Center for Research in Educational Policy

The University of Memphis
325 Browning Hall
Memphis, Tennessee 38152
Toll Free 1-866-670-6147

FLORIDA'S

ENHANCING EDUCATION THROUGH TECHNOLOGY

Leveraging Laptops: Effective Models for Enhancing Student Achievement

2006-2007 EVALUATION REPORT: Classroom Practices

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Leveraging Laptops: Effective Models for Enhancing Student Achievement

2006-2007 EVALUATION REPORT: Classroom Practices

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Deborah L. Lowther
J. Daniel Strahl
Steven M. Ross
Ying Huang
Center for Research in Educational Policy

Florida's Enhancing Education Through Technology (Florida EETT)
Leveraging Laptops: Effective Models for Enhancing Student Achievement

2006-2007 EVALUATION REPORT: Classroom Practices

ABSTRACT

This report summarizes the 2006-2007 evaluation that was focused toward investigating one primary question: What changes in tool-based, student-centered teaching happen as a result of the infusion of technology and professional development? The research methodology involved the use of trained external researchers from Florida EETT schools conducting multi-class and targeted classroom observations in each participating school during two time periods: baseline (fall 2006) and end of year one (spring 2007). A total of 381 hours of direct classroom observations were conducted in 845 FL EETT classrooms in 41 schools representing 11 districts. Observation data were collected with the School Observation Measure (SOM©) and the Survey of Computer Use (SCU©). The SOM was used to collect data regarding overall classroom activities and the SCU was used to assess student use of computers. Both descriptive and inferential analyses were conducted. The Mantel-Haentzel procedure was used to infer statistical differences between the fall and spring classroom observations.

Both the SOM and SCU Multi-Class and Targeted observations revealed significant fall to spring increases in the use of teacher-centered practices. For the SOM, significant increases were found for both the Multi-Class and Targeted observations for student engagement in "Project-based learning", "Independent inquiry/research on the part of students", and student use of "Technology as a learning tool or resource." The SCU results from both the Multi-Class and Targeted observations yielded significant increases in students' overall use of newer and more up-to-date computers (laptops) and positive trends toward increased uses of production tools and Internet/research tools to support learning. A key finding that emerged from the results was the significant increase in the frequency with which teachers implemented meaningful computer activities that engaged students in higher-order thinking and problem solving through effective use of laptop-based technology tools.

These first year results show promising trends in that the Florida EETT program seems to be serving as a catalyst for positive changes from traditional teaching environments to ones that are student-centered and engage learners in meaningful use of computers to enhance learning. However, the data also reveal room for continued growth due to the modest frequency with which most of these changed practices occurred. An additional consideration when reviewing the evaluation results is the possible bias that may occur due to observer involvement in the Florida EETT program.

2006-2007 EVALUATION REPORT: CLASSROOM PRACTICES

This report summarizes the 2006-2007 classroom practices evaluation results of the Florida EETT program. The overall purpose of the evaluation was twofold: (a) to provide evidence of EETT program implementation progress as demonstrated through classroom practices and (b) to provide formative evaluation data of classroom practices as a basis for guiding improvement planning. The evaluation question, participants, instrumentation, procedures, and results are provided in the sections to follow.

EVALUATION QUESTION

This evaluation was focused toward investigating one primary question: What changes in tool-based, student-centered teaching happen as a result of the infusion of technology and professional development?

METHODOLOGY

The methodology chosen to address the evaluation question was to conduct direct classroom observations in each participating Florida EETT school during two time periods: baseline (fall 2006) and end of year one (spring 2007). Trained external researchers from Florida EETT schools conducted both multi-class and targeted observations. The two types of observations were used to more fully investigate program impact on classroom practices. The intent of the multi-class observations was to identify laptop integration practices that routinely occur on a day-to-day basis. Conversely, targeted observations were prescheduled and allowed teachers to demonstrate their best practices with regard to integrating the use of laptops into classroom instruction. Details of the participants, observation measures, and procedures are provided below.

Participants

A total of 428 Florida laptop teachers and approximately 8,500 students from 41 schools participated in the observation activities. The schools represented 11 districts from rural Florida as

well as major metropolitan areas distributed across the state. Of the 41 schools, 12 were elementary schools, 17 middle schools, and 12 were high schools.

Measures and Procedures

External researchers completed extensive training to conduct both multi-class and targeted classroom observations of Florida EETT classrooms with two data collection instruments: the School Observation Measure (SOM©), and the Survey of Computer Use (SCU©). The SOM was used to collect data regarding overall classroom activities and the SCU was used to assess student use of computers.

The *multi-class* procedure involved an observer visiting 10-12 randomly selected laptop classrooms for 15 minutes each during a three-hour visitation period. At the conclusion of the three-hour visit, the observer summarized the frequency with which the SOM and SCU strategies were observed across all classes on a data summary form. *Targeted* observations involved observing laptop classrooms during prearranged 45- to 90-minute sessions in which randomly selected Florida EETT teachers were asked to implement a prepared lesson that integrated the use of laptops. Notes forms were completed every 15 minutes of the lesson and then summarized on a data summary form.

SOM. The SOM was developed to determine the extent to which different common and alternative teaching practices are used throughout an entire school or program (Ross, Smith, & Alberg, 1999). The observer examines classroom events and activities descriptively, not judgmentally. Notes are taken relative to the use or nonuse of 24 target strategies. The notes form also contains two global items that use a three-point scale (low, moderate, high) to rate, respectively, the degree of academically focused instructional time and degree of student attention and interest. The frequency is recorded via a 5-point rubric that ranges from (0) Not observed to (4) Extensively. The same 5-point scale is used to summarize how frequently *high* academically focused class time and *high* student interest/attention are observed.

To ensure the reliability of data, observers receive a manual providing definitions of terms, examples and explanations of the target strategies, and a description of procedures for completing the instrument. The target strategies include traditional practices (e.g., direct instruction and

independent seatwork) and alternative, predominately student-centered methods associated with educational reforms (e.g., cooperative learning, project-based learning, inquiry, discussion, using technology as a learning tool). The strategies were identified through surveys and discussions involving policy makers, researchers, administrators, and teachers, as those most useful in providing indicators of schools' instructional philosophies and implementations of commonly used reform designs (Ross, Smith, Alberg, & Lowther, 2001).

In a 2004 reliability study reported by Sterbinsky, Ross and Burk, observer ratings were within one category for 96% of the multi-class observations and for 91% of the targeted observations.

SCU. A companion instrument to the SOM is the Survey of Computer Use (SCU) (Lowther & Ross, 2001). The SCU was completed as part of the SOM observation sessions, during which SCU data were also recorded in 15-minute intervals and then summarized on an overall data form.

The SCU was designed to capture exclusively *student* access to, ability with, and use of computers rather than teacher use of technology by recording four types of data: (a) computer capacity and currency, (b) configuration, (c) student computer ability and (d) student activities while using computers. Computer capacity and currency is defined as the age and type of computers available for student use and whether or not Internet access was available. Configuration refers to the number of students working at each computer (e.g., alone, in pairs, in small groups). Student computer ability was assessed by recording the number of students who were computer literate (i.e., easily used software features/menus) and the number of students who easily used the keyboard.

The next section of the SCU focuses on student use of computers with regard to: the types of activities, the subject areas of activities, and the software being used. The computer activities are divided into four categories based on the type of software tool: production tools, Internet/research tools, educational software, and testing software. Within each category, primary types of software are identified. For example, under Production Tools, the software includes: word processing, databases, spreadsheets, draw/paint/graphics, presentation (e.g., PowerPoint®),

authoring (e.g., KidPix®), concept mapping (e.g., Inspiration), and planning (MS Project®). For the Internet/Research Tools, three types of software are included: Internet browser, CD reference materials, and communications (e.g., email, listservs, and chat rooms). The Educational Software category also has three types of software: drill/practice/tutorial, problem-solving (e.g., Riverdeep™), and process tools (e.g., Author's Toolkit™). Testing Software has individualized/tracked (Accelerated Reader™) and generic types. With this type of recording system, several activities can be noted during the observation of one student working on a computer. For example, if a student gathered data from the Internet, created a graph from the data, and then imported the graph into a PowerPoint presentation, the observer would record three types of software tools as being observed: Internet browser, spreadsheet, and presentation.

This section of the SCU ends by identifying the subject area of each computer activity. The categories include: language arts, mathematics, science, social studies, other, and none. The computer activities and software being used are summarized and recorded using a five-point rubric that ranges from (0) Not Observed to (4) Extensively observed. The final section of the SCU is an "Overall Rubric" designed to assess the degree to which the activity reflects "meaningful use" of computers *as a tool* to enhance learning. The rubric has four levels: 1) Low-level use of computers, 2) Somewhat meaningful, 3) Meaningful, and 4) Very meaningful. Reliability data for the SCU (Sterbinsky & Burke, 2004) show that observer ratings were within one category for 97% of the multi-class observations and for 91% of the targeted observations.

Data Collection

A data collection summary of the Florida EETT classroom observations is presented in Table 1. A total of 381 hours of direct classroom observations were conducted in 845 FL EETT classrooms.

TABLE 1

Data Collection Summary

Type	Instrument	Number Collected		Classrooms Observed		Schools Involved		Procedure
		Fall	Spring	Fall	Spring	Fall	Spring	
Multi-Class Observations	SOM	34	54	284	447	41	41	Multi-class observations were three- hour sessions in which external researchers observed about 10 randomly selected classes for 15 minutes each. The purpose was to obtain a program-wide perspective on common teaching practices and the use of technology in EETT laptop classrooms.
	SCU	35	54			41	41	
Targeted Classroom Observations	SOM	38	76	38	76	41	41	Targeted observations were pre-arranged one-hour sessions in which EETT teachers were asked to demonstrate a prepared lesson using laptops. Note forms were completed every 15 minutes of the lesson.
	SCU	37	70			41	41	

Data Analysis

The majority of observation results for both SOM and SCU are in an ordinal scale of measurement, which usually fails to have a normal distribution. In addition, the observations in school year 2006-07 were collected twice: once in fall 2006 (pre), then in spring 2007 (post). Thus, to account for data stratified in nature and with particular characteristics (i.e., ordinal response data and repeated measures), the Mantel-Haentzel procedure was used to infer statistical differences between the pre- and post-classroom observations.

Two statistics, Q_{SMH} and Q_{CSMH}, were reported. The statistic Q_{SMH} was used to measure the trend (e.g., increase or decrease) in the value of responses between observations, while Q_{CSMH} was used to detect whether the mean responses were the same across the measurement time points (pre = Fall and post = Spring). As data from both SOM and SCU are complete (i.e., without missing values), the Q_{SMH} and Q_{CSMH} outcomes are identical in value (see Tables 2, 3 and 4). For multiple comparisons, the Bonferroni adjustment was used on the alpha level to control the experimental-wise error. However, because of the strictness of the Bonferroni adjustment, observations that approached the adjusted significance level were also reported. Effect sizes were computed by dividing the mean difference by the pooled standard deviation. Except where noted,

a positive sign before the effect size is indicative of outcomes favoring the spring (post) over the fall (pre) observation results, while a negative sign reveals that the fall had higher ratings than the spring.

RESULTS

The results of the study are presented below by data collection strategy: multi-class and targeted observations. Within these categories, data are presented by observation measure (SOM; SCU). In the Conclusion section, findings are synthesized across the two instruments to address the evaluation question.

Multi-Class Observation Results

A total of 89 multi-class observations (35 Fall and 54 Spring) were conducted in 41 Florida schools, which yielded approximately 267 hours of direct observation. The SOM and SCU instruments were used to collect data from unannounced, random visits to 284 classrooms in the fall and 447 classrooms in the spring. Results from the multi-class visits are presented below by observation instrument.

Multi-Class SOM

The SOM results from the fall and spring observations revealed changes in teaching strategies as well as student activities (see Table 2). Overall, the greatest fall (baseline) to spring differences were seen in increased "High student attention, interest, and engagement" (Fall *M* = 2.18, Spring *M* = 2.91, *ES* = +1.00) and a decrease in the use of traditional "Independent seatwork" (Fall *M* = 2.68, Spring *M* = 1.69, *ES* = -1.00). Other notable differences include greater use of "Project-based learning" (*ES* = + 0.93), "Teacher acting as coach/facilitator" (*ES* = + 0.78), "Cooperative/Collaborative learning" (*ES* = + 0.62), "Independent inquiry/research" (*ES* = + 0.63), and "High academically focused class time" (*ES* = + 0.61), with an understandable decline in the use of "Direct instruction" (Fall *M* = 2.91, Spring *M* = 2.19, *ES*= -0.82). Of particular interest are the positive changes in computer use. While use of "Computers as a delivery tool" (a teacher-centered

activity) showed a decrease (*ES*= -.40), student use of "Technology as a learning tool" (student-centered) showed a impressive increase. (*ES*=+.61)

TABLE 2

Multi Class School Observation Measure (SOM)

Fall (Baseline) N=34 (284 Classrooms)
Spring N=54 (447 Classrooms)

The extent to which each of the following was observed in the classroom.		Percent Observed			Florida EETT			National Norm	
		None or Rarely	Occasionally	Frequently or Extensively	Mean	Standard Deviation	*ES*	Mean	Standard Deviation
Instructional Orientation									
Direct instruction (lecture)	Baseline	5.9	20.6	73.5	2.91	0.83	-0.82	2.77	1.01
	Spring	22.3	38.9	38.9	2.19	0.87			
Team teaching	Baseline	94.1	5.9	0.0	0.38	0.60	+0.15	0.81	0.94
	Spring	88.9	11.1	0.0	0.52	0.69			
Cooperative/collaborative learning	Baseline	73.6	26.5	0.0	0.85	0.82	+0.62	1.08	0.98
	Spring	48.2	33.3	18.5	1.46	1.06			
Individual tutoring (teacher, peer, aide, adult volunteer)	Baseline	82.3	14.7	2.9	0.62	0.85	-0.25	0.77	0.94
	Spring	90.7	9.3	0.0	0.44	0.66			
Classroom Organization									
Ability groups	Baseline	85.3	5.9	8.8	0.71	1.12	0.00	1.16	1.33
	Spring	81.5	5.6	13.0	0.72	1.16			
Multi-age grouping	Baseline	94.1	5.9	0.0	0.21	0.54	+0.30	0.58	1.03
	Spring	87.1	9.3	3.7	0.39	0.81			
Work centers (for individuals or groups)	Baseline	94.2	5.9	0.0	0.24	0.55	+0.17	1.35	1.14
	Spring	94.4	5.6	0.0	0.33	0.58			
Instructional Strategies									
Higher level instructional feedback (written or verbal) to enhance student learning	Baseline	55.9	23.5	20.5	1.35	1.20	+0.17	1.44	1.15
	Spring	53.7	20.4	26.0	1.61	1.16			
Integration of subject areas (interdisciplinary/thematic units)	Baseline	91.2	5.9	2.9	0.59	0.86	+0.20	0.54	0.80
	Spring	79.7	7.4	13.0	0.80	1.11			
Project-based learning	Baseline	79.4	20.6	0.0	0.59	0.82	+0.93	0.45	0.76
	Spring	50.0	18.5	31.5	1.56	1.33			
Use of higher-level questioning strategies	Baseline	61.8	20.6	17.6	1.26	1.08	+0.25	1.63	1.12
	Spring	53.7	16.7	29.7	1.59	1.32			
Teacher acting as a coach/facilitator	Baseline	58.8	20.6	20.5	1.26	1.24	+0.78	2.29	1.18
	Spring	29.7	35.2	35.2	2.19	1.07			
Parent/community involvement in learning activities	Baseline	100.0	0.0	0.0	0.06	0.24	0.00	0.31	0.60
	Spring	98.2	0.0	1.9	0.13	0.58			
Student Activities									
Independent seatwork (self-paced worksheets, individual assignments)	Baseline	12.7	20.6	64.7	2.68	1.04	-1.00	2.41	0.98
	Spring	46.3	31.5	22.2	1.69	1.02			
Experiential, hands-on learning	Baseline	73.5	23.5	2.9	0.85	0.89	+0.45	1.20	1.00
	Spring	59.2	18.5	22.3	1.35	1.26			

The extent to which each of the following was observed in the classroom.		Percent Observed			Florida EETT			National Norm	
		None or Rarely	Occasionally	Frequently or Extensively	Mean	Standard Deviation	*ES*	Mean	Standard Deviation
Systematic individual instruction (differentiated assignments geared to individual needs)	Baseline	97.1	2.9	0.0	0.32	0.53			
	Spring	90.8	5.6	3.7	0.39	0.9	+0.14	0.44	0.76
Sustained writing/composition (self-selected or teacher-generated topics)	Baseline	91.2	5.9	2.9	0.47	0.75			
	Spring	85.2	13.0	1.9	0.65	0.78	+0.13	0.75	0.86
Sustained reading	Baseline	88.2	5.9	5.9	0.53	0.86			
	Spring	85.1	14.8	0.0	0.70	0.72	+0.25	1.08	0.98
Independent inquiry/research on the part of students	Baseline	85.3	8.8	5.9	0.76	0.85			
	Spring	57.4	25.9	16.7	1.43	1.02	+0.63	0.32	0.65
Student discussion	Baseline	67.7	32.4	0.0	1.00	0.82			
	Spring	59.2	33.3	7.5	1.09	1.07	+0.10	0.89	1.11
Technology Use									
Computer for instructional delivery (e.g. CAI, drill & practice)	Baseline	20.5	55.9	23.5	2.09	0.90			
	Spring	38.9	35.2	25.9	1.72	1.12	-0.40	0.96	0.97
Technology as a learning tool or resource (e.g. Internet research, spreadsheet or database creation)	Baseline	58.9	26.5	14.7	1.35	1.15			
	Spring	27.8	35.2	37.0	2.15	1.07	+0.61	0.80	0.98
Assessment									
Performance assessment strategies	Baseline	94.2	0.0	5.9	0.29	0.76			
	Spring	87.1	7.4	5.6	0.52	0.86	+0.23	0.50	0.83
Student self-assessment (portfolios, individual record books)	Baseline	91.1	5.9	2.9	0.24	0.70			
	Spring	98.2	1.9	0.0	0.24	0.47	0.00	0.32	0.65
Summary Items									
High academically focused class time	Baseline	5.9	38.2	55.9	2.59	0.74			
	Spring	0.0	18.5	81.5	3.04	0.64	+0.61	3.33	0.80
High level of student attention, interest, engagement	Baseline	14.7	55.9	29.4	2.18	0.72			
	Spring	1.9	25.9	72.3	2.91	0.73	+1.00	3.12	0.83

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively

SOM Multi-Class Inferential Analyses

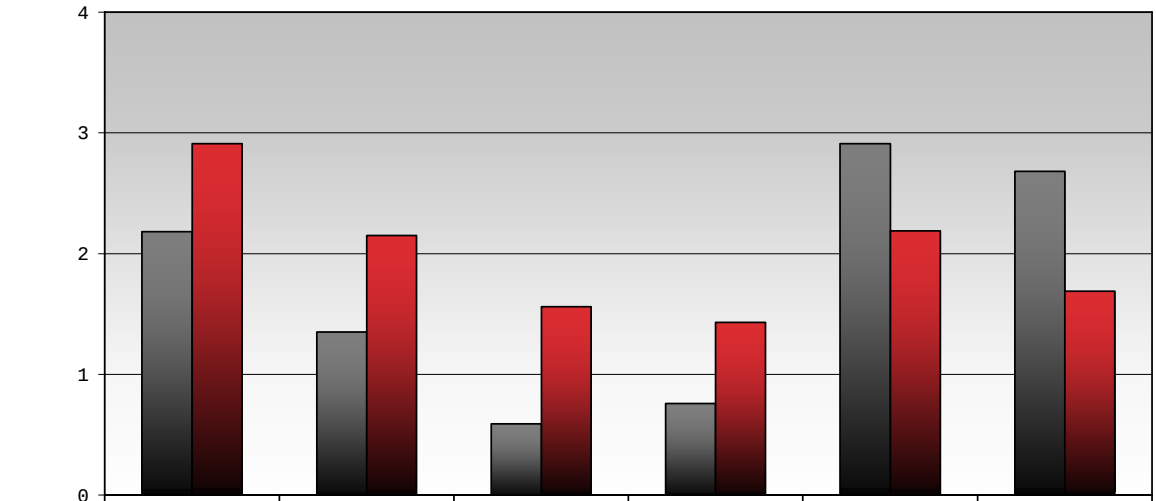
As previously mentioned, there are a total of 26 items on the SOM, which are evaluated using an ordinal 5-point Likert scale that ranges from "0 = Not observed" to "4 = Extensively". The SOM multi-class inferential analysis outcomes are presented in Table 3 and Figure 1. The FL EETT classrooms that were observed had significant increases on four SOM items: (1) "Project-based learning" (*p<.001)*, (2) "Independent inquiry/research on the part of students" (*p=.001)*, (3) "Technology as a learning tool or resource" (*p<.001)*, and (4) "High level of student attention/interest/engagement" (*p<.001),* and significant decreases in "Direct instruction" (*p=.001)* and "Independent seatwork" (*p<.001)*. In addition, two items, (1) "Teacher acting as a coach/facilitator" (*p=.0021)* and (2) "High academically focused class time" (*p=.0021),* approached significance with large associated effect sizes.

TABLE 3

SOM Multi-Class Means Comparison between Fall and Spring Using Mantel-Haentzel Test

Item	Q_{SMH}	*p*	Q_{CSMH}	*p*
Instructional Orientation				
Direct instruction (lecture)	10.639*	.001	10.639*	.001
Team teaching	0.519	.471	0.519	.471
Cooperative/collaborative learning	6.721	.010	6.721	.010
Individual tutoring (teacher, peer, aide, adult volunteer)	2.045	.153	2.045	.153
Classroom Organization				
Ability groups	0.288	.592	0.288	.592
Multi-age grouping	2.253	.133	2.253	.133
Work centers (for individuals or groups)	0.828	.363	0.828	.363
Instructional Strategies				
Higher-level instructional feedback (written or verbal) to enhance student learning	0.865	.352	0.865	.352
Integration of subject areas (interdisciplinary/thematic units)	2.124	.145	2.124	.145
Project-based learning	13.627*	<.001	13.627*	<.001
Use of higher-level questioning strategies	2.139	.144	2.139	.144
Teacher acting as a coach/facilitator	9.459	.0021	9.459	.0021
Parent/community involvement in learning activities	0.441	.507	0.441	.507
Student Activities				
Independent seatwork (self-paced worksheets, individual assignments)	13.133*	<.001	13.133*	<.001
Experiential, hands-on learning	4.573	.033	4.573	.033
Systematic individual instruction (differential assignments geared to individual needs)	0.180	.671	0.180	.671
Sustained writing/composition (self-selected or teacher-generated topics)	0.636	.425	0.636	.425
Sustained reading	0.656	.418	0.656	.418
Independent inquiry/research on the part of students	10.565*	.001	10.565*	.001
Student discussion	1.323	.250	1.323	.250
Technology Use				
Computer for instructional delivery (e.g., CAI, drill & practice)	2.760	.097	2.760	.097
Technology as a learning tool or resource (e.g., Internet research, spreadsheet creation, multi-media, CD Rom, Laser disk)	10.419*	.001	10.419*	.001
Assessment				
Performance assessment strategies	0.590	.442	0.590	.442
Student self-assessment (portfolios, individual record books)	0.001	.974	0.001	.974
Summary Items				
High academically focused class time	9.486	.0021	9.486	.0021
High level of student attention/interest/engagement	16.988*	<.001	16.988*	<.001

**statistically significant at alpha<.0019*



	High Student Attention	Technology as a Learning Tool	Project-based Learning	Independent Research	Direct Instruction	Independent Seatwork
Fall	2.18	1.35	0.59	0.76	2.91	2.68
Spring	2.91	2.15	1.56	1.43	2.19	1.69

Figure 1. Multi-Class SOM: Significant Fall vs. Spring Differences

Multi-Class SCU

As seen in Table 4, the number of classrooms with "11 or more" computers available for student use increased from 57.1% in the fall to 72.2% in the spring, with 98.1% of the computers observed in the spring considered as "Up-to-date". There was also an increase (Fall = 28.6%; Spring = 51.9%) in the percentage of classrooms in which the laptops were used by "nearly all" of the students, as well as an increase in the percentage of students rated with "very good" computer literacy skills (Fall = 31.4%; Spring = 46.3%) and keyboarding skills (Fall = 14.3%; Spring = 35.2%). As would be expected, there was a decrease in the percentage of classrooms in which desktop computers were "Frequently" to "Extensively" observed (Fall = 17.2%; Spring = 8.6%), while laptop availability increased (Fall = 37.2%; Spring = 74.1%).

Students were observed using a variety of computer applications during the multi-class visits, with notable increased usage of three key tools from fall to spring. Specifically, the greatest increase was seen in student use of "Internet Browsers" (Fall *M* = 1.23, Spring *M* = 2.17; *ES* = +0.80). Students also more frequently used "Draw, paint, and/or graphics" software (*ES* = +0.70) and "Presentation" software (*ES* = +0.58). The most frequently observed subject area of the

computer activities was language arts, which was seen during 74.1% of the "Production tool" use and 59.3% of the "Internet/Research tool" use.

Meaningfulness of Computer Activities. The data revealed very positive trends. The largest gain was seen in the category "Meaningful use of computers" (Fall *M* = 0.94, Spring *M* = 1.87, ES = +0.83), which is defined as, "activities were problem-based, required some critical thinking skills, and some use of computer applications to locate and/or process information or some manipulation of educational software variables to reach solutions." Additionally it should be noted that this category was observed Extensively to Occasionally in 59.3% of the spring multi-class visits. "Very meaningful use of computers" also had a substantial gain (Fall M = 0.31, Spring M = 1.11, ES = +0.77). Conversely, a large drop was seen in "Low level Use of Computers" (Fall M = 1.17, Spring M = 0.78, ES = -0.36), defined as "activities in general required no critical thinking, e.g., used computer applications for copying text or free-time drawing, or used educational software for drill & practice, tutorials, or games", as it was only seen "Frequently" to "Extensively" in 5.6% of the spring visits.

TABLE 4

Multi-Class SCU Data Summary

Fall (Baseline) N = 35
Spring N = 54

Computer Configuration	Florida EETT	Percent Observed
Percentages of classrooms with the following numbers of computers or digital tools:		
None, one, or 2 -4	Baseline	31.4
	Spring	7.4
5 – 10	Baseline	11.2
	Spring	20.4
11 or more	Baseline	57.1
	Spring	72.2
Percentages of classrooms in which the majority of computers were:		
Up-to-date	Baseline	74.3
	Spring	98.1
Aging, but adequate	Baseline	25.7
	Spring	0.0
Outdated/limited capacity	Baseline	0.0
	Spring	1.9
Percentages of classrooms in which the majority of computers were:		
Connected to the Internet	Baseline	91.4
	Spring	92.6
Student Computer Use		
Percentage of classrooms in which computers or digital tools were used by:		
Few (less than 10%) to Some (about 10-50%) students	Baseline	28.6
	Spring	13.0
Most (about 51-90%) students	Baseline	34.3
	Spring	31.5
Nearly all (91-100%) students	Baseline	28.6
	Spring	51.9
Percentage of classrooms in which students worked with computers or digital tools:		
Alone	Baseline	88.6
	Spring	75.9
In pairs or small groups	Baseline	2.9
	Spring	18.5
Percentage of classrooms in which student computer literacy skills were:		
Poor	Baseline	5.7
	Spring	3.7
Moderate	Baseline	40.0
	Spring	31.5
Very good	Baseline	31.4
	Spring	46.3
Not observed	Baseline	22.9
	Spring	18.5
Percentage of classrooms in which student keyboarding skills were:		
Poor	Baseline	8.6
	Spring	1.9
Moderate	Baseline	40.0
	Spring	38.9
Very good	Baseline	14.3
	Spring	35.2
Not observed	Baseline	37.1
	Spring	24.1

Table 4 Continued

Digital Devices Used by Students		Percent Observed		
		Not or Rarely Observed	Occasionally	Frequently or Extensively
Desktop Computers	Baseline	77.1	14.3	17.2
	Spring	74.0	18.5	8.6
Laptop Computers	Baseline	37.1	25.7	37.2
	Spring	9.3	16.7	74.1
Personal Data Assistants (PDA)	Baseline	100.0	0.0	0.0
	Spring	98.1	1.9	0.0
Graphing Calculator	Baseline	100.0	0.0	0.0
	Spring	96.3	3.7	0.0
Information Processor (e.g., Alphaboard)	Baseline	100.0	0.0	0.0
	Spring	100.0	0.0	0.0
Digital Accessories (e.g., camera, scanner, probes)	Baseline	94.3	5.7	0.0
	Spring	77.8	11.1	11.2

Note. Item percentages may not total 100% because of missing data.

Student Computer Activities The extent to which each of the following was observed in the classroom.		**Percent Observed**			**Florida EETT**			**National Norm**	
		None or Rarely	Occasionally	Frequently or Extensively	Mean	Standard Deviation	*ES*	Mean	Standard Deviation
Production Tools Used by Students									
Word Processing	Baseline	71.5	17.1	11.4	0.97	1.20	+0.32	0.50	0.90
	Spring	55.5	18.5	25.9	1.44	1.33			
Database	Baseline	100.0	0.0	0.0	0.00	0.00	+0.47	0.02	0.19
	Spring	98.1	1.9	0.0	0.07	0.33			
Spreadsheet	Baseline	97.2	2.9	0.0	0.14	0.43	+0.35	0.07	0.35
	Spring	88.9	11.1	0.0	0.30	0.66			
Draw/Paint/Graphics	Baseline	94.3	5.7	0.0	0.23	0.55	+0.70	0.19	0.57
	Spring	74.1	14.8	11.2	0.80	1.12			
Presentation (e.g., MS PowerPoint)	Baseline	77.2	17.1	5.8	0.77	1.03	+0.58	0.26	0.68
	Spring	55.5	13.0	31.5	1.50	1.37			
Authoring (e.g., HyperStudio)	Baseline	94.3	2.9	2.9	0.17	0.75	+0.25	0.02	0.20
	Spring	83.3	11.1	5.6	0.43	0.90			
Concept Mapping (e.g., Inspiration)	Baseline	100.0	0.0	0.0	0.20	0.41	+0.32	0.08	0.40
	Spring	88.9	9.3	1.9	0.37	0.81			
Planning (e.g., MS Project)	Baseline	100.0	0.0	0.0	0.00	0.00	+0.00	0.01	0.11
	Spring	100.0	0.0	0.0	0.02	0.14			
Other	Baseline	94.3	2.9	2.9	0.23	0.77	+0.49	0.10	0.46
	Spring	77.8	9.3	13.0	0.72	1.19			
Internet/Research Tools Used by Students									
Internet Browser (e.g., Netscape)	Baseline	57.1	28.6	14.3	1.23	1.17	+0.80	0.73	1.12
	Spring	33.4	11.1	55.5	2.17	1.31			
CD Reference (encyclopedias, etc.)	Baseline	100.0	0.0	0.0	0.09	0.28	+0.00	0.05	0.29
	Spring	98.2	1.9	0.0	0.06	0.30			
Communications	Baseline	100.0	0.0	0.0	0.03	0.17	+0.45	0.02	0.25
	Spring	94.3	9.3	0.0	0.24	0.61			
Other	Baseline	94.3	2.9	2.9	0.23	0.65	+0.26	0.09	0.45
	Spring	87.1	3.7	9.3	0.41	0.94			

Student Computer Activities The extent to which each of the following was observed in the classroom.		Percent Observed			Florida EETT			National Norm	
		None or Rarely	Occasionally	Frequently or Extensively	Mean	Standard Deviation	*ES*	Mean	Standard Deviation
Educational Software Used by Students									
Drill/Practice/Tutorial	Baseline	65.7	17.1	17.2	1.06	1.24	-0.27	0.73	1.06
	Spring	79.6	13.0	7.5	0.76	1.01			
Problem Solving (e.g., SimCity)	Baseline	94.3	5.7	0.0	0.14	0.49	+0.33	0.07	0.31
	Spring	90.7	5.6	3.7	0.26	0.73			
Process Tools (e.g.,Geometer's Sketchpad)	Baseline	94.3	2.9	2.9	0.17	0.75	+0.13	0.03	0.27
	Spring	87.1	9.3	3.7	0.31	0.80			
Other	Baseline	97.2	2.9	0.0	0.09	0.37	+0.32	0.21	0.66
	Spring	88.9	5.6	5.6	0.30	0.82			
Testing Software Used by Students									
Individualized/Tracked (e.g., Accelerated Reader)	Baseline	91.4	5.7	2.9	0.26	0.70	+0.23	0.52	0.91
	Spring	83.3	11.1	5.6	0.48	0.97			
Generic	Baseline	100.0	0.0	0.0	0.03	0.17	+0.26	0.02	0.20
	Spring	98.2	0.0	1.9	0.11	0.46			
Other	Baseline	94.3	5.7	0.0	0.14	0.49	-0.26	0.08	0.41
	Spring	100.0	0.0	0.0	0.04	0.19			
Meaningfulness of Computer Activities*									
Low level use of computers	Baseline	68.6	8.6	22.8	1.17	1.32	-0.36	0.84	1.16
	Spring	79.6	14.8	5.6	0.78	0.90			
Somewhat meaningful use of computers	Baseline	77.1	22.9	0.0	0.86	0.77	+0.42	0.75	1.00
	Spring	48.1	44.4	7.5	1.28	1.05			
Meaningful use of computers	Baseline	65.7	25.7	8.6	0.94	1.06	+0.83	0.86	1.21
	Spring	40.7	20.4	38.9	1.87	1.26			
Very meaningful use of computers	Baseline	91.4	5.7	2.9	0.31	0.72	+0.77	0.39	0.88
	Spring	64.8	13.0	22.2	1.11	1.31			

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively
Note. Item percentages may not total 100% because of missing data.

***Meaningfulness of Computer Activities Scale**

1. **Low level use of computers:** activities in general required no critical thinking, e.g., used computer applications for copying text or free-time drawing, or used educational software for drill & practice, tutorials, or games.
2. **Somewhat meaningful use of computers**: activities in general required very little problem-solving or critical thinking and used computer applications or educational software in a limited manner.
3. **Somewhat meaningful use of computers**: activities were problem-based, required some critical thinking skills, and some use of computer applications to locate and/or process information or some manipulation of educational software variables to reach solutions.
4. **Very meaningful use of computers**: activities were based on meaningful problems, required critical thinking skills, and appropriate use of computer applications to locate and/or process information or manipulation of educational software variables to reach solutions.

Subject Areas of Computer Activities		Language	Mathematics	Science	S. Studies	Other	Percent Not Observed
Production Tools	Baseline	37.1	17.1	34.3	31.4	5.7	22.9
	Spring	74.1	29.6	44.4	40.7	9.3	5.6
Internet/Research Tools	Baseline	25.7	11.4	31.4	20.0	2.9	37.1
	Spring	59.3	22.2	44.4	42.6	3.7	14.8
Educational Software	Baseline	37.1	20.0	8.6	5.7	2.9	54.3
	Spring	35.2	38.9	24.1	14.8	1.9	35.2
Testing Software	Baseline	20.0	2.9	2.9	8.6	0.0	74.3
	Spring	29.6	20.4	16.7	11.1	0.0	53.7

Note. Item percentages may not total 100% because of missing data or activities involving more than one subject area.

SCU Multi-Class Inferential Statistics

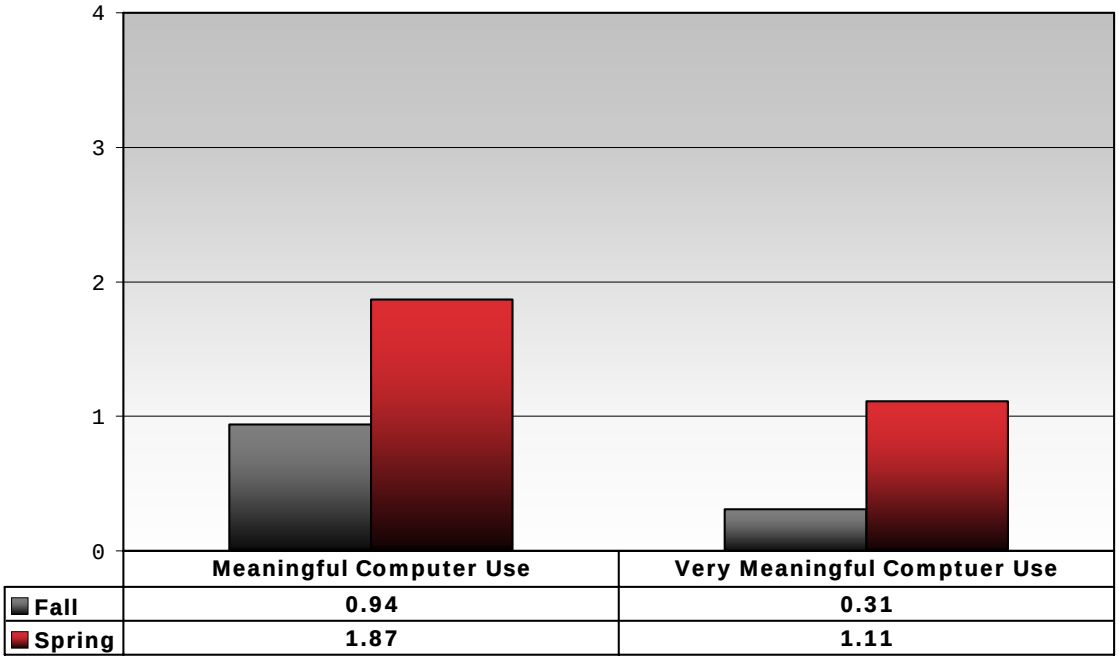
The Survey of Computer Use (SCU) observations are organized into 8 categories: "Computer Configuration", "Computer Use", "Frequency of Computer Type Use", "Production Tools Used", "Internet/Research Tools Used", "Educational Software Used", "Testing Software", and "Overall Meaningful Use of Computers". All rating categories with the exception of items under "Computer Configuration" and "Computer Use" are measured using a 5-point Likert scale (0=Not Observed, 1=Rarely, 2=Occasionally, 3=Frequently, and 4=Extensively). As a result, all SCU observations except "Computer Configuration" and "Computer Use" were analyzed using an adjusted alpha with Bonferroni correction, whereas the items under the first two categories were assessed using the normal alpha level (0.05). The SCU observation analyses outcomes are presented in Q_{SMH} and Q_{CSMH} statistics in Table 5. The following *SCU Multi-Class* categories had significant findings: Computer Configuration, Digital Devices Available for Students, Student Computer Activities, and Overall Meaningful Use of Computers. Details of these differences are below.

Computer Configuration. A larger number of computers or digital tools were observed during the spring observations as compared to the fall observations ($Q_{SMH} = Q_{CSMH} = 4.263, p = .039$). Classroom computers observed during spring visits were also better equipped (more up-to-date) ($Q_{SMH} = Q_{CSMH} = 5.452, p = .020$). Attention should be paid when interpreting the effect size associated with this item (i.e., negative as better) because of descending order of the rating scale (1 = up-to-date, 2 = Aging but adequate, 3 = Outdated/limited capacity, and 4 = No computers were observed). Spring observations found significantly fewer classrooms without students using computers ($Q_{SMH} = Q_{CSMH} = 10.028, p = .002$). Once again, please note that the negative effect size is actually positive feedback on the spring over the fall results.

Digital Devices Available for Student Use. There was significantly more Laptop computer usage during spring observations ($Q_{SMH} = Q_{CSMH} = 14.612, p < .001$). Use of "Digital Accessories" ($Q_{SMH} = Q_{CSMH} = 9.131$, $p = .0025$) approached significance with an adjusted alpha of 0.0017, with more usage during the spring as compared to the fall visits.

Student Computer Activities. Under "Internet/Research Tools Used by Students", "Internet Browser" ($Q_{SMH}=Q_{CSMH}=9.192, p<.0024$) also approached significance with an adjusted alpha of 0.0017, meaning students usage of the Internet was more frequent during spring vs. fall observations.

Overall Meaningful Use of Computers. When examining the meaningfulness of computer activities that were observed during the fall observations as compared to those seen during spring observations, two positive significant differences were revealed (see Figure 2). Specifically, "Meaningful use of computers" ($Q_{SMH}=Q_{CSMH}=10.780, p=.001$), and "Very meaningful use of computers" ($Q_{SMH}=Q_{CSMH}=10.712, p=.001$) were observed significantly more during the spring observations.



	Meaningful Computer Use	Very Meaningful Comptuer Use
Fall	0.94	0.31
Spring	1.87	1.11

Figure 2. Multi-Class SCU: Mean Scores of Significant Fall vs. Spring Differences in Meaningful use of Computers

TABLE 5

SCU Multi-Class Means Comparison between Fall and Spring Using Mantel-Haentzel Test

Item	Q_{SMH}	*p*	Q_{CSMH}	*p*
Computer Configuration				
Classrooms most frequently had the following number of computers or digital tools (1 = None, 2= One, 3= 2-4, and 4 = No computers were observed)	4.263*	.039	4.263*	.039
Classroom computers were most frequently (1 = Up-to-date, 2= Aging but adequate, 3= Outdated/limited capacity, 4 = 5-10, and 5 = 11 or more)	5.452*	.020	5.452*	.020
In classrooms, computers were most frequently (1 = Connected to the Internet, 2 = Not connected to the Internet, and 3 = No computers were observed)	0.500	.480	0.500	.480
Total number of classrooms visited	0.973	.324	0.973	.324
Total number of classrooms without students using computers	10.028*	.002	10.028*	.002
Student Computer Use				
Classroom computers or digital tools were most frequently used by (1 = few, 2 = most, 3 = nearly all)	2.168	.141	2.168	.141
Students most frequently worked with computers/digital tools (1 = alone, 2 = pairs, 3 = groups)	0.312	.576	0.312	.576
Student computer literacy skills were most frequently (1 = poor, 2 = moderate, 3 = very good)	0.444	.505	0.444	.505
Student keyboarding skills were most frequently (1 = poor, 2 = moderate, 3 = very good)	0.108	.743	0.108	.743
Digital Devices used by Students				
Desktop computers.	0.961	.327	0.961	.327
Laptop computers.	14.612*	<.001	14.612*	<.001
Personal Data Assistants (PDA).	1.333	.248	1.333	.248
Graphing calculators.	3.800	.051	3.800	.051
Information Processors (e.g. Alphaboard).	0.143	.706	0.143	.706
Digital Accessories (e.g. camera, scanner, probes).	9.131	.0025	9.131	.0025
Production Tools Used by Students				
Word Processor	2.379	.123	2.379	.123
Database	1.455	.228	1.455	.228
Spreadsheet	0.852	.356	0.852	.356
Draw/Paint/Graphics/Photo-imaging	5.984	.014	5.984	.014
Presentation	4.880	.027	4.880	.027
Authoring	1.649	.200	1.649	.200
Concept Mapping	1.563	.211	1.563	.211
Planning (e.g. MS Project)	0.500	.480	0.500	.480
Other production tools	5.410	.020	5.410	.020
Internet/Research Tools Used by Students				
Internet Browser	9.192	.0024	9.192	.0024
CD Reference	1.400	.237	1.400	.237
Communications	5.079	.024	5.079	.024
Other Internet/Research Tools	2.551	.110	2.551	.110
Educational Software Used by Students				
Drill/Practice/Tutorial	6.203	.013	6.203	.013
Problem-Solving	0.287	.592	0.287	.592
Process Tools	0.681	.409	0.681	.409
Other educational software	4.268	.039	4.268	.039
Testing Software Used by Students				
Individualized/Tracked	1.130	.288	1.130	.288
Generic	0.435	.510	0.435	.510
Other testing software	2.380	.123	2.380	.123

Table 5 continued

Item	Q_{SMH}	*p*	Q_{CSMH}	*p*
Overall Meaningful Use of Computers				
Low level use of computers	4.047	.044	4.047	.044
Somewhat meaningful use of computers	1.330	.249	1.330	.249
Meaningful use of computers	10.780*	.001	10.780*	.001
Very meaningful use of computers	10.712*	.001	10.712*	.001

Statistically significant at alpha<.0017

Targeted Classroom Observation Results

Targeted observations were conducted in 38 classrooms in the fall and 76 classrooms in the late spring. The data were collected with SOMs and SCUs during prearranged one-hour sessions in which teachers were asked to implement a prepared lesson using the laptops. The targeted observation results are presented by data collection instrument.

Targeted SOM

The targeted SOM results revealed positive fall to spring increased usage of student-centered classroom practices (see Table 6). The most notable increase, as indicated by an Effect Size of +0.93, was in student engagement in "Project based learning" (Fall *M* = 0.58, Spring *M* = 1.97). Other striking increases included more "Integration of subject areas" (*ES* = +0.87), "Teachers acting as coach/facilitators" (*ES* = +0.69), "Independent inquiry/research on the part of students" (*ES* = +0.58), "Cooperative/collaborative learning" (*ES* = +0.58), and "Sustained writing" (*ES* = +0.55). Additionally, the context for technology use shifted, with student use of "Technology as a learning tool/resource" increasing (Fall *M* = 1.97, Spring *M* = 2.95, *ES* = +0.60) and "Technology as a delivery tool" decreasing (Fall *M* = 2.37, Spring *M* = 1.58, *ES* = -0.48).

Overall, "High academically focused class time" was observed frequently to extensively in approximately 70% of the classrooms during both the fall and spring semesters. However, there was an increase in the frequency with which a "High level of student attention, interest, and engagement" was seen in the spring as compared to the fall observations (Fall *M* = 2.66, Spring *M* = 3.12, *ES* = +0.38).

TABLE 6

Targeted School Observation Measure (SOM) Results

Fall (Baseline) N = 38
Spring N = 76

The extent to which each of the following was observed in the classroom.		Percent Observed			Florida EETT			National Norm	
		None or Rarely	Occasionally	Frequently or Extensively	Mean	Standard Deviation	*ES*	Mean	Standard Deviation
Instructional Orientation									
Direct instruction (lecture)	Baseline	31.6	13.2	55.2	2.37	1.46	-0.28	2.77	1.01
	Spring	42.1	18.4	39.4	2.00	1.40			
Team teaching	Baseline	84.2	2.6	13.1	0.58	1.33	+0.08	0.81	0.94
	Spring	79.0	7.9	13.1	0.66	1.20			
Cooperative/collaborative learning	Baseline	68.4	10.5	21.1	1.13	1.47	+0.58	1.08	0.98
	Spring	39.4	6.6	53.9	1.97	1.61			
Individual tutoring (teacher, peer, aide, adult volunteer)	Baseline	86.8	7.9	5.2	0.42	0.95	+0.30	0.77	0.94
	Spring	77.7	9.2	13.2	0.71	1.09			
Classroom Organization									
Ability groups	Baseline	86.8	0.0	13.1	0.50	1.31	+0.15	1.16	1.33
	Spring	80.2	5.3	14.5	0.72	1.44			
Multi-age grouping	Baseline	92.1	2.6	5.3	0.26	0.95	0.00	0.58	1.03
	Spring	90.8	5.3	3.9	0.26	0.84			
Work centers (for individuals or groups)	Baseline	89.4	0.0	10.8	0.42	1.18	0.00	1.35	1.14
	Spring	86.8	3.9	9.2	0.36	0.93			
Instructional Strategies									
Higher level instructional feedback (written or verbal) to enhance student learning	Baseline	60.5	10.5	28.9	1.37	1.46	+0.40	1.44	1.15
	Spring	34.2	22.4	43.4	2.03	1.45			
Integration of subject areas (interdisciplinary/thematic units)	Baseline	92.1	5.3	2.6	0.24	0.79	+0.87	0.54	0.80
	Spring	57.8	7.9	34.2	1.33	1.56			
Project-based learning	Baseline	84.2	0.0	15.8	0.58	1.31	+0.93	0.45	0.76
	Spring	40.8	6.6	52.6	1.97	1.70			
Use of higher-level questioning strategies	Baseline	65.8	15.8	18.5	1.03	1.33	+0.43	1.63	1.12
	Spring	51.3	13.2	35.6	1.64	1.49			
Teacher acting as a coach/facilitator	Baseline	36.9	36.8	26.3	1.68	1.36	+0.69	2.29	1.18
	Spring	19.7	18.4	61.8	2.58	1.24			
Parent/community involvement in learning activities	Baseline	94.7	0.0	5.3	0.21	0.91	+0.11	0.31	0.60
	Spring	90.7	2.6	6.5	0.32	0.91			
Student Activities									
Independent seatwork (self-paced worksheets, individual assignments)	Baseline	47.4	18.4	34.2	1.71	1.54	-0.34	2.41	0.98
	Spring	63.1	11.8	25.0	1.17	1.40			
Experiential, hands-on learning	Baseline	52.6	21.1	26.3	1.34	1.49	+0.25	1.20	1.00
	Spring	48.7	14.5	36.8	1.67	1.71			
Systematic individual instruction	Baseline	89.4	0.0	10.5	0.42	1.18	+0.09	0.44	0.76
	Spring	85.5	3.9	10.5	0.47	1.10			
Sustained writing/composition (self-selected or teacher-generated topics)	Baseline	94.7	5.3	0.0	0.13	0.47	+0.55	0.75	0.86
	Spring	85.6	9.2	5.3	0.49	0.87			
Sustained reading	Baseline	94.7	0.0	5.2	0.21	0.81	+0.44	1.08	0.98
	Spring	84.2	9.2	6.5	0.55	1.00			

The extent to which each of the following was observed in the classroom.		Percent Observed			Florida EETT			National Norm	
		None or Rarely	Occasionally	Frequently or Extensively	Mean	Standard Deviation	*ES*	Mean	Standard Deviation
Independent inquiry/research on the part of students	Baseline	65.8	10.5	23.7	1.11	1.64			
	Spring	36.8	11.8	51.3	2.04	1.53	+0.58	0.32	0.65
Student discussion	Baseline	76.3	2.6	21.0	0.97	1.42			
	Spring	43.4	22.4	34.2	1.62	1.41	+0.43	0.89	1.11
Technology Use									
Computer for instructional delivery (e.g. CAI, drill & practice)	Baseline	31.6	18.4	50.0	2.37	1.70			
	Spring	51.3	13.2	35.5	1.58	1.59	-0.48	0.96	0.97
Technology as a learning tool or resource (e.g. Internet research, spreadsheet or database creation)	Baseline	39.5	21.1	39.4	1.97	1.64			
	Spring	15.7	11.8	72.4	2.95	1.37	+0.60	0.80	0.98
Assessment									
Performance assessment strategies	Baseline	97.4	2.6	0.0	0.11	0.39			
	Spring	84.2	11.8	3.9	0.38	0.85	+0.47	0.50	0.83
Student self-assessment (portfolios, individual record books)	Baseline	97.4	0.0	2.6	0.11	0.65			
	Spring	80.2	7.9	11.8	0.55	1.10	+0.56	0.32	0.65
Summary Items									
High academically focused class time	Baseline	7.9	21.1	71.1	3.08	1.08			
	Spring	3.9	23.7	72.3	3.12	0.91	0.00	3.33	0.80
High level of student attention, interest, engagement	Baseline	15.8	21.1	63.1	2.66	1.19			
	Spring	6.6	17.1	76.3	3.12	0.92	+0.38	3.12	0.83

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively

SOM Targeted Inferential Statistics

As shown in Table 7, a significant upward trend between observations was found on five SOM items: (1) "Integration of subject areas" *(p<.001)*, (2) "Project-based learning" *(p<.001)*, (3) "Teacher acting as a coach/facilitator" *(p=.001)*, (4) "Independent inquiry/research on the part of students" *(p<.001),* and (5) "Technology as a learning tool or resource" *(p=.001)*, meaning significantly more activities in these five areas were observed during spring observations compared to those conducted in the fall.

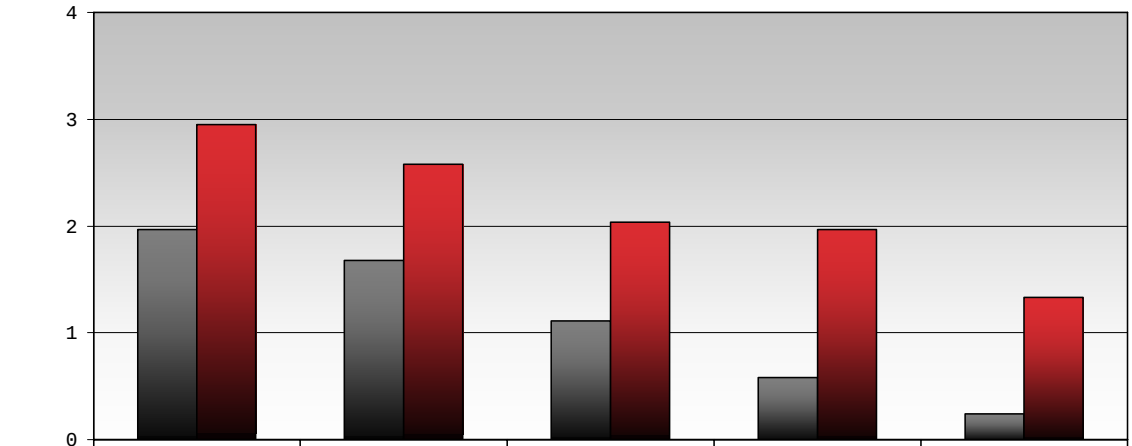
As revealed by Q_{CSMH} and its associated p-value, these five areas also had significantly higher mean responses at the spring observation (see Table 6 and Figure 3). In particular, the associated effect sizes (ranging from .58 to .93) are substantially large. An additional three SOM items approached significance with moderate to substantial effect sizes. They are "Cooperative/collaborative learning" (*p=.005)*, "Higher-level instructional feedback to enhance student learning" (*p=.002),* and "Use of higher-level questioning strategies" (*p=.005)*.

TABLE 7

SOM Targeted Means Comparison between Fall and Spring Using Mantel-Haentzel Test

Item	Q_{SMH}	*p*	Q_{CSMH}	*p*
Instructional Orientation				
Direct instruction (lecture)	0.414	.520	0.414	.520
Team teaching	0.274	.600	0.274	.600
Cooperative/collaborative learning	8.022	.005	8.022	.005
Individual tutoring (teacher, peer, aide, adult volunteer)	1.080	.299	1.080	.299
Classroom Organization				
Ability groups	0.058	.810	0.058	.810
Multi-age grouping	0.107	.744	0.107	.744
Work centers (for individuals or groups)	3.990	.046	3.990	.046
Instructional Strategies				
Higher-level instructional feedback (written or verbal) to enhance student learning	9.186	.002	9.186	.002
Integration of subject areas (interdisciplinary/thematic units)	16.076*	<.001	16.076*	<.001
Project-based learning	16.848*	<.001	16.848*	<.001
Use of higher-level questioning strategies	7.900	.005	7.900	.005
Teacher acting as a coach/facilitator	10.608*	.001	10.608*	.001
Parent/community involvement in learning activities	0.178	.673	0.178	.673
Student Activities				
Independent seatwork (self-paced worksheets, individual assignments)	7.438	.006	7.438	.006
Experiential, hands-on learning	1.331	.249	1.331	.249
Systematic individual instruction (differential assignments geared to individual needs)	2.350	.125	2.350	.125
Sustained writing/composition (self-selected or teacher-generated topics)	3.597	.058	3.597	.058
Sustained reading	0.910	.340	0.910	.340
Independent inquiry/research on the part of students	11.258*	<.001	11.258*	<.001
Student discussion	6.498	.011	6.498	.011
Technology Use				
Computer for instructional delivery (e.g., CAI, drill & practice)	3.763	.052	3.763	.052
Technology as a learning tool or resource (e.g., Internet research, spreadsheet creation, multi-media, CD Rom, Laser disk)	10.320*	.001	10.320*	.001
Assessment				
Performance assessment strategies	1.048	.306	1.048	.306
Student self-assessment (portfolios, individual record books)	2.667	.102	2.667	.102
Summary Items				
High academically focused class time	0.987	.321	0.987	.321
High level of student attention/interest/engagement	6.290	.012	6.290	.012

**statistically significant at alpha<.0019*



	Technology as a Learning Tool	Teacher as Facilitator	Independent Research	Project-based Learning	Integration of Subjects
Fall	1.97	1.68	1.11	0.58	0.24
Spring	2.95	2.58	2.04	1.97	1.33

Figure 3. Targeted SOM: Significant Fall vs. Spring Differences

Targeted SCU

Following the same trend as seen in the Multi-class results, the number of classrooms with "11 or more" computers available for student use increased from 64.9% in the fall to 87.1% in the spring, with nearly all (98.6%) considered as "Up-to-date" in the spring (see Table 8). There was also an increase (Fall = 62.2%; Spring = 71.4%) in the percentage of classrooms in which the laptops were used by "nearly all" of the students, as well as an increase in the percentage of students rated with "very good" computer literacy skills (Fall = 18.9%; Spring = 55.7%) and keyboarding skills (Fall = 16.2%; Spring = 35.7%). The results revealed that during the fall and spring, students more frequently worked alone when using the laptop (Fall = 70.3%; Spring = 71.4%), however, there was a fall to spring increase in the frequency with which students worked in pairs during laptop use (Fall = 10.8%; Spring = 22.9%)

Also following the same pattern of progress as the Multi-class results, the greatest fall to spring increase was in student use of the Internet, which was seen "Frequently" to "Extensively" in over one-half (55.7%) of the spring observations as compared to less than one-fourth (21.6%) of the fall observations. This gain yielded an impressive Effect Size of +0.64. Other striking increases were in student use of "Presentation" software (Fall *M* = 0.43, Spring *M* = 1.43, *ES* = +0.73) and "Other" types of "Production Tools" (Fall *M* = 0.11, Spring *M* = 0.81, *ES* = +0.67).

Listed examples of these tools included Puzzle Maker, PhotoShop and Note Taker. Spring observations revealed that student use of "Production Tools" and "Internet/Research Tools" were most often associated with Language Arts (Production Tools = 44.3%, Internet/Research Tools = 35.7%) and Science (Production Tools = 38.6%, Internet/Research Tools = 31.4%).

Although the targeted results are positive, it should be noted that although students were observed using 18 of the 20 computer applications listed on the SCU, the majority of the tools were used infrequently as seen in Mean scores for all but 3 of 18 uses that were at or below 1.00, which equals "Rarely" observed.

Meaningfulness of Computer Activities. Significant positive gains were seen from fall to spring regarding the meaningfulness of computer activities that were implemented during the targeted observations (see Table 8). Specifically, "Meaningful use of Computers" defined as "activities were problem-based, required some critical thinking skills, and some use of computer applications to locate and/or process information or some manipulation of educational software variables to reach solutions" increased from a Mean of 0.97 in the fall to 1.94 in the spring (*ES* = +0.64). Encouragingly, the teachers demonstrated increased ability to implement lessons that engaged students in "Very meaningful use of computers" in which "activities were based on meaningful problems, required critical thinking skills, and appropriate use of computer applications to locate and/or process information or manipulation of educational software variables to reach solutions" (Fall M = 0.57, Spring M = 1.27, ES = +0.49). Just as the "meaningfulness" of computer activities was observed to increase, the occurrence of "Low level use of computers" (activities in general required no critical thinking, e.g., used computer applications for copying text or free-time drawing, or used educational software for drill & practice, tutorials, or games) showed a fall to spring decrease (Fall M = 1.00, Spring M = 0.54, ES = -0.39).

TABLE 8

Targeted SCU Data Summary

Fall (Baseline) N = 37
Spring N = 70

Computer Configuration	Florida EETT	Percent Observed
Percentages of classrooms with the following numbers of computers or digital tools:		
None; One, or 2 -4	Baseline	21.6
	Spring	2.9
5 – 10	Baseline	13.5
	Spring	10.0
11 or more	Baseline	64.9
	Spring	87.1
Percentages of classrooms in which the majority of computers were:		
Up-to-date	Baseline	81.1
	Spring	98.6
Aging, but adequate	Baseline	10.8
	Spring	1.4
Outdated/limited capacity	Baseline	2.7
	Spring	0.0
Percentages of classrooms in which the majority of computers were:		
Connected to the Internet	Baseline	83.8
	Spring	97.1
Student Computer Use		
Percentage of classrooms in which computers or digital tools were used by:		
Few (less than 10%) to Some (about 10-50%) students	Baseline	16.2
	Spring	10.0
Most (about 51-90%) students	Baseline	2.7
	Spring	10.0
Nearly all (91-100%) students	Baseline	62.2
	Spring	71.4
Percentage of classrooms in which students worked with computers or digital tools:		
Alone	Baseline	70.3
	Spring	71.4
In pairs or small groups	Baseline	10.8
	Spring	22.9
Percentage of classrooms in which student computer literacy skills were:		
Poor	Baseline	8.1
	Spring	0.0
Moderate	Baseline	43.2
	Spring	25.7
Very good	Baseline	18.9
	Spring	55.7
Not observed	Baseline	29.7
	Spring	18.6
Percentage of classrooms in which student keyboarding skills were:		
Poor	Baseline	18.9
	Spring	1.4
Moderate	Baseline	32.4
	Spring	37.1
Very good	Baseline	16.2
	Spring	35.7
Not observed	Baseline	32.4
	Spring	25.7

Table 8 continued

Digital Devices Used by Students		Not or Rarely Observed	Occasionally	Frequently or Extensively
Desktop Computers	Baseline	100.0	0.0	0.0
	Spring	77.2	12.9	10.0
Laptop Computers	Baseline	27.0	10.8	62.2
	Spring	24.3	4.3	71.4
Personal Data Assistants (PDA)	Baseline	97.3	0.0	2.7
	Spring	94.3	2.9	2.9
Graphing Calculator	Baseline	100.0	0.0	0.0
	Spring	94.3	1.4	4.3
Information Processor (e.g., Alphaboard)	Baseline	100.0	0.0	0.0
	Spring	98.6	1.4	0.0
Digital Accessories (e.g., camera, scanner, probes)	Baseline	97.3	0.0	2.7
	Spring	77.1	7.1	15.7

Note. Item percentages may not total 100% because of missing data.

Student Computer Activities The extent to which each of the following was observed in the classroom.		Percent Observed			Florida EETT			National Norm	
		None or Rarely	Occasionally	Frequently or Extensively	Mean	Standard Deviation	*ES*	Mean	Standard Deviation
Production Tools Used by Students									
Word Processing	Baseline	64.9	8.1	27.0	1.22	1.65	0.00	0.50	0.90
	Spring	62.9	7.1	30.0	1.17	1.54			
Database	Baseline	97.3	0.0	2.7	0.11	0.52	-0.28	0.02	0.19
	Spring	100.0	0.0	0.0	0.00	0.00			
Spreadsheet	Baseline	94.6	0.0	5.4	0.16	0.69	-0.16	0.07	0.35
	Spring	95.7	0.0	2.9	0.10	0.51			
Draw/Paint/Graphics	Baseline	86.5	8.1	5.4	0.38	1.04	+0.27	0.19	0.57
	Spring	75.7	10.0	14.3	0.74	1.24			
Presentation (e.g., MS PowerPoint)	Baseline	86.5	2.7	10.8	0.43	1.14	+0.73	0.26	0.68
	Spring	54.3	10.0	35.7	1.43	1.57			
Authoring (e.g., HyperStudio)	Baseline	97.3	0.0	2.7	0.11	0.66	+0.13	0.02	0.20
	Spring	94.3	0.0	5.8	0.23	0.84			
Concept Mapping (e.g., Inspiration)	Baseline	91.9	2.7	5.4	0.27	0.87	0.00	0.08	0.40
	Spring	92.9	1.4	5.7	0.29	0.92			
Planning (e.g., MS Project)	Baseline	100.0	0.0	0.0	0.00	0.00	0.00	0.01	0.11
	Spring	100.0	0.0	0.0	0.00	0.00			
Other	Baseline	97.3	0.0	2.7	0.11	0.52	+0.67	0.10	0.46
	Spring	74.3	4.3	21.4	0.81	1.41			
Internet/Research Tools Used by Students									
Internet Browser (e.g., Netscape)	Baseline	64.9	13.5	21.6	1.19	1.54	+0.64	0.73	1.12
	Spring	34.3	10.0	55.7	2.20	1.60			
CD Reference (encyclopedias, etc.)	Baseline	100.0	0.0	0.0	0.05	0.23	-0.71	0.05	0.29
	Spring	100.0	0.0	0.0	0.00	0.00			
Communications	Baseline	100.0	0.0	0.0	0.00	0.00	+0.35	0.02	0.25
	Spring	98.6	0.0	1.4	0.07	0.39			
Other	Baseline	86.5	5.4	8.1	0.46	1.02	-0.21	0.09	0.45
	Spring	88.5	4.3	7.1	0.33	0.91			
Educational Software Used by Students									
Drill/Practice/Tutorial	Baseline	94.6	0.0	5.4	0.19	0.81	+0.13	0.73	1.06
	Spring	90.0	2.9	7.1	0.31	0.84			

Student Computer Activities The extent to which each of the following was observed in the classroom.		Percent Observed			Florida EETT			National Norm	
		None or Rarely	Occasionally	Frequently or Extensively	Mean	Standard Deviation	*ES*	Mean	Standard Deviation
Problem Solving (e.g., SimCity)	Baseline	97.3	2.7	0.0	0.05	0.33	0.00	0.07	0.31
	Spring	97.2	0.0	2.9	0.11	0.53			
Process Tools (e.g.,Geometer's Sketchpad)	Baseline	94.6	0.0	5.4	0.19	0.81	+0.12	0.03	0.27
	Spring	90.0	1.4	8.6	0.30	0.87			
Other	Baseline	89.2	0.0	10.8	0.38	1.11	-0.21	0.21	0.66
	Spring	94.3	0.0	5.8	0.21	0.83			
Testing Software Used by Students									
Individualized/Tracked (e.g., Accelerated Reader)	Baseline	97.3	0.0	2.7	0.14	0.67	+0.13	0.52	0.91
	Spring	91.4	1.4	7.1	0.24	0.81			
Generic	Baseline	100.0	0.0	0.0	0.00	0.00	0.00	0.02	0.20
	Spring	100.0	0.0	0.0	0.00	0.00			
Other	Baseline	97.3	0.0	2.7	0.11	0.66	0.00	0.08	0.41
	Spring	97.1	0.0	2.9	0.09	0.50			
Meaningfulness of Computer Activities*									
Low level use of computers	Baseline	73.0	5.4	21.6	1.00	1.56	-0.39	0.84	1.16
	Spring	85.7	10.0	4.3	0.54	0.90			
Somewhat meaningful use of computers	Baseline	67.6	21.6	10.8	0.78	1.13	+0.33	0.75	1.00
	Spring	61.4	21.4	17.1	1.16	1.28			
Meaningful use of computers	Baseline	73.0	2.7	24.3	0.97	1.44	+0.64	0.86	1.21
	Spring	37.2	12.9	50.0	1.94	1.43			
Very meaningful use of computers	Baseline	81.1	5.4	13.5	0.57	1.24	+0.49	0.39	0.88
	Spring	65.7	7.1	27.1	1.27	1.55			

Scale: 0 = Not Observed; 1 = Rarely; 2 = Occasionally; 3 = Frequently; 4 = Extensively
Note. Item percentages may not total 100% because of missing data.

Meaningfulness of Computer Activities Scale

1. **Low level use of computers:** activities in general required no critical thinking, e.g., used computer applications for copying text or free-time drawing, or used educational software for drill & practice, tutorials, or games.
2. **Somewhat meaningful use of computers**: activities in general required very little problem-solving or critical thinking and used computer applications or educational software in a limited manner.
3. **Somewhat meaningful use of computers**: activities were problem-based, required some critical thinking skills, and some use of computer applications to locate and/or process information or some manipulation of educational software variables to reach solutions.
4. **Very meaningful use of computers**: activities were based on meaningful problems, required critical thinking skills, and appropriate use of computer applications to locate and/or process information or manipulation of educational software variables to reach solutions.

Subject Areas of Computer Activities		Language	Mathematics	Science	S. Studies	Other	Percent Not Observed
Production Tools	Baseline	21.6	8.1	24.3	10.8	2.7	35.1
	Spring	44.3	18.6	38.6	27.1	11.4	11.4
Internet/Research Tools	Baseline	8.1	5.4	18.9	5.4	2.7	67.6
	Spring	35.7	14.3	31.4	21.4	8.6	21.4
Educational Software	Baseline	8.1	5.4	5.4	0.0	2.7	81.1
	Spring	15.7	11.4	12.9	12.9	0.0	55.7
Testing Software	Baseline	5.4	8.1	5.4	2.7	0.0	83.8
	Spring	11.	2.9	10.0	11.4	0.0	68.6

Note. Item percentages may not total 100% because of missing data or activities involving more than one subject area.

SCU Targeted Inferential Statistics

The SCU Targeted observation analyses outcomes are presented in Q_{SMH} and Q_{CSMH} statistics in Table 9 and Figure 4. The following *SCU* categories had significant findings: Computer Configuration, Student Computer Activities, and Overall Meaningful Use of Computers. Details of these differences are below.

Computer Configuration. As with the Multi-class observations, there were significantly more computers or digital tools observed in use during the spring observations as compared to the fall observations ($Q_{SMH} = Q_{CSMH} = 10.119$, $p = .0015$). Classroom computers observed during spring visits were newer and more up-to-date) ($Q_{SMH}=Q_{CSMH} = 8.487$, $p = .004$). Again, attention should be paid when interpreting the effect size (Table 8) of this SCU item. As the ratings were arranged in *descending* order (1=up-to-date, 2=Aging but adequate, 3=Outdated/limited capacity, and 4=No computers were observed), the effect size should be interpreted in the opposite direction, with a negative sign indicating a more positive rating in the observation. Spring observations revealed more classroom computers connected to the Internet as compared to the fall ($Q_{SMH} = Q_{CSMH} = 5.744$, $p = .017$). The ratings for this SCU item are: 1=connected to the Internet, 2=Not connected to the Internet, and 3=No computers were observed. Thus, as noted above, special attention should be made to interpret the effect size.

Student Computer Activities. Using an adjusted alpha of 0.0017 to examine "Production Tools Used by Students", the analysis revealed that students were found to have significantly increased use of "Other production tools" ($Q_{SMH} = Q_{CSMH} = 14.781$, $p < .001$). As noted earlier, examples of these tools included Puzzle Maker, PhotoShop, and Note Taker.

Overall Meaningful Use of Computers. When examining the meaningfulness of computer activities that were observed during the fall Targeted observations as compared to those seen during spring observations, one significant difference was revealed (see Table 9). Specifically, using an adjusted alpha of 0.0017, students were found to have significantly increased "Meaningful use of computers" ($Q_{SMH} = Q_{CSMH} = 13.384$, $p < .001$) during the spring observations.

TABLE 9

SCU Targeted Means Comparison between Fall and Spring Using Mantel-Haentzel Test

Item	Q_{SMH}	*p*	Q_{CSMH}	*p*
Computer Configuration				
Classrooms most frequently had the following number of computers or digital tools (1 = None, 2= One, 3= 2-4, and 4 = No computers were observed)	10.119*	.0015	10.119*	.0015
Classroom computers were most frequently (1 = Up-to-date, 2= Aging but adequate, 3= Outdated/limited capacity, and 4 = No computers were observed)	8.487*	.004	8.487*	.004
In classrooms, computers were most frequently (1 = Connected to the Internet, 2 = Not connected to the Internet, and 3 = No computers were observed)	5.744*	.017	5.744*	.017
Total number of classrooms visited	1.990	.158	1.990	.158
Total number of classrooms without students using computers	0.248	.619	0.248	.619
Student Computer Use				
Classroom computers or digital tools were most frequently by (1 = few, 2 = most, 3 = nearly all)	0.003	.960	0.003	.960
Students most frequently worked with computers/digital tools (1 = alone, 2 = pairs, 3 = groups)	0.192	.662	0.192	.662
Student computer literacy skills were most frequently (1 = poor, 2 = moderate, 3 = very good)	2.329	.127	2.329	.127
Student keyboarding skills were most frequently (1 = poor, 2 = moderate, 3 = very good)	3.084	.079	3.084	.079
Digital Devices used by Students				
Desktop computers.	6.810	.009	6.810	.009
Laptop computers.	0.063	.802	0.063	.802
Personal Data Assistants (PDA).	0.615	.433	0.615	.433
Graphing calculators.	3.046	.081	3.046	.081
Information Processors (e.g. Alphaboard).	0.033	.855	0.033	.855
Digital Accessories (e.g. camera, scanner, probes).	5.539	.019	5.539	.019
Production Tools Used by Students				
Word Processor	1.081	.299	1.081	.299
Database	1.899	.168	1.899	.168
Spreadsheet	0.118	.732	0.118	.732
Draw/Paint/Graphics/Photo-imaging	0.472	.492	0.472	.492
Presentation	9.049	.003	9.049	.003
Authoring	0.371	.543	0.371	.543
Concept Mapping	0.028	.867	0.028	.867
Planning (e.g. MS Project)	-	-	-	-
Other production tools	14.781*	<.001	14.781*	<.001
Internet/Research Tools Used by Students				
Internet Browser	5.486	.019	5.486	.019
CD Reference	5.628	.018	5.628	.018
Communications	0.400	.527	0.400	.527
Other Internet/Research Tools	0.310	.578	0.310	.578
Educational Software Used by Students				
Drill/Practice/Tutorial	0.048	.827	0.048	.827
Problem-Solving	0.215	.643	0.215	.643
Process Tools	0.015	.902	0.015	.902
Other educational software	0.435	.510	0.435	.510
Testing Software Used by Students				
Individualized/Tracked	0.022	.881	0.022	.881
Generic	-	-	-	-
Other testing software	0.030	.862	0.030	.862

Table 9 continued

Item	Q_{SMH}	*p*	Q_{CSMH}	*p*
Overall Meaningful Use of Computers				
Low level use of computers	7.450	.006	7.450	.006
Somewhat meaningful use of computers	0.417	.519	0.417	.519
Meaningful use of computers	13.384*	<.001	13.384*	<.001
Very meaningful use of computers	6.571	.010	6.571	.010

Statistically significant at alpha<.0017

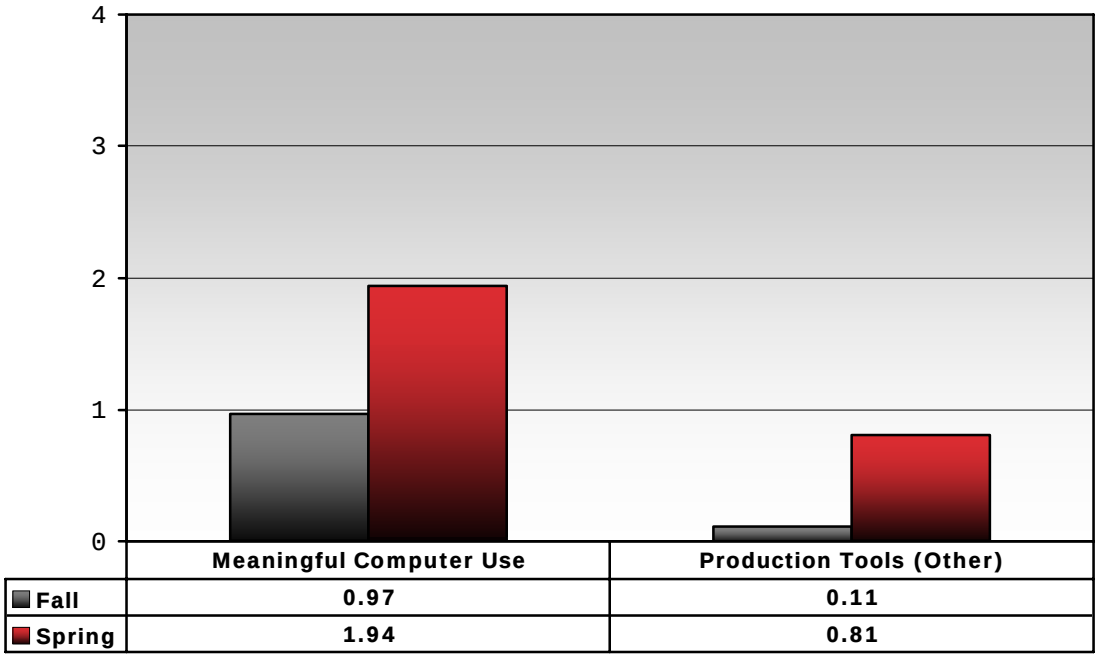


Figure 4. Target SCU: Mean Scores of Significant Fall vs. Spring Differences

SUMMARY

The primary purpose of this study was to address the following question:

- *What changes in tool-based, student-centered teaching happen as a result of the infusion of technology and professional development?*

Both the SOM and SCU Multi-Class and Targeted observations revealed significant fall to spring increases in the use of student-centered practices. For the SOM, significant increases were found for both the Multi-Class and Targeted observations for student engagement in "Project-based learning", "Independent inquiry/research on the part of students", and student use of "Technology as a learning tool or resource." The SCU results from both the Multi-Class and Targeted observations yielded significant increases in students' overall use of newer and more up-to-date computers (laptops) and positive trends toward increased uses of production tools and Internet/research tools to support learning. A key finding that emerged from the results was the significant increase in the frequency with which teachers implemented meaningful computer activities that engaged students in higher-order thinking and problem solving through effective use of laptop-based technology tools.

These first year results show promising trends in that the Florida EETT program seems to be serving as a catalyst for positive changes from traditional teaching environments to ones that are student-centered and engage learners in the meaningful use of computers to enhance learning. However, the data also reveal room for continued growth due to the modest frequency with which most of these changed practices occurred. An additional consideration when reviewing the evaluation results is the possible bias that may occur due to observer involvement in the Florida EETT program.