![Office of Social and Economic Data Analysis]

**Typology of eMINTS Lessons
Based on Classroom Observations
Conducted During 2000 & 2001**

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A General Typology of eMINTS Lessons

This report summarizes classroom observations conducted in FY00 classrooms. This report describes a general typology of instructional lessons based on 85 classroom observations conducted in 2000 and 2001. This discussion outlines the rationale for the lesson typology and the key characteristics of the categories that constitute the typology. Comparisons between observations conducted in 2000 and 2001 shows a general increase in the occurrence of facilitated lessons.

Introduction

This report describes a general typology of instructional lessons based on two years of observations in 85 FY00 eMINTS classrooms. The observations, which serve as the empirical basis for the typology, were conducted during site visits made by the eMINTS evaluation team in two waves, between March 1 and May 20, 2000 and between November 11, 2000 and April 18, 2001. During each lesson, evaluation team members observed teachers' interaction with students, their use of computers and their general conduct of the lesson. In considering this typology, it is important to note that it is based on observations of two isolated lessons, and does not characterize all of the activities of individual eMINTS teachers. As such, this typology is limited in that these observations do not represent all of the teaching strategies an individual teacher might employ in their classroom.

Background and Relevance of the Lesson Typology

According to the eMINTS webpage,

> The eMINTS professional development program provides teachers with the knowledge and skills they need to examine their teaching practices as they relate to instructional technology. Teachers in the eMINTS Program have been presented with a monumental learning task: they must develop technology fluency with a wide variety of tools, many of which they have never seen or used, and they must learn how to integrate these new tools into their classrooms in ways that may differ considerably from teaching methods they currently use.

The main purpose of the eMINTS program as a whole has been to develop constructivist, "inquiry-based" teaching practices among the participating teachers. This purpose has realized through the creation of technologically intensive classrooms and the provision of extensive professional development. The professional development effort has focused ways to create a classroom environment that facilitates student inquiry, higher-order thinking skills and interdisciplinary student work.

The observations made by the evaluation team were an attempt to understand progress towards the programmatic ideal of a student-centered facilitated learning environment. Two observations were made during the first two-years of the program. The first observation was made during the program's first year, as FY00 teachers were beginning to teach using the eMINTS equipment. The second was made after the FY00 teachers had completed a full school year in the eMINTS classroom.

The categories of the lesson typology are based on generalizations of teacher's activities, students' activities, the tasks students are asked to complete, and the ways the eMINTS equipment is used in the conduct of the observed lessons. Summaries of these observations are used to isolate and understand differences between the broad classes of lessons observed in the eMINTS classrooms. The resulting typology is a useful tool for discussing the types of lessons being developed in the eMINTS classrooms, their forms and the classroom practices associated with them.

For the eMINTS Program, these lesson categories help clarify the ways the eMINTS experience is changing the classroom environment. These categories document impact of the training process by describing the ways that the project's professional development program is changing teachers' professional practices. By identifying the key areas and their characteristics for each lesson category, we hope to contribute to the developing understanding of the potential of the eMINTS classrooms.

This typology contributes to the formative focus of the evaluation process by comparing observed classroom activities from the beginning and the end of teachers' participation in the program. Over their two years in the program, FY00 teachers felt they had become proficient in using computers and the Internet as resources to motivate student learning. Overall, these changes are reflected in the classroom observations. The entire body of information from teachers, including interviews, survey results and classroom observations, suggests that the set of FY00 teachers have changed their classroom practices, as seen in both their overall teaching styles and their use of technological resources, during their eMINTS participation.

This typology identifies what the key characteristics of each category are in the hope that project personnel can use these characteristics to help teachers develop new approaches to their teaching activities. The typology also helps us to understand how the eMINTS resources are changing classroom practices. As the evaluation effort continues, this understanding will help to characterize the ways that the project has helped classrooms change.

Limitations of the Typology

In considering the materials below, one should keep in mind that they are based on observation of two isolated classroom periods. These observations represent two cross sections of a teacher's classroom activities. As such, they do not represent all of the activities a teacher uses in a classroom day. Thus, it would not be accurate to classify teachers based on these observations. In the teacher interviews

accompanying the observations, several teachers discussed how the activities observed by the evaluators differed from their usual teaching activities.

However, the set of individual observations shows a remarkable consistency across the four categories of the typology. This typology is based on the set of observed lessons at two points in the teacher's eMINTS experience. It is not an attempt to classify teachers, nor should it be regarded as such.

Plan of the Document

The remainder of this report is devoted to the description of the typology, the categories and their relation to each other. The discussion begins with a definition of the three homogenous types of lessons and a fourth, heterogeneous category of lessons, a category that contains features of the three homogenous types. The analysis focuses on 14 dichotomous dimensions used in the classification of lesson types. These dimensions are also used to understand the relationship between the lesson types developed by the evaluation team and the criteria for Inquiry-Based Lessons developed by the eMINTS professional development staff.

Key Characteristics of Teacher-Centered Lessons, Student-centered, Facilitated Lessons and Student-centered, Un-facilitated Lessons

The overall lesson typology is organized around three homogenous types of lessons, designated here as "teacher-centered", "student-centered, facilitated" and "student-centered, un-facilitated" lessons. These types differ substantially along four very general dimensions: the characteristic activities of the teachers, the characteristic activities of the students, the learning tasks observed during the lesson, and the characteristic ways the eMINTS equipment is used in the lesson.

Teacher-Centered Lessons

Teacher-centered lessons are typically situated in traditional, teacher-centered classrooms. In these lessons, the predominant teaching method is whole class lecture or demonstration, typically broken up by individual student instruction.

Teacher Practices

Teachers control the pace and content of work, they control the available time for work, and through their control of the classroom, they exercise control over the knowledge available for their students. In teacher-centered lessons, instruction is organized around discrete instructional tasks, e.g., completing worksheets, and the sequence of these tasks is dictated by a conventional single disciplinary structure. That is, language skills are taught in a language lesson and mathematics skills are taught in a math lesson, with almost no overlap or interdisciplinary work.

Student Activities

Students in these lessons are largely passive receivers of knowledge. Their activities have a limited acceptable response, i.e., tasks and assignments have "one right answer." These answers tend to be simple, declarative statements, much like responses found on worksheets. The structured nature of activities and the focus on single subject areas limit the time students have for understanding and completing assignments. Finally, students generally have no opportunity for inquiry. Partially this is due to the role of the teacher as the controlling source of

information and partially this is due to the number of activities students are expected to complete over the course of a lesson.

Lesson Tasks

The central role of the teacher as a controlling element in the teacher-centered lesson impacts students' opportunities for learning by creating an environment organized around discrete assignments and tasks. This is seen both in the progression of a lesson through academic subjects, and in the discrete nature of activities within particular subjects. The scope of student activity is limited to specific materials presented in a textbook or specified by district curriculum. The discrete nature of classroom work emphasizes simple learning of immediate academic goals. Typically, this emphasis puts a premium on the memorization of information at the expense of higher-level comprehension.

Use of the eMINTS Equipment

In the teacher-centered lesson, the eMINTS equipment is used in a limited fashion. Information resources available from the Internet are used like textbooks, that is, students are instructed to read materials off of their screens rather than out of a book. eMINTS equipment use is not integrated into classroom instruction, and the computer work is often used as a fill-in or reward activity.

Student-Centered Lessons

While teacher-centered lessons are relatively simple to describe, student-centered lessons are not. Close control over student activity characterizes teacher-centered lessons. This is seen in the discrete character of learning activities and the rigid scheduling of subjects during the school day. In student-centered, lessons, students have more control over the conduct of their work. Providing students with this control requires a new role for the teacher, new lesson activities and a more explicit approach to assessment.

Two types of student-centered lessons were identified. The first, the Student-centered, Un-facilitated Lesson, is more problematic. These lessons appear to put less emphasis on specific learning activities in favor of unstructured classroom time. The other type of lesson, the Student-centered, Facilitated Lesson, places the learning activity at the center of a classroom's work. In this type of lesson the eMINTS equipment is used as a resource to facilitated higher-order learning in a cooperative environment.

Student-Centered, Un-facilitated Lessons

In many ways, the student-centered, un-facilitated lesson represents a misapplication of the eMINTS resources and equipment. When discussing their roles, teachers of student-centered, un-facilitated lessons describe their activities as inquiry-based teaching. However, the observations of these classrooms suggest that these teachers have removed themselves from their academic roles in the name of student autonomy. The results are lessons without clear goals, without integrated activities, and without observable student progress on educational tasks.

Teacher Practices

In the observations of student-centered, un-facilitated lessons, teachers take on one of two typical roles, either they focus on enabling the technical activities of their students (e.g., helping with searches, instructing students in use of the software, etc.), or they remove themselves from most classroom activity. Both roles have the effect of distancing the teacher from the academic goals of a given lesson and from the learning environment in which their students are placed.

Typically, teachers of these lessons set general goals for their students, but they do not structure lesson activities and tasks in grade appropriate ways. Lesson goals are implicit or, if stated explicitly, are not reinforced as part of the interaction between student and teacher. They do not provide students with academic support to enable the satisfaction of the academic or curriculum goal; rather, they assume that students possess the requisite skills to make sense of Internet materials and web pages on their own.

Student Activities

For their part, students are engaged in the work; they use computers, use the software, search the Internet, etc. However this activity is performed without a clear goal and much of the student activity is not related to completing a lesson task. In these lessons, students do not appear to gain an understanding of how to apply computer resources to the completion of their lessons, and much of their activities appear to be undirected searching or technical "doodling" with different software attributes (e.g., animation effects in PowerPoint slide presentations).

Lesson Tasks

In terms of learning, in these lessons the academic goals are difficult to understand. There is no obvious or explicit relation of the lesson activity to a curriculum goal. The lesson goal is often too complex for students to understand and complete, i.e., it has not been sufficiently structured into grade-appropriate activities. For example, in one lesson students were asked to conduct a search about "rocks and minerals," as opposed to specifying the topic (e.g., "find information about three kinds of quartz"). In the absence of a clear and manageable academic goal, the technical aspects of computer use predominate. Internet searching and applying software "bells and whistles" become ends in themselves.

Use of the eMINTS Equipment

The use of computers in these lessons reveals a lack of integration of the technology into the curriculum. Simply put, computer work in these lessons does not contribute to the overall lesson. However, in most of these lessons, computer work was the central activity during the observation period. One may argue that learning about technology, learning how computers and software work, is a legitimate curriculum goal. However, in these lessons it appears that other curriculum goals have been replaced by technology experience and exploration.

Student-centered, Facilitated Lessons

The student-centered, facilitated lesson is the more positive of the two types of student-centered, lessons observed. In many ways, this lesson type embodies the goals of the eMINTS program.

Teacher Practices

The teacher's role is much more than a lecturer. Teachers in student-centered, facilitated lessons vary their teaching activities and methodology according to their lesson's instructional goal. Teachers lecture, conduct group discussions, facilitate student brainstorming, etc. when appropriate to the academic goal of the lesson.

The essence of this type of lesson lies in the structure of the "learning task." Teachers structure the lesson as a series of tasks and subtasks. Each task is broken down into grade-appropriate activities, that is, individual activities are constructed to meet both the abilities of the student and the appropriate curriculum standard. These activities have an explicit sequence to them, and each has stated criteria for completion. In some instances, these criteria are written down in a scoring guide. In others, the teacher communicates them to the class in a variety of ways. In all cases, these criteria are stated and reinforced at multiple points throughout the lesson. The goals of the lessons are constructed by combining district curriculum goals from a variety of subject areas. Lessons are less focused on issues of basic mastery and stress higher-order comprehension and logic. Finally, opportunities for consultation and communication between students and with the teacher are structured into the conduct of the lesson.

Student Activities

In student-centered, facilitated lessons, students have "bounded autonomy," that is, they have great latitude in the completion of specific tasks, but the tasks themselves are bounded by the overall structure of the lesson and the task. For example, in many student-centered, facilitated lessons, students are able to choose background colors, typefaces, and pictures to include in their documents or slide presentations. However, the activity of creating the document or presentation occurs within a general structure of tasks established by the teacher, for example, as part of a WebQuest or other extended activity. In these lessons, students' opportunity to "inquire" occurs in the completion of these tasks.

Because they have control over their work products, students appear to feel empowered to complete subtasks to their satisfaction. Because the teacher does not occupy the classroom as the absolute authority over information, student work tends to be integrative; students take information from several sources (the Internet, other electronic sources, textbooks, reference materials, etc.) as appropriate. Student work also tends to be collaborative. Students confer and discuss assignments within and between student teams. Students confer with the teacher at predetermined points in the sequence of a lesson.

Lesson Tasks

The instructional and academic goals of a lesson are stated explicitly. Teachers embed these goals into specific tasks and subtasks. The tasks and subtasks relate to each other in clear and understandable ways. Teachers express the goals and tasks of the lesson in multiple, and often repeated, ways (e.g., through scoring guides, daily summaries, conferencing, etc.). In their interaction with students, teachers explicitly share classroom knowledge and expertise. This sharing is seen as appropriate intellectual interplay between teachers and students. Often, teachers will devise an extensive division of labor among students, e.g., relying on students to assist each other with basic computer operation tasks, establishing consulting and conferencing arrangements among groups of students, etc., and

creating an environment where students have substantial responsibility for their learning work.

Use of the eMINTS Equipment

In this type of lesson, all of the individual characteristics, i.e., the teacher's construction of the lesson, the students' activities, the cooperative classroom climate, etc., work together to support a classroom community organized to maximize learning. In all of this activity, the relationship between the use of the eMINTS equipment, the teaching activities, and the learning outcomes is kept explicit. In this environment students are fully engaged participants in the educational endeavor.

In these lessons, this equipment is fully integrated into the lesson, and is used whenever appropriate to meet the academic goals of the lesson. Computers are used as one source of information along with books and other resources. A premium is placed on the appropriate use of technology within the structure of the lesson and activities.

Hybrid Lessons

Between each of the three homogenous lesson types, is a heterogeneous lesson type, the "hybrid lesson." The majority of observed lessons fall into this category, and the category reflects the attempts of eMINTS teachers to use their technology in creative ways. Hybrid lessons combine characteristics of facilitated and teacher-centered lessons, most typically by attempting an innovative computer lesson in a teacher-centered classroom.

Teaching Practices

In these lessons, teachers are working very hard to facilitate an inquiry-based activity. The effectiveness of this activity appears limited by the prominent role of the teacher as the main source of information. Typically, teachers undertake these activities without providing students with sufficient background information about the assignment, the tasks necessary to complete the assignment, or its grading or scoring.

In these lessons the working environment does not encourage student independence. In student-centered, facilitated lessons students always know what to do and, in time, become comfortable progressing from one activity to the next without extensive prompting. In hybrid lessons, students still rely on the teacher to give them permission to proceed from one activity to the next. Teachers in hybrid lessons tend to answer more student requests about more topics –both technical and substantive— than teachers in either teacher-centered or student-centered, facilitated lessons.

Student Activities

For students, these lessons are difficult to complete. Students are certainly engaged in operating the computer, but they typically do not have an opportunity to inquire into any subject. Often, hybrid lessons appear to be unrelated to the other work of the class. In many cases, the computer work is limited to one subject and must be completed in the time normally allocated to that subject.

Lesson Tasks and the Use of the eMINTS Equipment

In terms of learning, the computer activities in hybrid lessons are seen as discrete activities. In these lessons there is an almost mechanical approach to using WebQuests, i.e., WebQuests are implemented as they are received, rather than adapted to meet the needs of a particular class. For example, the teacher of one lesson remarked to the evaluators that the WebQuest their class was working on was "a lousy WebQuest. All they are doing is completing a worksheet. Couldn't they do this with a textbook?" Rather than adapting the WebQuest to the classes' needs, this teacher used the activities she received. In this sense, the WebQuest was used like a textbook. The results are lessons that are not substantially different from lessons in teacher-centered classrooms.

It is clear that the teachers of hybrid lessons have made changes in their teaching. It is clear that they are attempting to implement what they believe are "inquiry-based" lessons. They have moved from the traditional, teacher-centered lesson towards something more facilitated. But it is also clear that they have not yet found ways to fully implement student-centered, facilitated lessons, even though the content of individual lessons has changed.

Relating the Lesson Categories to Each Other

The four categories in the lesson typology identify a rough continuum of teaching activities, from situations characterized by teacher control over the pace and sequence of learning in the teacher-centered lesson, to situations characterized by teacher absence from the academic work of the class in the student-centered, un-facilitated lesson. In between these two extremes are lesson types characterized by experimentation on the one hand and by a desirable balance between teacher control and student inquiry on the other.

The conduct of student-centered, facilitated lessons, as expressed in the integration of computer resources, teacher leadership and student activities, meets the criteria of effective instruction endorsed by several educational organizations. For example, the National Association for the Education of Young Children argues that, "technical skills are taught as needed to accomplish larger goals (language, writing, spelling, and reading ability) not as a goal itself."[1]

In very real ways, the hybrid lesson type reveals teachers experimenting with new ways of instructing and teaching. These teachers are trying different strategies and implementing teaching methods that are new to them. The strategies they are choosing and the new activities they are implementing reflect a developing understanding of what is possible with the eMINTS technology.

Student-centered, facilitated lessons exhibit a balance between teacher authority and student inquiry, and contain many of the "critical attributes" found in the WebQuest model.[2] All of these lessons are structured around a clearly identified and doable *task*. The task is structured around a clear and appropriate *process*,

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[1] *Technology and Young Children – Ages 3 through 8* NAEYC Position Statement, 1996.
http://www.naeyc.org/about/position/pstech98.htm
[2] Dodge, Bernie 1997 *Some thoughts about WebQuests*.
http://edweb.sdsu.edu/courses/edtec596/about_webquests.html

and the teacher provides consistent and appropriate *guidance* for student work. In these lessons, the teacher remains an important part of the educational process. Unlike teacher-centered lessons, these teachers are not the only source of knowledge and information and unlike student-centered, un-facilitated lessons they have not given up their academic authority to students. In student-centered, facilitated lessons teachers have found a balance and are able to use this balance to create meaningful educational experiences for their students.

Table 1
Change in Lesson Classifications, FY00 to FY01
Percentage Change

	FY00		FY01		FY00-FY01	
	Count	Percentage	Count	Percentage	Change	% Change
Teacher-Centered	18	21.2	19	22.4	1	5.6
Hybrid	41	48.2	24	28.2	-17	-41.5
Student-centered, Facilitated	21	24.7	37	43.5	16	76.2
Student-centered, Unfacilitated	5	5.9	5	5.9	0	0.0
Total	85	100.0	85	100.0		

Distribution of Lessons by Category, FY00 to FY01

Eighty-five FY00 teachers were observed twice, once in the FY00 school year and again in the FY01 school year. The distribution of lesson types across the two years is presented in Table 1. By far, the greatest change is the percentage increase in the number of student-centered, facilitated lessons. These lessons increased by 16, or 76.2 percent. In contrast, the number of hybrid lessons decreased by 17, or 41.5 percent.

Table 2
Transition Rates in Lesson Classification, FY00 to FY01
in Percent

Classification in FY00	Teacher-Centered	Hybrid	Classification in FY01 Student-centered, Facilitated	Student-centered, Unfacilitated
Teacher-Centered	**44.4**	27.8	27.8	0.0
Hybrid	24.4	**26.8**	39.0	9.8
Student-centered, Facilitated	4.8	23.8	**71.4**	0.0
Student-centered, Unfacilitated	0.0	60.0	20.0	**20.0**

Table 2 shows the detailed transition rates between observations in FY00 and FY01. This table shows the classification of lessons in FY00 by its classification in FY01. This table shows differences between categories in each year. For example, the table shows that 44.4 percent of the teachers classified in the "Teacher-Centered" category in FY00 were classified as "Teacher-Centered" in FY01.

The largest overall change was in the number of hybrid lessons observed in FY00. Of these, 39.0 percent were classified as student-centered, facilitated lessons in FY01, 24.4 percent were classified as teacher-centered lessons, and 26.8 percent were classified as hybrid lessons in FY01.

Classification of Lessons

The overall typology is based on differentiating the content of teacher activities, student activities, the overall content of the lesson, and the use of the eMINTS equipment during the observed lesson[3]. These four general dimensions were operationalized into 14 dichotomous variables describing some key features of the observed classroom context. These dimensions are presented in Table 3. Each observed lesson was coded according to whether or not the dimension was present. These dimensions create a scale with a range between zero and 14 points. The summary statistics of this scale is presented in Table 4.

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[3] The selection of the lesson to be observed was made in consultation with the teacher, so we assume that these lessons reflect the selection of the teacher's "best" lesson. Evaluators scheduled their observations in consultation with the teacher. Teachers were asked to allow evaluators to observe a "typical" lesson. However, many teachers rearranged their daily schedules so the evaluators would observe lessons teachers thought showed the best use of the eMINTS equipment.

Table 3
Dimensions of Lesson Classification

Teacher Activities
Teacher asks open-ended questions
Teacher elicits student help
Teachers gives students positive feedback
Teacher has a positive attitude towards students
Teacher has good classroom discipline

Student Activities
Students work in teams
Students involved in determining content of the lesson
Classroom showed student ownership with student work displayed

Lesson Activities
Lesson is age appropriate
Lesson integrates multiple subjects
Lesson has an identifiable framework

Use of eMINTS Equipment
Teacher uses SMART Board interactively
Students use computers during observation
Students use Internet during observation

First, there are no statistically significant differences between program years, that is, the mean score for observations in FY01 is not significantly different from the mean score in FY00. However, there are significant differences between typology categories. The pattern of scores shows a general increase from teacher-centered lessons, through hybrid lessons to student-centered, facilitated lessons. For both years student-centered, unfacilitated lessons have a score between teacher-centered and hybrid Lessons.

These differences show the progressive differences between categories of the typology. Generally, one would expect higher scores on these dimensions as one moves from teacher-centered to student-centered, facilitated lessons. These differences also document the problematic characterization of student-centered, unfacilitated lessons. Student-centered, unfacilitated lessons show less progress towards the "facilitated" lesson ideal than hybrid lessons, indicating the unfocused nature of the lesson type.

Table 4
Scale Summary Statistics by Lesson Category and Program Year

Program Year	All Teachers	Teacher-Centered	Hybrid	Student-centered, Facilitated	Student-centered, Unfacilitated	Within-Year P-Value
FY00						
Mean	9.02	5.28	8.95	12.57	8.20	<0.0001
Standard Deviation	3.37	2.74	2.38	1.36	3.27	
Minimum	1	1	5	9	3	
Maximum	14	12	13	14	11	
Number of Observations	85	18	41	21	5	
FY01						
Mean	9.37	5.00	8.50	12.43	7.40	<0.0001
Standard Deviation	3.43	1.83	2.19	1.37	1.14	
Minimum	2	2	5	9	6	
Maximum	14	9	12	14	9	
Number of Observations	85	19	24	37	5	
Between-Year P-Value	0.383	0.066	0.533	0.615	0.697	

The one curious characteristic of Table 4 is the fact that while the overall score for all lessons increases between FY00 and FY01 the average scores for each category decreases. While none of these differences are statistically significant, their distribution bears some scrutiny.

Table 5 presents the FY00-FY01 score differences for all of the combinations in the lesson typology. The results of this table show a general decrease in scale scores between observations for lessons classified in the same category each year and for lessons classified down a category, e.g., the ten lessons classified as hybrid in FY00 and teacher-centered in FY01. However, lessons that improved, i.e., moved up at least one category, showed score increases.

This pattern has several interpretations. First, the limited nature of the classroom observations cannot be ignored. These observations cannot reflect the full range of activities teachers engage in. It is entirely possible that the activities observed reflect the particular circumstances of the observed class period, rather than reflecting the overall character of the school day. However, these differences do suggest that lessons classified in higher categories in FY01, i.e., lessons where classification "improved", showed more of these activities. Another, more troubling, aspect of Table 5 is the reduction in scale score among lessons in the same category each year. This may indicate that these lessons are less innovative in FY01 than they were in FY00. It may also indicate that the teacher has found a balance between her conventional teaching activities and the inquiry-based ideals espoused by the eMINTS project.

Table 5
Mean Scale Differences by Lesson Category and Program Year

FY00	Teacher Centered	Hybrid	FY01 Student-centered, Facilitated	Student-centered, Unfacilitated
Teacher Centered				
Mean	-0.63	0.60	8.00	
Standard Deviation	3.02	1.82	2.83	
Number of Observations	8	5	5	0
Hybrid				
Mean	-2.50	-0.73	2.75	0.75
Standard Deviation	2.07	3.77	2.67	1.71
Number of Observations	10	11	16	4
Student-centered, Facilitated				
Mean	-2.00	-3.20	-0.53	
Standard Deviation	0.00	2.59	1.64	
Number of Observations	1	5	15	0
Student-centered, Unfacilitated				
Mean		0.33	-1.00	-1.00
Standard Deviation		4.04	0.00	0.00
Number of Observations	0	3	1	1

The Distribution of Lesson Dimensions

The percentage distribution of the 14 lesson categories in Table 3 across lesson categories and program years is presented in Table 6. This table shows changes in the percentage of all teachers who were scored positively on a dimension during each observation as well as the percentage distribution across each category in the typology.

Only one dimension shows a significant increase between FY00 and FY01. The proportion of teachers who were observed asking open-ended questions increased from 48.2 percent in FY00 to 64.7 percent in FY01. There was no difference in the proportion of teachers observed providing students with positive feedback. There were small decreases in the proportion of teachers observed maintaining classroom discipline and the number of classrooms that displayed student work. All of the remaining dimensions showed slight increases between FY00 and FY01. Within each year there is a general increase in the proportion of teachers coded positively on each dimension between teacher-centered, hybrid and student-centered, facilitated lessons. Typically the proportion of teachers of student-centered, unfacilitated lessons was between hybrid and student-centered, facilitated lessons.

Table 6
Scale Dimensions by Lesson Category and Program Year

	All Teachers	P-Value	Teacher-Centered	Hybrid	Student-centered, Facilitated	Student-centered, Unfacilitated	P-Value
Teacher Activities							
Teacher asks open-ended questions							
FY00	48.2	0.0300	22.2	41.5	81.0	60.0	0.0020
FY01	64.7		26.3	50.0	94.6	60.0	<0.0001
Teacher elicits student help							
FY00	37.6	0.0890	11.1	26.8	85.7	20.0	<0.0001
FY01	50.6		5.3	37.5	81.1	60.0	<0.0001
Teachers gives students positive feedback							
FY00	56.5	1.0000	33.3	48.8	95.2	40.0	<0.0001
FY01	56.5		21.1	37.5	94.6	0.0	<0.0001
Teacher has a positive attitude towards students							
FY00	71.8	0.7300	33.3	75.6	95.2	80.0	<0.0001
FY01	74.1		42.1	62.5	100.0	60.0	<0.0001
Teacher has good classroom discipline							
FY00	90.6	0.1700	88.9	90.2	100.0	60.0	0.0520
FY01	83.5		78.9	79.2	94.6	40.0	0.0130
Student Activities							
Students work in teams							
FY00	60.0	0.8750	16.7	58.5	95.2	80.0	<0.0001
FY01	61.2		5.3	58.3	91.9	60.0	<0.0001
Students involved in determining content of the lesson							
FY00	57.6	0.4330	27.8	48.8	95.2	80.0	<0.0001
FY01	63.5		15.8	41.7	97.3	100.0	<0.0001
Classroom showed student ownership with student work displayed							
FY00	65.9	0.0610	50.0	70.7	71.4	60.0	0.4210
FY01	51.8		31.6	50.0	64.9	40.0	0.1140
Lesson Activities							
Lesson is age appropriate							
FY00	96.5	0.3040	94.4	97.6	100.0	80.0	0.1640
FY01	92.9		94.7	87.5	100.0	60.0	0.0070
Lesson has an identifiable framework							
FY00	65.9	0.7480	44.4	65.9	100.0	0.0	<0.0001
FY01	63.5		21.1	58.3	97.3	0.0	<0.0001
Lesson integrates multiple subjects							
FY00	43.5	0.5380	5.6	39.0	85.7	40.0	<0.0001
FY01	48.2		5.3	50.0	73.0	20.0	<0.0001

(Continued.)

Table 6 Continued.

	All Teachers	P-Value	Teacher-Centered	Hybrid	Student-centered, Facilitated	Student-centered, Unfacilitated	P-Value
Use of eMINTS Equipment							
Teacher uses SMART Board interactively							
FY00	49.4	0.2820	38.9	48.8	66.7	20.0	0.1690
FY01	57.6		26.3	58.3	75.7	40.0	0.0040
Students use computers during observation							
FY00	87.1	0.0580	44.4	100.0	95.2	100.0	<0.0001
FY01	95.3		84.2	100.0	97.3	100.0	0.0730
Students use Internet during observation							
FY00	71.8	0.8640	16.7	82.9	90.5	100.0	<0.0001
FY01	72.9		42.1	79.2	81.1	100.0	0.0050

There are some exceptions to this pattern. In FY01 all of student-centered, unfacilitated lessons were classified as involving students in determining the content of the lesson, compared to 97.3 percent of teachers of student-centered, facilitated lessons. Likewise, in all of the hybrid and student-centered, unfacilitated lessons students were observed using the eMINTS computers and the Internet.

There is evidence that the use of the eMINTS equipment in teacher-centered lessons had increased from FY00 and FY01. The proportion of lessons where students were observed using eMINTS computers and the Internet has more than doubled between FY00 and FY01.

Table 7
IBL Criteria by Lesson Dimension

IBL Criteria	Substantive Category	Lesson Dimension
Uses questions and activities that are interesting and motivating		
	Lesson Activities	Lesson has an identifiable framework
		Lesson integrates multiple subjects
		Lesson is age appropriate
	Student Activities	Students involved in determining content of the lesson
	Teacher Activities	Teacher asks open-ended questions
Uses a wide variety of resources so students can gather information and form opinions		
	Student Activities	Students work in teams
	Use of eMINTS Equipment	Class uses computers during observation
		Class uses Internet during observation
		Teacher uses SMART Board interactively
Teachers play role as a facilitator		
	Teacher Activities	Teacher elicits student help
		Teacher has a positive attitude towards students
		Teacher has good classroom discipline
		Teachers gives students positive feedback
Not in Criteria		
	Student Activities	Classroom showed student ownership with student work displayed

The Lesson Typology and Criteria for Inquiry-Based Lessons

Over the first two years of eMINTS professional development program, the eMINTS professional development staff encouraged eMINTS teachers to adopt teaching activities grounded in a constructivist orientation to inquiry-based lessons. At the FY02 eMINTS Kickoff meeting, the eMINTS professional development staff outlined five general characteristics of inquiry-based lessons (IBL). According to the IBL criteria, inquiry-based lessons have the following characteristics:

1. Activities use higher levels of Bloom's Taxonomy (e.g., Analysis, Synthesis and Evaluation)
2. Uses questions that are interesting and motivating
3. Uses a wide variety of resources so students can gather information and form opinions.
4. Teachers play role as facilitator
5. Creates meaningful products

Table 8
Lesson Scores on IBL Criteria
(Summary Statistics)

	Teacher-Centered Lessons	Hybrid Lessons	Student-centered, Facilitated Lessons	Student-centered, Unfacilitated Lessons	Within-Year P-Value
Uses questions and activities that are interesting and motivating					
FY00					
Mean	1.9	2.9	4.6	2.6	<0.0001
Standard Deviation	1.2	1.0	0.6	1.1	
Minimum	0	1	3	1	
Maximum	5	5	5	4	
Number of Cases	18	41	21	5	
FY01					
Mean	1.6	2.9	4.6	2.4	<0.0001
Standard Deviation	0.7	0.9	0.6	0.9	
Minimum	1	1	3	2	
Maximum	3	5	5	4	
Number of Cases	19	24	37	5	
Between-Year P-Value	0.330	0.833	0.987	0.766	
Uses a wide variety of resources so students can gather information and form opinions					
FY00					
Mean	1.2	2.9	3.5	3.0	<0.0001
Standard Deviation	1.0	0.8	0.7	0.7	
Minimum	0	1	2	2	
Maximum	3	4	4	4	
Number of Cases	18	41	21	5	
FY01					
Mean	1.6	3.0	3.5	3.0	<0.0001
Standard Deviation	1.0	0.9	0.7	1.0	
Minimum	0	1	1	2	
Maximum	4	4	4	4	
Number of Cases	19	24	37	5	
Between-Year P-Value	0.232	0.806	0.931	1.000	

(Continued.)

Table 8 Continued.

	Teacher-Centered Lessons	Hybrid Lessons	Student-centered, Facilitated Lessons	Student-centered, Unfacilitated Lessons	Within-Year P-Value
Teachers play role as a facilitator					
FY00					
Mean	1.7	2.4	3.8	2.0	<0.0001
Standard Deviation	1.2	1.1	0.7	1.6	
Minimum	0	0	1	0	
Maximum	4	4	4	4	
Number of Cases	18	41	21	5	
FY01					
Mean	1.5	2.2	3.7	1.6	<0.0001
Standard Deviation	1.1	1.3	0.5	0.9	
Minimum	0	0	2	0	
Maximum	3	4	4	2	
Number of Cases	19	24	37	5	
Between-Year P-Value	0.616	0.439	0.737	0.639	

The lesson observations conducted by the evaluation team were completed without the evaluation team's knowledge of the IBL criteria but thirteen of the fourteen lesson dimensions described above fall within one of these criteria (see Table 7). Table 7 does not address two criteria.

The first is the location of the observed lesson on Bloom's Taxonomy. This typology classifies cognitive learning activities on a continuum between categories of "Knowledge" and "Evaluation". As lessons are classified at higher levels of this taxonomy, the character of the lesson becomes more inquiry-based, and they motivate higher-order thinking skills among students. Versions of this typology provide an extensive list of keywords and activities that characterize each category. Unfortunately, the observations made among FY00 and FY01 teachers were not designed to locate lessons on this taxonomy. Consequently, no reliable assessment of FY00 and FY01 teachers can be made. Future observations will use the criteria in Bloom's taxonomy to classify lessons.

The other IBL criteria not addressed in Table 7 is the "creation of meaningful products." The observed lessons were coded to identify specific lesson products, i.e., PowerPoint presentations, brochures, trading cards, etc. Lessons were coded as producing a product if any product was in evidence.

Summary statistics for the IBL criteria are presented in Tables 8 and 9. In every case, the application of the IBL criteria were done after the observations were complete, so the validity of the coding lessons according to these criteria is limited by the information the evaluators recorded in their notes. Consequently, any conclusions based on the information in these tables should be made cautiously.

Table 9

Table 9
Observed Classroom Product by Lesson Typology Category
(in Percent)

	Teacher Centered	Hybrid	Student-centered, Facilitated	Student-centered, Unfacilitated	Total	Within-Year P-Value
FY00						
No	83.3	73.2	23.8	100.0	64.7	<0.0001
Yes	16.7	26.8	76.2	0.0	35.3	
Total	100.0	100.0	100.0	100.0	100.0	
FY01						
No	94.7	54.2	54.1	100.0	65.9	0.0040
Yes	5.3	45.8	45.9	0.0	34.1	
Total	100.0	100.0	100.0	100.0	100.0	
Between-Year P-Value	0.264	0.118	0.025	1.000	0.827	

Table 8 presents the summary statistics for the dimensions of the lesson typology by the categories of the IBL criteria. In each year there are statistically significant across the categories of the lesson typology. However, there is no evidence that the overall score within each lesson category changed from year to year. This suggests that teachers in each category did not become more inquiry-based between their first and second years in the program.

A similar pattern is seen in the presence of a "meaningful product." There are significant differences between categories, but not between years. In FY00 16.7 percent of teacher-centered lessons were coded as having a product, compared to 76.2 percent of the student-centered, facilitated lessons. With the exception of student-centered, facilitated lessons, there are no significant differences between years. For student-centered, facilitated lessons a smaller proportion of the lessons observed in FY01 had an observed product, 45.9 percent compared to 76.2 percent in FY00.

Table A.1 through A.3 in Appendix A show the transition differences between FY00 and FY01. These tables show a similar pattern to Table 5, i.e., score increases among teachers whose classification improved between FY00 and FY01 and score decreases among teachers whose classifications decreased or stayed the same.

Interpretation
The use of the IBL criteria to understand teachers' lesson activities is a relatively new part of the eMINTS professional development program. In fact, the observations made by the evaluation team were conducted independent of these criteria. Rather than looking for the characteristics of the IBL criteria during the observations, these criteria were applied after the observations were completed. Consequently, these results are not a complete assessment of whether teachers are engaged in Inquiry-Based Instruction as defined by the eMINTS project.

Nevertheless, it is interesting to note that the only consistent differences one sees are between categories of the lesson typology. There are statistically significant

differences among different categories, but not between years. These between-year differences generally show a slight decrease in scores between FY00 and FY01.

One interpretation of this decrease is that teachers have reached a level of comfort in their instruction; that after a year of experimentation in FY00, teachers have selected a set of activities they are comfortable with. Another interpretation reflects the marginal changes in the number of teachers in each category. It could be that the decrease is due to teachers new to a particular category. This would suggest that as teachers continue to gain experience with IBL teaching methods, these scores would increase.

Both of these interpretations are speculative. The problem of using a single observation to assess the process of teacher change is relevant here as well. There is no way to understand the overall pattern of change by observing two classroom lessons in two years. A more appropriate data design would collect observations at multiple times throughout the school year. Fortunately, the classroom observations conducted by the CIS during the FY01 school year provide some insights into the development of teaching practices.

Figure 1
Percentage Distribution of eMINTS Professional Development Staff
Narrative Reports, by Lesson Category
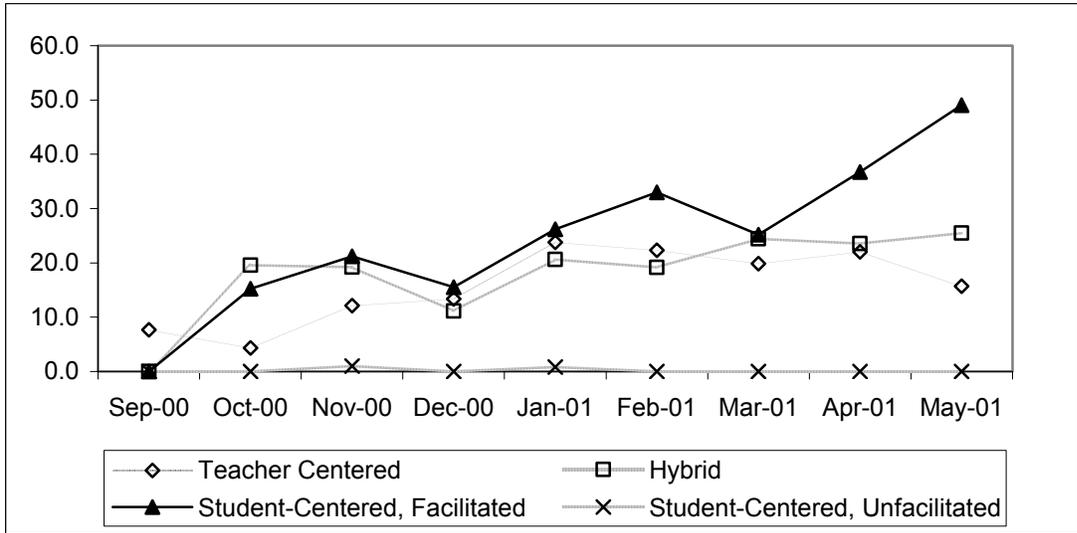
Patterns of Lessons Observed by the eMINTS Professional Development Staff, September 2000 to May 2001

As part of their work with participating teachers members of the eMINTS professional development staff submitted 1520 narrative report forms describing visits to participating teachers. Forty-five percent of the narratives were about FY00 teachers. Members of the evaluation team coded these narratives in terms of the categories of the lesson typology. Many of these narratives were short descriptions of lesson activities and did not provide enough information to support classification according to the fourteen lesson dimensions discussed above. However, it was possible to code 443 narratives (or 66 percent of all FY00 narratives) into the four general categories of the lesson typology.

These narratives have the advantage of being collected throughout the FY01school year, and show a general increase in the number of student-centered, facilitated lessons (see Figure 1). The percentage of student-centered, facilitated lessons rose from none in September 2000 to about half of the observed lessons by May 2001.

Summary and Conclusions: The state of hybrid lessons

At its most general level, the results of the classroom observations show a general improvement in the percentage of student-centered, facilitated lessons. Between the FY00 and FY01 observations the number of lessons classified as "student-centered, facilitated" increased by 76.2 percent.

The lessons in this category generally correspond to the inquiry-based, "constructivist" instructional ideal embodied in the eMINTS professional development program. By FY01, student-centered, facilitated lessons were the most frequently observed type of lesson. However, these lessons are less than half of the 85 lessons observed.

Forty-eight of the lessons were not classified as student-centered, facilitated, and half of these were classified as "hybrids." The presence of hybrid lessons is difficult to understand. It suggests that these teachers are not completely successful in implementing an inquiry-based lesson. One can speculate about what factors prevent teachers of hybrid lessons from mounting a fully student-centered, lesson; certainly everything from the personal qualities or tenure of individual teachers to the curriculum demands of individual schools and districts can impact what types of instructional approaches and activities an individual teacher feels is appropriate.

The results in Table 6 provide some insight into the difficulties teachers of hybrid lessons have in conducting inquiry-based lessons. A close reading of this table suggests that the teachers of hybrid lessons are not as successful in creating a classroom environment that supports inquiry-based instruction as the teachers of student-centered, facilitated lessons.

Between FY00 and FY01 the percentage scores for hybrid lessons fell in eight of the fourteen dimensions. Five of these dimensions deal directly with the interaction of teachers and students and the participation of students in their learning. Teachers in the hybrid category in FY01 were less likely to be observed giving their students positive feedback, exhibiting a positive attitude towards their students, and maintaining classroom discipline. In addition, in these lessons evaluators observed fewer situations where students had opportunities to determine the content of their work and fewer classrooms that had student work on display.

The results from Table 6 suggest that the interaction between teachers and students in hybrid lessons does not support the types of community necessary for student-centered, inquiry-based instruction. A necessary feature of a student-centered, environment is an explicit community, one with norms that support student-directed education. It appears that this is one thing that teachers of hybrid lessons have not been able to achieve. For the program, the existence of the hybrid lessons suggests that the professional development program focus more explicitly on how to create and sustain an operating classroom community.

Over the period of these observations, FY00 to FY01, the eMINTS professional development program has developed a fairly sophisticated methodology supporting inquiry-based instruction. While the FY00 cohort of teachers has benefited from this professional development effort, they have also had to cope with the shortcomings of a new program. As the teacher training components of the eMINTS program develops, the central role of a supportive student learning community in facilitating inquiry-based instruction becomes clearer. At the beginning of the program the role of the classroom community was implicit, now, at the end of the first cohort's participation, it is clear that a supportive community must be developed in order to support inquiry-based learning.

The observations suggest that over the period of their eMINTS participation, many FY00 teachers learned how to create and support student centered learning communitiies. However, other teachers apparently require additional support to make inquiry-based instruction a central part of their classroom activities.

Uses questions and activities that are interesting and motivating

| | Classification in FY01 | | | |
Classification in FY00	Teacher-Centered	Hybrid	Student-centered, Facilitated	Student-centered, Unfacilitated
Teacher-Centered				
Mean	-0.50	-0.60	3.60	
Standard Deviation	0.93	1.14	0.55	
Number of Observations	8	5	5	0
Hybrid				
Mean	-1.00	-0.46	1.94	-0.50
Standard Deviation	1.33	1.51	1.18	0.58
Number of Observations	10	11	16	4
Student-centered, Facilitated				
Mean	-2.00	-1.60	-0.13	
Standard Deviation		1.14	0.64	
Number of Observations	1	5	15	0
Student-centered, Unfacilitated				
Mean		0.33	2.00	2.00
Standard Deviation		1.53		
Number of Observations	0	3	1	1

(Continued.)

Uses a wide variety of resources so students can gather information and form opinions

	Classification in FY01			
Classification in FY00	Teacher-Centered	Hybrid	Student-centered, Facilitated	Student-centered, Unfacilitated
Teacher-Centered				
Mean	0.50	1.80	2.20	
Standard Deviation	1.20	0.45	2.05	
Number of Observations	8	5	5	0
Hybrid				
Mean	-1.50	-0.18	0.56	1.00
Standard Deviation	1.35	1.60	1.09	1.41
Number of Observations	10	11	16	4
Student-centered, Facilitated				
Mean	1.00	-0.20	-0.33	
Standard Deviation		0.84	1.05	
Number of Observations	1	5	15	0
Student-centered, Unfacilitated				
Mean		0.33	1.00	-1.00
Standard Deviation		1.53		
Number of Observations	0	3	1	1

(Continued.)

Teachers play role as a facilitator

Classification in FY00	Teacher-Centered	Hybrid	Classification in FY01 Student-centered, Facilitated	Student-centered, Unfacilitated
Teacher-Centered				
Mean	-0.63	-0.60	2.20	
Standard Deviation	1.92	0.89	0.84	
Number of Observations	8	5	5	0
Hybrid				
Mean	0.10	0.09	0.56	0.50
Standard Deviation	1.60	1.45	1.15	1.00
Number of Observations	10	11	16	4
Student-centered, Facilitated				
Mean	-1.00	-1.20	0.07	
Standard Deviation		0.84	0.70	
Number of Observations	1	5	15	0
Student-centered, Unfacilitated				
Mean		-0.33	0.00	-2.00
Standard Deviation		1.53		
Number of Observations	0	3	1	1