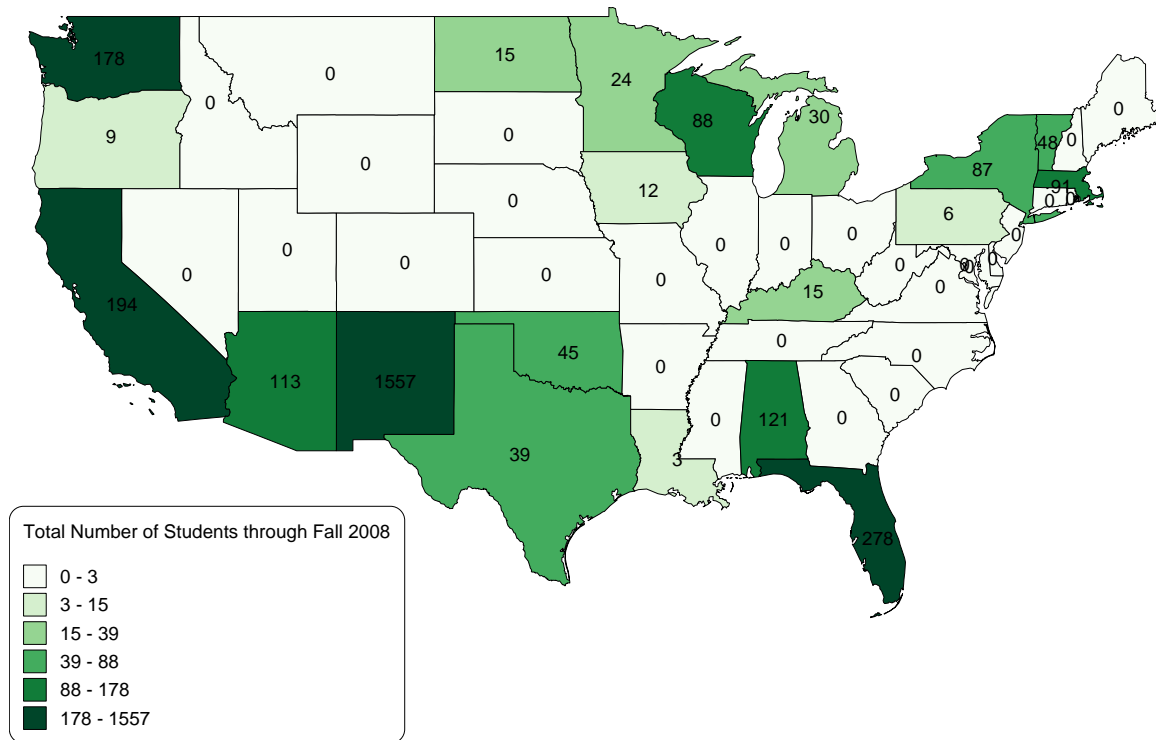


Figure 4. Map showing the distribution by state of students impacted, by state.

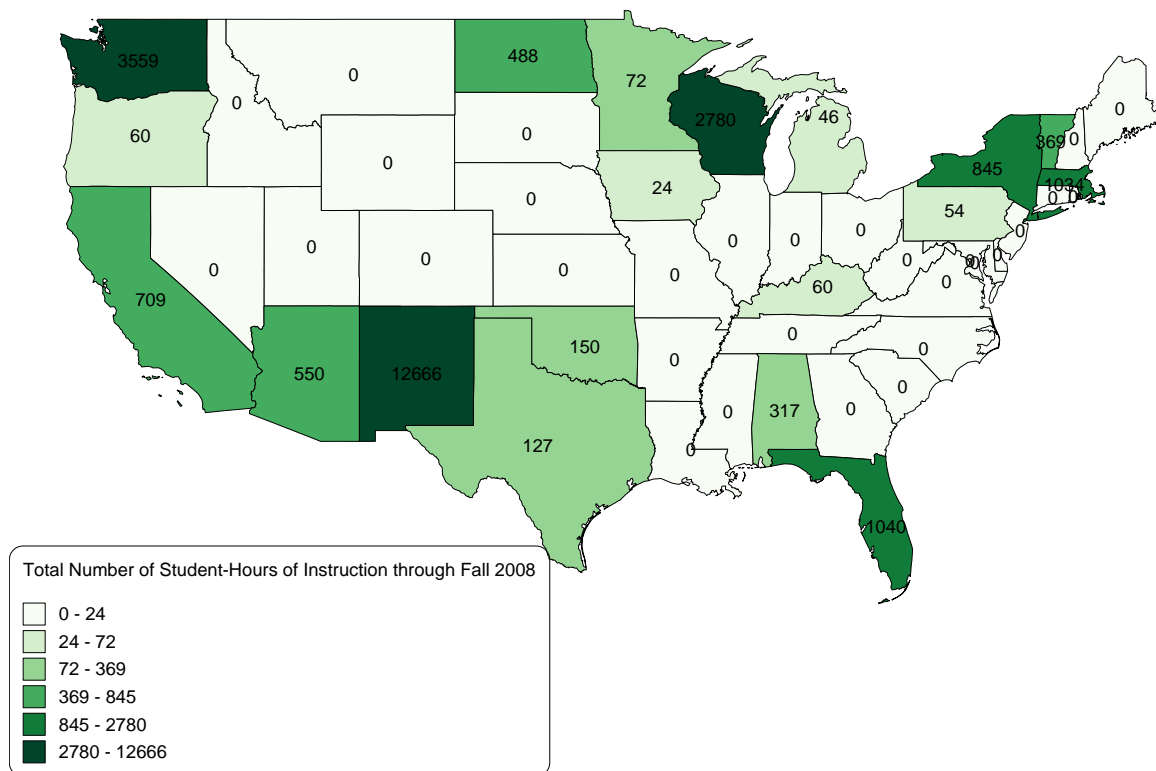


Figure 5. Map showing the distribution of student-hours of instruction, by state.