OMLI Classroom Observation Protocol

Instructions

About Mathematical Discourse

The OMLI Classroom Observation Protocol is a tool for documenting the quantity and quality of mathematical discourse that transpires during mathematics lessons observed as part of the OMLI project. For this research study, we are interested in documenting evidence of mathematical discourse that engage students in thinking about mathematical concepts and procedures. Several aspects of this definition require elaboration. First, the observation is looking for evidence of mathematical thinking among *students*. The teacher may initiate the discourse and may be involved in the discussion, but the student is the focus of the observation. The observer should not document evidence of mathematical thinking on the part of the teacher if it does not engage students. Second, the evidence must center around *mathematical ideas or procedures*. Interactions around classroom logistics or management are not part of mathematical discourse. Exhibit 1 provides examples of typical classroom activities that are and are not considered mathematical discourse for the purposes of this study.

Exhibit 1—What Is and Is Not Student Mathematical Discourse

IS Considered Discourse	IS NOT Considered Discourse
A student asks, "I don't understand how you got that answer. Could you explain it again?"	The teacher provides an explanation of a mathematical procedure to the class.
A student explains, "I first added 20 and 40 to get 60. Then I subtracted 2 and added 3 to get 61."	The teacher provides further explanation in response to a student's question.
A student explains, "I saw that 18 + 43 was the same as (20 + 40) – 2 + 3."	Two students discuss the scores of last week's football game.
Students write in their journals about their thinking to solve a problem.	The teacher provides instructions to the class about an activity they are about to engage in.
A student states, "I think I see a pattern. Each one goes up by 3 more than the one before it."	A student asks a question about nonmathematical procedures related to an assignment such as when the assignment is due, whether students need to show their work, and the like .
Two students discuss whether a procedure suggested by a student will work in all similar situations.	
A students challenges an algorithm posed by a student by saying, "Yes, but how does it work with 37 x 98?"	Students practice applying a procedure to solve problems of a specific type (seat work).
A student answers a question in response to the teacher.	The teacher provides a counter example to a method posed by a student.

Notation System for Classroom Discourse

This classroom observation protocol includes a notation system that enables observers to quickly and accurately record evidence of student discourse. Notation involves recording the mode, type, and the tools used by the students who are engaged in mathematical discourse in each lesson observed. The follow section provides a detailed description of each aspect of the notation system and outlines the method observers should use to record evidence of mathematical discourse among students.

Mode of Discourse—Mathematical discourse—that is, the act of articulating mathematical ideas or procedures—may take place in several modes. The observer should identify who the student is addressing. Exhibit 2 provides the codes, definitions, and descriptions of the various modes that are applicable in this study.

Exhibit 2—Modes of Mathematical Discourse

Code	Definition	Explanation
T	Student to Teacher	The student primarily addresses the teacher even though the entire class or group hears the student's comments.
S	Student to Student	The student addresses another student.
G	Student to Group or Class	The student addresses a small group of students or the entire class.
IR	Individual Reflection	The student documents his or her reflections about mathematics in writing.

Please note that the teacher to student and teacher to group or class modes, although common, are not listed because they relate to the mathematical thinking of the teacher, not the student.

Types of Discourse—Effective mathematical discourse is an iterative process by which students engage in a variety of types of discourse at different cognitive levels. Student questions lead to explanations and justifications that may be challenged and subsequently defended, which might in turn lead to the formation of new generalizations or conjectures, thereby initiating a new cycle. Exhibit 3 describes the types of mathematical discourse the observer should document during classroom observation.

Exhibit 3—Types of Mathematical Discourse

Code	Level	Definition	Explanation
A	1	Answering	A student gives a short answer to a direct question from the teacher or another student.
S	2	Making a Statement or Sharing	A student makes a simple statement or assertion, or shares his or her work with others and the statement or sharing does not involve an explanation of how or why. For example, a student reads what she wrote in her journal to the class.
E	3	Explaining	A student explains a mathematical idea or procedure by stating a description of what he or she did, or how he or she solved a problem, but the explanation does not provide any justification of the validity of the idea or procedure.
Q	4	Questioning	A student asks a question to clarify his or her understanding of a mathematical idea or procedure.
C	5	Challenging	A student makes a statement or asks a question in a way that challenges the validity of a mathematical idea or procedure. The statement may include a counter example. A challenge requires someone else to reevaluate his or her thinking.
R	6	Relating	A student makes a statement indicating that he or she has made a connection or sees a relationship to some prior knowledge or experience.

Code	Level	Definition	Explanation
P	7	Predicting or Conjecturing	A student makes a prediction or a conjecture based on their understanding of the mathematics behind the problem. For example, a student may recognize a pattern in a sequence of numbers or make a prediction about what might come next in the sequence or state a hypothesis a mathematical property they observe in the problem.
J	8	Justifying	A student provides a justification for the validity of a mathematical idea or procedure by providing an explanation of the thinking that led him or her to the idea or procedure. The justification may be in defense of the idea challenged by the teacher or another student.
G	9	Generalizing	A student makes a statement that is evidence of a shift from a specific example to the general case.

Tools for Discourse—Students may employ a variety of tools to help them communicate the mathematical ideas or procedures. The tools they choose to use are important indicators of their level of sophistication with respect to mathematics. Exhibit 4 describes some of the tools that students are likely to use.

Exhibit 4—Tools for Mathematical Discourse

Code	Definition	Explanation
V	Verbal	A student communicates mathematical ideas or procedures verbally (orally).
A	Gesturing/Acting	A student makes gestures or other body movements to communicate mathematical ideas or procedures.
W	Written	A student writes a narrative of mathematical ideas or procedures.
G	Graphs, Charts, Sketches	A student uses tables, graphs, charts, sketches, or other visual aids to depict mathematical ideas or procedures.
M	Manipulative	A student uses physical objects to model mathematical ideas or procedures.
S	Symbolization	A student uses informal, nonmathematical notation to communicate mathematical ideas or procedures.
N	Notation	A student uses standard (formal) mathematical notation to communicate mathematical ideas or procedures.
C	Computers/Calculators	A student uses computers, calculators, the Internet, or other forms of technology to communicate mathematical ideas or procedures.
O	Other	A student uses tools other that those described above.

Using the Notation—The observer will use the codes that appear in Exhibits 2 through 4 to document the quantity and quality of the mathematical discourse that occurs among the students in the classrooms observed. Exhibit 5 provides examples of observer's notations of evidence of mathematical discourse along with explanation of each set of notations.

Exhibit 5—Examples of Evidence Notation

Mode	Type	Tools	Explanation
T	Q	V	A student verbally asked the teacher a question to clarify a mathematical idea or procedure he or she did not understand.
G	E, J	V, A	A student addressed the class to give a verbal explanation of a mathematical idea or procedure; the student used hand gestures and the explanation included justification of the idea or procedure.
S S	E, J Q	G V	A student presented a mathematical idea or procedure to another student using tables and graphs. The second student asked questions to clarify his or her understanding of the idea or procedure but did not challenge its validity.
G	G	V	A student shared with the class an observation that he or she made about a pattern in a number sequence.
IR	E, J	W	Students individually reflected on a mathematical idea or procedure and wrote their thoughts in their journals.
T	A	V	A student answers a question from the teacher with a correct answer.
S	S	V	A student reads what he wrote in his journal to another student.
G	J	M	A student used manipulatives to build a model to justify a mathematical idea or procedure and presented the model to the class.
N			Students did not engage in any discourse during the lesson episode observed.
S	S	VM	One student in a small group uses a wooded cube to point out (make a statement) that a cube has 8 corners, 12 edges, and 6 flat surfaces.
G	E	V, G	A student drew a diagram on the board and explained to the class how he or she solved a mathematics problem.
G	G	V	A student verbally shared with the class a generalization or conjecture regarding a mathematical idea or procedure.
S S S	E, J, C J	G, N N G	Two students engaged in high-level dialogue over a single mathematical idea. The exchange involved an explanation and justification by one student, a challenge to the validity by the other student, followed by a defense of the idea by the first student. The students used graphs and mathematical notation during the process. (The observer's notations represent several exchanges between the 2 students, but all of the exchanges were around a single idea or procedure.)

Classroom Observations Procedures

Step 1: Schedule Observations

RMC Research staff drew a random sample of 25 participating schools for in-depth evaluation. Within each school, teachers were randomly selected for periodic observation throughout the duration of the project. Each graduate student observer was assigned approximately 16 to 18 teachers whom they will observe according to a schedule provided by RMC Research. If a selected teacher teaches more than one mathematics class, the observer should consult the teacher to select a class that would best typify the teacher's practices. The observer should observe the same class for each subsequent observation during the same school year.

RMC Research will send a letter to the teachers selected to participate in the observations explaining their involvement and how and why they were selected and inviting them to participate. Copies of the letters will also be sent to the school principals. The letter will include a consent form that the teachers will sign and return if they choose to participate. Those teachers who participate will receive $100 in 2 installments.

RMC Research will notify the appropriate observer once a teacher agrees to participate. At that point the observer should follow up with a telephone call to schedule the exact date and time for the observation. Observers must remember to schedule time for both the pre- and postobservation interviews and the observation itself. Contact information for teachers is available on the OMLI Professional Development Database (www.rmccorp.com/OMLI).

Step 2: Prepare for the Observation

Observers may find the following tips helpful when preparing for an observation:

- Make sure you have enough copies of the Discourse and Summary forms. You will need one copy of the Classroom Observation Summary Form for each observation but will likely need several copies of the Classroom Observation Discourse Form for each observation.
- Bring a tablet for taking notes, pencils and pens, and possibly a clipboard.
- Be sure you know how to find the school. Observers may wish to ask for directions when scheduling the observation or use an online map service such as MapQuest (www.mapquest.com) to help find the school. The address of all participating schools appears in the OMLI Professional Development Database.
- Check on the availability of parking if you are visiting a high school. Observers may wish to ask the teacher about parking when scheduling the observation.
- Allow enough time to drive to the school, park, sign in at the main office, obtain a visitor's pass, and find your way to the teacher's classroom.

Step 3: Conduct the Pre-observation Interview

The observer must gain information about the context of the lesson before it starts. Exhibit 6 lists several questions that observers can use to learn about the context of the lessons. Observers may elect to gather some of this information when scheduling the observation.

Exhibit 6—Suggested Pre-observation Interview Questions

1. What has this class been covering recently?

What unit are you working on?

What instructional materials are you using?

2. What do you anticipate doing with this class today/on the day of the observation?

What would you like the students to learn during this class?

3. Is there anything in particular that I should know about the students in this class?

The information gained through the preobservation interview will assist in the completion of the lesson context portion of the Classroom Observation Summary Form. Observers should be sure to express appreciation to the teachers for allowing the observation and should answer any questions they have about confidentiality, the use of the data collected, the incentive, and so on.

If the teacher is using published materials, be sure to note the complete name of the materials, publisher, chapter, section, and pages that relate to the lesson observed. If the teacher developed the lesson, get a copy of the lesson plan and include it with your submission.

Step 4: Observe the Lesson

The observer must be as unobtrusive as possible during the lesson. Avoid distracting the students by staying out of the spotlight as much as possible. Avoid interacting with the students in a way that takes their attention away from the lesson. Definitely avoid the urge to help the students with the activities or assignments.

Any lesson observed is likely to comprise distinct episodes and transitions between the episodes. Episodes have a distinct beginning and end and usually focus on 1 or 2 instructional objectives. The time during which students work in small groups to solve problems using manipulatives is a distinct episode. A large group discussion that engages students in sharing a variety of approaches to solving a problem followed by time for students to write in their journals is 2 episodes: the large group discussion is one episode and the journal time is another episode. Not all episodes will present opportunities for mathematical discourse among students. For example, a lesson may include materials cleanup. Such episodes do not require the observer to record evidence of mathematical discourse because none is likely to occur.

Observers should collect data on each distinct episode that has an instructional focus. The approach to data collection will change depending upon the type of episode that is observed. Exhibit 7 provides guidelines for collecting data on each type of episode. Observers should use the Classroom Observation Discourse Form to document evidence of mathematical discourse and ensure that all information required is captured for each episode that occurs during the lessons.

Exhibit 7—Episode Data Collection Guidelines

Episode Type	Data Collection Guidelines
Large group (All or most all students)	Observe the entire group and record the evidence of mathematical discourse as it occurs.
Pairs or small groups	Randomly choose one of the pairs or small groups and observe the interaction among the members of the selected group, recording evidence of mathematical discourse as it occurs. If the group is off task, move to another group of the same size.
Individual	Circulate among the students and observe what they are working on. If students are solving problems, it is unlikely any mathematical discourse will occur unless student interaction is involved. If all students are writing in their journals, record a single notation indicating as much (IR/E, J/W). If the teacher is circulating among the students or working with individual students, follow the teacher and record evidence of mathematical discourse on the part of the students.

The Classroom Observation Discourse Form is intended for use during the observation to record lesson episodes and the evidence of mathematical discourse that is observed during each episode. Because a lesson may involve any number of distinct episodes, observers must have a supply of blank Classroom Observation Discourse Forms readily available. Observers should indicate the teacher's name, the date of the observation, and page number at the top of each Classroom Observation Discourse Form to ensure that the forms can easily be associated with the corresponding Classroom Observation Summary Form. Exhibit 8 provides guidelines for completing each column of the Classroom Observation Discourse Form.

Exhibit 8—Classroom Observation Discourse Form Field Definitions

Field	Explanation
Episode Type	Check the ONE column that best describes how students are grouped for the episode. A change in the grouping is a good indicator that an episode has ended and a new one is about to begin.
Start/End Times	Record the time of day that the episode starts and when it ends to the nearest minute. It is very important that both of these times are recorded.
Students Observed	Record the number of students being observed during the episode.
Episode Description	Write a brief description of the episode, describing what students are doing.
Discourse Codes	Use these columns to record every incident of student mathematical discourse observed during the episode using the specified notation system described earlier. Assign a mode, type, and tools code to every incident.
Tally	For each incident of mathematical discourse that occurs, tally the number of times that it is observed during an episode. Remember to tally the first case.

Episodes that have a management or logistics focus such as cleanup or roll call need not be recorded. When one episode ends and another begins, *draw a horizontal line across the Classroom Obseration Discourse Form to indicate the transition* between episodes. Be sure to note the time each episode begins and ends. Use as many copies of the form as necessary to document each episode that has an instructional focus. Gaps in segments of the lesson with instructional focus should be indicated as a gap between the end time of one episode and the start time of the next instructional episode.

Step 5: Conduct the Postobservation Interview

Conduct a brief postobservation interview with the teacher as soon after the classroom observation as possible. Exhibit 9 lists questions that observers can use to obtain the information needed to complete the Classroom Observation Summary Form and to assess the degree to which the class observed represented a typical class taught by this teacher. Observers should express appreciation for the opportunity to observe the class at the conclusion of the postobservation interview.

Exhibit 9—Suggested Postobservation Interview Questions

1. Did this lesson turn out different from what you planned? If so, in what ways?
2. How typical was this lesson for the students?

3. What do you think the students learned from this lesson, and what they still need to learn?
4. What challenges did you confront in encouraging students to engage in the mathematical discourse?
5. What do you plan to do in the next lesson with these students?

Step 6: Complete the Classroom Observation Summary Form

Observers should complete the Classroom Observation Summary Form as soon after each observation and postobservation interview as possible. The form includes a Lesson Context section and an Observation Summary section.

Lesson Context—Use this section of the form to document the lesson context. Be sure to complete all items in this section. Exhibit 10 provides an explanation of each fields in this section of the form.

Exhibit 10—Classroom Observation Summary Form Lesson Context Field Definitions

Field	Explanation
Observer	The first and last name of the person who conducted the classroom observation and completed the form.
Date	The date the observation took place. *Not* the date the form was submitted.
Teacher	The first and last name of the teacher of the class that was observed.
School	The name of the school where the observation took place.
Grade(s)	The grade or grade range of the students in the class.
Course	The name of the course (e.g., Algebra I, Interactive Math, Grade 3 Math)
Unit/Topic	The name of the unit and topic the students were studying the day of the observation (e.g., percentage, polynomials, whole number multiplication)
Learning Objective	A brief statement that explicitly describes what the teacher intended the students to learn from the lesson. This statement should not describe what students were intended to do, but what they should have learned.
Instructional Materials	A specific reference to the instructional materials (including manipulatives) that were used in the lesson. If the materials were printed, please record the title, publisher, chapter, section, and page. If the lesson is teacher developed, get a copy of the lesson plans.
Math Class Began/Ended	The time of the day the class began and ended.
Students	The total number of students present during the observation. If the number of students changed during the class period, the maximum number of students.
Percent Minority	An estimate of the percentage of the students present during the observation who were ethnic minority (non-White).
Relationship to previous and future lessons	A brief description of students had learned prior to the lesson observed and what the teacher planned to address in future lessons. This description should place the lesson observed in the overarching instructional.
Other comments	Other comments regarding the aspects of the lesson context not already addressed (e.g., the presence of an instructional aide, information about the classroom environment, unexpected events that occurred such as a fire drill).

Observation Summary—Use this section of the form to rate the overall lesson according to key lesson characteristics. Base the ratings on the information gathered during the observation and the interviews. Provide a rationale for extreme ratings and general impressions regarding the lesson on the last page of the form (use the back side if necessary).

Step 7: Submit the Results

Observers are responsible for submitting the classroom observation results to RMC Research via the OMLI Professional Development Database. The URL for the web site is:

http://www.rmccorp.com/OMLI

Passwords for access to the web site will be issued to each observer by RMC Research staff. The observations forms can be found under the data collection menu.

Once the data have been submitted electronically, mail the original forms to:

Dave Weaver
RMC Research Corporation
522 SW Fifth Avenue, Suite 1407
Portland, OR 97204-2131

If you have any questions regarding classroom observations procedures or about submitting data, feel free to contact Dave by phone at (503) 223-8248 or (800) 788-1887 or by e-mail at dweaver@rmccorp.com.

References

Some of the items used in this protocol were adapted from instruments available from the following sources:

Horizon Research, Inc. (2003). *Local systemic change 2003–04 core evaluation data collection manual*. Chapel Hill, NC: Author.

Secada, W. & Byrd, L. (1993). *Classroom observation scales: School-level reform in the teaching of mathematics.* Madison, WI: National Center for Research in Mathematical Sciences Education.

Classroom Observation Discourse Form

Oregon Mathematics Leadership Institute
equity • high achievement • community

Evidence of Mathematical Discourse

Page: _____

Teacher: ______________________________ Date: ____________________

Episode Type			Start/End Times	Students Observed	Episode Description	Discourse Codes			Tally
Large Group	Pairs/Small Group	Individual				Mode	Type	Tools	

Classroom Observation Reference Sheet

Preobservation Interview Questions

1. What has this class been covering recently?
   a. What unit are you working on?
   b. What instructional materials are you using?
2. What do you anticipate doing with this class today/on the day of the observation?
   a. What would you like the students to learn during this class?
3. Is there anything in particular that I should know about the students in this class?

NOTE: Get specific instructional materials reference or a copy of the lesson plans.

Postobservation Interview Questions

1. Did this lesson turn out different from what you planned? If so, in what ways?
2. How typical was this lesson for the students?
3. What do you think the students learned from this lesson, and what they still need to learn?
4. What challenges did you confront in encouraging students to engage in the mathematical discourse?
5. What do you plan to do in the next lesson with these students?

MODES

Code	Definition
T	Student to Teacher
S	Student to Student
G	Student to Group or Class
I	Individual Reflection

TYPES

Code	Definition
A	Answering
S	Stating or Sharing
E	Explaining
Q	Questioning
C	Challenging
R	Relating
P	Predicting or Conjecturing
J	Justifying
G	Generalizing

TOOLS

Code	Definition
V	Verbal
A	Gesturing/Acting
W	Written
G	Graphs, Charts, Sketches
M	Manipulative
S	Symbolization
N	Notation
C	Computers/Calculators
O	Other

Classroom Observation Summary Form

Lesson Context

Observer: ______________________________ Date: ______________________

Teacher: ____________________________ School: _______________________

Grade(s): __________________ Course: _________________________________

Unit/Topic ____

Learning Objective ____

____

____

Instructional Materials: ____

____

Math Class Began: ______________ Math Class Ended: _________________

Students: _____________ Percent Minority: ___________%

Relationship to previous and future lessons:

Other comments regarding the lesson context:

Observation Summary

Assess this lesson based on your observation data and the information gathered during the pre- and postobservation interviews.

A. Representativeness—How typical was the lesson observed in comparison to other lessons taught by this teacher?

⓪	①	②	③
Not at all Typical	**Somewhat Typical**	**Mostly Typical**	**Very Typical**
The teacher clearly made special preparations for the observation. The lesson was very contrived. Student behavior seemed rehearsed and the students were clearly unaccustomed to the instructional approach employed in the lesson.	Many parts of the lesson seemed contrived. Students seemed uncomfortable and unfamiliar with the instructional approach. The teacher may have stated that he or she tried to show you what you wanted to see.	A few parts of the lesson seemed contrived but for the most part the students seemed comfortable and familiar with the instructional approach. The teacher might have made a few modifications for the observation.	This lesson was very typical of the lessons normally conducted by this teacher. The students appeared very familiar with the instructional approach. There was no evidence the lesson was contrived.

	Rate the extent to which each of the following characteristics was evident in the lesson observed.	**Not at All**	**Very Little**	**Some**	**Mostly**	**To a Great Extent**
B.	**Lesson Design and Implementation**					
1	The instructional objectives of the lesson were clear and the teacher was able to clearly articulate what mathematical ideas and/or procedures the students were expected to learn.	⓪	①	②	③	④
2	The lesson design provided opportunities for student discourse around important concepts in mathematics.	⓪	①	②	③	④
3	The teacher appeared confident in his/her ability to teach mathematics.	⓪	①	②	③	④
4	The pace of the lesson was appropriate for the developmental level/needs of the students and the purpose of the lesson.	⓪	①	②	③	④
5	The teacher’s questioning strategies for eliciting student thinking promoted discourse around important concepts in mathematics.	⓪	①	②	③	④
6	The teacher was flexible and able to make adjustments to address student needs or to take advantage of teachable moments.	⓪	①	②	③	④
7	The teacher’s classroom management style/strategies enhanced the quality of the lesson.	⓪	①	②	③	④
8	The vast majority of the students were engaged in the lesson and remained on task.	⓪	①	②	③	④
C.	**Mathematical Discourse and Sensemaking**					
1	Student asked questions to clarify their understanding of mathematical ideas or procedures.	⓪	①	②	③	④
2	Students explained mathematical ideas and/or procedures.	⓪	①	②	③	④
3	Students justified mathematical ideas and/or procedures.	⓪	①	②	③	④

	Rate the extent to which each of the following characteristics was evident in the lesson observed.	Not at All	Very Little	Some	Mostly	To a Great Extent
4	Students thought critically about mathematical ideas and/or procedures and in an appropriate manner challenged each other's and their own ideas that did not seem valid.	⓪	①	②	③	④
5	Students defended their mathematical ideas and/or procedures.	⓪	①	②	③	④
6	Students determine the correctness/sensibility of an idea and/or procedure based on the reasoning presented.	⓪	①	②	③	④
7	Students shared their observations or predictions.	⓪	①	②	③	④
8	Students made generalizations, stated observations, or made conjectures regarding mathematical ideas and procedures.	⓪	①	②	③	④
9	Students drew upon a variety of methods (verbal, visual, numerical, algebraic, graphical, etc.) to represent and communicate their mathematical ideas and/or procedures.	⓪	①	②	③	④
10	Students listened intently and actively to the ideas and/or procedures of others for the purpose of understanding someone's methods or reasoning.	⓪	①	②	③	④
D.	**Task Implementation**					
1	Tasks focused on understanding of important and relevant mathematical concepts, processes, and relationships.	⓪	①	②	③	④
2	Tasks stimulated complex, nonalgorithmic thinking.	⓪	①	②	③	④
3	Tasks successfully created mathematically productive disequilibrium among students.	⓪	①	②	③	④
4	Tasks encouraged students to search for multiple solution strategies and to recognize task constraints that may limit solution possibilities.	⓪	①	②	③	④
5	Tasks encouraged students to employ multiple representation and tools to support their ideas and/or procedures.	⓪	①	②	③	④
6	Tasks encouraged students to think beyond the immediate problem and make connections to other related mathematical concepts.	⓪	①	②	③	④
E.	**Classroom Culture**					
1	Active participation of all students was encouraged and valued.	⓪	①	②	③	④
2	The classroom climate was one of respect for the students' ideas, questions, and contributions.	⓪	①	②	③	④
3	Interactions reflected a productive working relationship among students.	⓪	①	②	③	④
4	Interactions reflected a collaborative working relationship between the teacher and the students.	⓪	①	②	③	④
5	Wrong answers were viewed as worthwhile learning opportunities.	⓪	①	②	③	④
6	Students were willing to openly discuss their thinking and reasoning.	⓪	①	②	③	④
7	The classroom climate encouraged students to engage in mathematical discourse.	⓪	①	②	③	④

F. Overall Rating—For each section below, mark the choice that best describes your overall summary of the lesson based on the observation.

1. Depth of Student Knowledge and Understanding—This scale measures the depth of the students' mathematical knowledge as evidenced by the opportunities students had to produce new knowledge by discovering relationships, justifying their hypotheses, and drawing conclusions.

① Knowledge was very superficial. Mathematical concepts were treated trivially or presented as nonproblematic. Students were involved in the coverage of information which they are to remember, but no attention was paid to the underlying mathematical concepts. For example, students applied an algorithm for factoring binomials or used the FOIL method of multiplication—in either case with no attention to the underlying concepts.

② Knowledge was superficial or fragmented. Underlying or related mathematical concepts and ideas were mentioned or covered, but only a superficial acquaintance with or trivialized understanding of these ideas was evident. For example, a teacher might have explained why binomials are factored or why the FOIL method works, but the focus remained on students mastering these procedures.

③ Knowledge was uneven; a deep understanding of some mathematics concepts was countered by a superficial understanding of other concepts. At least one idea was presented in depth and its significance was grasped by some students, but in general the focus was not sustained.

④ Knowledge was relatively deep because the students provide information, arguments, or reasoning that demonstrate the complexity of one or more ideas. The teacher structured the lesson so that many (20% to 50%) students did at least one of the following: sustain a focus on a topic for a significant period of time; demonstrate their understanding of the problematic nature of a mathematical concept; arrive at a reasoned, supported conclusion with respect to a complex mathematical concept; or explain how they solved a relatively complex problem. Many (20% to 50%) students clearly demonstrated understanding of the complexity of at least one mathematical concept.

⑤ Knowledge was very deep. The teacher successfully structured the lesson so that almost all (90% to 100%) students did at least one of the following: sustain a focus on a topic for a significant period of time; demonstrate their understanding of the problematic nature of a mathematical concept; arrive at a reasoned, supported conclusion with respect to a complex mathematical concept; or explain how they solved a complex problem. Most (51% to 90%) students clearly demonstrated understanding of the complexity of more than one mathematical concept.

2. Locus of Mathematical Authority—This scale determines the extent to which the lesson supported a shared sense of authority for validating students' mathematical reasoning.

① Students relied on the teacher or textbook as the legitimate source of mathematical authority. Students accepted an answer as correct only if the teacher said it was correct or if it was found in the textbook. If stuck on a problem, students almost always asked the teacher for help.

② Students relied on the teacher and some of their more capable peers (who were clearly recognized as being better at math) as the legitimate sources of mathematical authority. The teacher often relied on the more capable students to provide the right answers when pacing the lesson or to correct erroneous answers. As a result, other students often relied on these students for correct solutions, verification of right answers, or help when stuck.

③ Many (20% to 50%) students shared mathematical authority among themselves. They tended to rely on the soundness of their own arguments for verification of answers, but, they still looked to the teacher as the authority for making final decisions. The teacher intervened with answers to speed things up when students seemed to be getting bogged down in the details of an argument.

④ Most (51% to 90%) students shared in the mathematical authority of the class. Though the teacher intervened when the students got bogged down, he or she did so with questions that focused the students' attention or helped the students see a contradiction that they were missing. The teacher often answered a question with a question, though from time to time he or she provided the students with an answer.

⑤ Almost all (90% to 100%) of the students shared in the mathematical authority of the class. Students relied on the soundness of their own arguments and reasoning. The teacher almost always answered a question with a question. Many (20% to 50%) students left the class still arguing about one or more mathematical concepts.

3. Social Support—This scale measures the extent to which the teacher supported the students by conveying high expectations for all students.

① Social support was negative. Negative teacher or student comments or behaviors were observed. The classroom atmosphere was negative.

② Social support was mixed. Both negative and positive teacher or student comments or behaviors were observed.

③ Social support was neutral or mildly positive. The teacher expressed verbal approval of the students' efforts. Such support tended, however, to be directed to students who were already taking initiative in the class and tended not to be directed to students who were reluctant participants or less articulate or skilled in mathematical concepts.

④ Social support from the teacher was clearly positive and there was some evidence of social support among students. The teacher conveyed high expectations for all, promoted mutual respect, and encouraged the students try hard and risk initial failure.

⑤ Social support was strong. The class was characterized by high expectations, challenging work, strong effort, mutual respect, and assistance for all students. The teacher and the students demonstrated these attitudes by soliciting contributions from all students, who were expected to put forth their best efforts. Broad participation was an indication that low-achieving students received social support for learning.

4. Student Engagement in Mathematics—This scale measures the extent to which students engaged in the lesson (e.g., attentiveness, doing the assigned work, showing enthusiasm for work by taking initiative to raise questions, contributing to group tasks, and helping peers).

① Students were disruptive and disengaged. Students were frequently off task as evidenced by gross inattention or serious disruptions by many (20% to 50%).

② Students were passive and disengaged. Students appeared lethargic and were only occasionally on task. Many (20% to 50%) students were either clearly off task or nominally on task but not trying very hard.

③ Students were sporadically or episodically engaged. Most (51% to 90%) students were engaged in class activities some of the time, but this engagement was uneven, mildly enthusiastic, or dependent on frequent prodding from the teacher.

④ Student engagement was widespread. Most (51% to 90%) students were on task pursuing the substance of the lesson most of the time. Most (51% to 90%) students seemed to take the work seriously and try hard.

⑤ Students were seriously engaged. Almost all (90% to 100%) students were deeply engaged in pursuing the substance of the lesson almost all (90% to 100%) of the time.

Rationale/General Impressions: