Mentoring Teachers

Overview: As teachers return to the classroom with newly acquired skills and strategies from the *Geometry Module*, the mentoring process will allow teachers to improve classroom practice. The substance of observations and mentoring should reflect the theoretical framework of the *Geometry Module* that includes active, student-centered mathematical investigations, group cooperation, and alternative assessments as means to reach diverse student populations. The observations and mentoring should also allow for reflection upon the tools for learning geometry outlined in the *Geometry Module*: construction tools, manipulatives, and technology. These tools are used to address various learning styles, to model or represent mathematical concepts, to abstract from the manipulative representations, to construct and explore mathematical properties of geometric objects, to generate authentic data, and to progress students through the van Hiele levels.

Objective: **TExES Mathematics Competencies**

VI.020.A. The beginning teacher applies research-based theories of learning mathematics to plan appropriate instructional strategies for all students.

VI.020.B. The beginning teacher understands how students differ in their approaches to learning mathematics.

VI.020.C. The beginning teacher uses students' prior mathematical knowledge to build conceptual links to new knowledge and plans instruction that builds on students' strengths and addresses students' needs.

VI.020.D. The beginning teacher understands how learning may be enhanced through the use of manipulatives, technology, and other tools.

VI.020.E. The beginning teacher understands how to provide instruction along a continuum from concrete to abstract.

VI.020.F. The beginning teacher understands a variety of instructional strategies and tasks that promote students' abilities to do the mathematics described in the TEKS.

VI.020.G. The beginning teacher understands how to create a learning environment that provides all students, including English Language Learners, with opportunities to develop and improve mathematical skills and procedures.

VI.020.H. The beginning teacher understands a variety of questioning strategies to encourage mathematical discourse and to help students analyze and evaluate their mathematical thinking.

VI.020.I. The beginning teacher understands how to relate mathematics to students' lives and a variety of careers and professions.

VI.021.A. The beginning teacher understands the purpose, characteristics, and uses of various assessments in mathematics, including formative and summative assessments.

VI.021.B. The beginning teacher understands how to select and develop assessments that are consistent with what is taught and how it is taught.
VI.021.C. The beginning teacher understands how to develop a variety of assessments and scoring procedures consisting of worthwhile tasks that assess mathematical understanding, common misconceptions, and error patterns.
VI.021.D. The beginning teacher understands the relationship between assessment and instruction and knows how to evaluate assessment results to design, monitor, and modify instruction to improve mathematical learning for all students, including English Language Learners.

Background: Teachers and mentors should be well-versed in the content and pedagogy presented during the *Geometry Module*.

Materials: Mentoring Timeline, Classroom Observation Protocol, Observation Record: Investigations and Tools, Observation Checklist: van Hiele Levels, Observation Checklist: Cooperative Learning, Observation Checklist: Alternative Assessments, Self Report: Geometry Competencies, Self-Report: TExES Competencies

Procedures:

Identify mentors for participants. Mentors should understand that their role is not to replicate themselves but to facilitate the professional growth of the teachers in their care. The emphasis of the process is on substance, not style. Mentoring involves more than observing and providing feedback; it requires a response to needs and situations as they happen; it includes meeting the teacher's needs with professional advice based on research rather than preference.

Mentors and participants will complete Pre-Observation Interview, Observation, and Post-Observation Interview documentation for each scheduled classroom visit/observation. The mentor and participant will meet to conduct a post-observation conference after each student classroom visit/observation.

During the pre-observation interview, the participant and mentor should review the instructional plan for TEKS appropriateness and use of pedagogical skills acquired in the Geometry Module. The teacher and mentor decide what specifically is to be observed and how this data will be collected. The teacher and mentor will select an appropriate checklist, record, or protocol form to record data during the lesson under observation.

During the observation, the mentor should make only those observations that were discussed during the pre-observation conference. This action serves to distinguish an observation for the purpose of mentoring from an observation for the purpose of evaluation. The mentor should record what is seen or heard rather than the mentor's perceptions of, inferences about, or judgments upon what the mentor saw or heard. This

objectivity provides data that accurately mirrors what took place during instructional time.

During the post-observation interview, quickly record the teacher's initial responses to the questions. The responses serve as another data source for the post-observation conference.

For the post-observation conference, prepare questions such as:
- What is another way you might have…?
- What might you see happening in your classroom if…?
- What criteria do you use to…?

These questions will help the teacher hypothesize about the results of a change in practice, analyze the effectiveness of the activity, imagine possibilities for improvement, look for patterns in teacher and student behavior, and evaluate the impact of a well-planned activity on student achievement.

During the post-observation conference, the teacher should be allowed to speak first, sharing his or her understanding of what took place, what was successful, and what might be improved. The mentor then presents the data collected during the observation. The teacher should be allowed a few moments for quiet reflection on the data. Discussion should then take place about any discrepancies that exist between the teacher's expectations for and thoughts about the lesson and the data recorded by the mentor. When these discrepancies are identified, a professional need presents itself. They allow the teacher to determine new instructional and professional development goals to address his or her needs. They also provide opportunities for meaningful mentoring.

At the end of the year, the mentor and participant will meet to reflect again regarding the teacher's Self-Report: Geometry Competencies and the Self-Report: TExES Competencies. The teacher will establish achievable instructional and professional development goals for the following school year.

Mentoring Timeline

Month	Focus	Activity	Tools
August	Investigations and Tools Geometry TEKS	• Pre-Observation Interview • Observation • Post-Observation Interview • Post-Observation Conference: Establish instructional goals based on discussions between participant and mentor	• Classroom Observation Protocol • Investigations and Tools • van Hiele Levels
September	Cooperative Learning Geometry TEKS	• Pre-Observation Interview • Observation • Post-Observation Interview • Post-Observation Conference: Establish instructional goals based on discussions between participant and mentor	• Classroom Observation Protocol • Cooperative Learning • van Hiele Levels
October	Alternative Assessments Geometry TEKS	• Pre-Observation Interview • Observation • Post-Observation Interview • Post-Observation Conference: Establish instructional goals based on discussions between participant and mentor	• Alternative Assessments • Cooperative Learning • van Hiele Levels
November	Investigations and Tools Geometry TEKS	• Pre-Observation Interview • Observation • Post-Observation Interview • Post-Observation Conference: Establish instructional goals based on discussions between participant and mentor	• Classroom Observation Protocol • Investigations and Tools • van Hiele Levels

January	Cooperative Learning Geometry TEKS	• Pre-Observation Interview • Observation • Post-Observation Interview • Post-Observation Conference: Establish instructional goals based on discussions between participant and mentor	• Classroom Observation Protocol • Cooperative Learning • van Hiele Levels
February	Alternative Assessments Geometry TEKS	• Pre-Observation Interview • Observation • Post-Observation Interview • Post-Observation Conference: Establish instructional goals based on discussions between participant and mentor	• Alternative Assessments • Cooperative Learning • van Hiele Levels
March	Participant and Mentor will decide which of these to use as a focus: Investigations and Tools Cooperative Learning Alternative Assessment Geometry TEKS	Pre-Observation Interview • Observation • Post-Observation Interview • Post-Observation Conference: Establish instructional goals based on discussions between participant and mentor	*Participant and mentor will select which records to use.*
April	Final debriefing	Generate professional development goals Identify areas for life-long learning	• Self-Report: Geometry Competencies • Self-Report: TExES Competencies

Classroom Observation Protocol

Observation #: _____

Date: _____
Start time: _____
End time: _____
Observer: _____

I. Pre-Observation Interview

Discuss the lesson with the teacher, ask the following questions, and record the responses. You may need to do this interview over the phone with the teacher the night before. You may also plan ahead and send the questions to the teacher via e-mail.

A. What are the instructional goals of the activity you have planned?

B. How will the students be engaged during the lesson?

C. What student success do you expect to see take place during this activity?

D. Do you have any concerns about the activity you have planned? If so, what are they? If not, why not?

E. What should I focus on during the observation?

II. Observation

During the observation, make a written record of teacher and student comments and actions about the topics identified for observation during the pre-observation interview. Focus on the teacher's words and actions. Whenever possible record the teacher's exact words. Abbreviate your notes as necessary (T for teacher, G1, B1 etc. for the students). Note the time every few minutes, or when a shift or transition in the activity takes place.

As soon after the observation as possible, use your notes to write a more polished narrative. The narrative should include an accurate description of the classroom, seating arrangements, displays, etc. Draw a map of the classroom and complete the following checklist in order to provide more detailed information about its layout. The narrative should also include a list of materials used during the observed lesson. Before leaving the classroom, request copies of any worksheets that were used during your observation.

A. Physical Environment: Seating arrangement

	YES	**NO**
Students have assigned seats.		
Desks are arranged in rows and columns.		
Desks are arranged in semi-circles.		
Desks are arranged in clusters.		
Tables are used rather than desks.		

B. Physical Environment: Walls

	YES	**NO**
Rules of behavior are posted.		
Rules of math are posted (formulas, process skills, problem solving styles).		
Illustrations of math concepts are posted.		
Number line is displayed.		
Pictures are displayed.		
Graphs or charts are displayed.		
Motivational posters are displayed.		
Student work is displayed.		
Student math assignments are posted.		

C. Students

Total number of students in the classroom _____

Ethnicity	**Number of Male Students**	**Number of Female Students**
White		
African-American		
Hispanic		
Asian		
Other		

D. Materials used during lesson

Textbooks	Yes	No
Worksheets	Yes	No
Manipulatives [List which kind(s).]	Yes	No
Calculators	Yes	No
Computers	Yes	No
Other	Yes	No

E. Teacher's actions during lesson

Teacher uses an exploratory activity to introduce the concept.	Yes	No
Teacher demonstrates without having students participate.	Yes	No
Teacher has student volunteers demonstrate.	Yes	No
Teacher leads whole class as they work with demonstration materials.	Yes	No

	Frequently	**Sometimes**	**Rarely**
Teacher raises questions that extend students' thinking.			
Teacher responds to students' questions in a positive and encouraging manner.			
Teacher incorporates manipulatives and technology appropriately.			
Teacher maintains an appropriate pace during the lesson.			
Teacher uses hands-on, interactive activities to develop the concept (not just problems from the textbook).			
Teacher moves around the room to keep everyone engaged and on track.			

F. Students' actions during lesson

	Frequently	Sometimes	Rarely
Students are interacting with each other.			
Students are working independently.			
Students use a variety of materials (aside from worksheets or textbook).			
Students are encouraged to explain the process used to reach a solution.			
The majority of students are engaged in the lesson.			
Students are encouraged to explore several solutions.			
Students ask each other questions.			
The majority of students are engaged in the mathematics activity.			

	Yes	No
Students develop their own products to demonstrate mastery of the concept.		
Students are encouraged to raise original questions about math and discuss these questions.		

G. General Comments

What concept was the teacher discussing? _____

1. How long was the teacher-led portion of the lesson?
   Approximate number of minutes _____

2. Describe the lesson taught.

3. How comfortable did the students appear to be with the teacher?

Not at all comfortable	Sort of comfortable	Very comfortable

4. Comments about teacher (her personality, teaching skills, rapport with students):

5. How much time was spent on student group work?
   Approximate number of minutes _____

6. Describe student group work.

7. How much time was spent on individual student work?
   Approximate number of minutes _____

8. Describe briefly.

9. Comments about students (their behavior, whether they were on task, understanding the lesson):

10. Please rate the quality of the teacher's classroom management.

Poor	Adequate	Excellent

11. Additional comments:

III. Post-observation interview

The post-interview should be done as soon after the observation as possible in order to capture data about the teacher's immediate perceptions.

A. What went particularly well during the lesson?

B. Did it differ from what you expected? If so, how?

C. If you were to teach this lesson again, what would you change?

Observation Record: Investigations and Tools

Criteria	Yes	No
Students identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics.		
Student use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness.		
Students select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem.		
Students select tools to solve problems.		
Students communicate mathematical ideas using multiple representations.		
Students evaluate the effectiveness of different representations to communicate ideas.		
Students make conjectures from patterns or sets of examples and non-examples.		
Students validate their conclusions using mathematical properties and relationships.		
Students are encouraged to solve problems.		
Students pose problems.		
Students pose alternate solution strategies.		
Students pose constructive questions.		
Students apply algebraic concepts and processes.		
Students use graphing calculators.		
Students use interactive geometry software (e.g. *The Geometer's Sketchpad*, NonEuclid).		

Observation Checklist: van Hiele Levels

Visual Level (0)	Descriptive Level (1)	Relational Level (2)	Deductive Level (3)	Rigor (4)
❑ Identifies a shape. ❑ Constructs, draws, or copies a shape. ❑ Names or labels shapes and other geometric configurations appropriately. ❑ Compares and sorts shapes. ❑ Verbally describes shapes. ❑ Solves routine problems by operating on shapes. ❑ Identifies parts of a figure.	❑ Identifies and tests relationships. ❑ Recalls and uses appropriate vocabulary. ❑ Compares two shapes. ❑ Interprets and uses verbal description of a figure in order to draw/construct figure. ❑ Interprets verbal or symbolic statements of rules and applies them. ❑ Discovers properties of specific figures and generalizes properties. ❑ Describes a class of figures in terms of its properties. ❑ Given certain properties, identifies a shape. ❑ Connect properties between classes of figures to compare. ❑ Discovers properties of an unfamiliar class of figures. ❑ Solves geometric problems. ❑ Formulates and uses generalizations about properties of figures.	❑ Identifies different sets of properties that characterize a class of figures and tests that these are sufficient. ❑ Identifies minimum sets of properties that can characterize a figure. ❑ Formulates and uses a definition for a class of figures. ❑ Gives informal arguments. ❑ Gives informal deductive arguments. ❑ Gives more than one explanation to prove something and justifies these explanations. ❑ Informally recognizes difference between a statement and its converse. ❑ Identifies and uses strategies or insightful reasoning to solve problems. ❑ Recognizes the role of deductive argument and approaches problems in a deductive manner.	❑ Recognizes the need for undefined terms, definitions, and basic assumptions (postulates). ❑ Recognizes characteristics of a formal definition and equivalence of definitions. ❑ Proves relationships in axiomatic settings. ❑ Proves relationships between a theorem and related statements. ❑ Establishes interrelationships among networks of theorems. ❑ Compares and contrasts different proofs of theorems. ❑ Examines effects of changing an initial definition or postulate in a logical sequence. ❑ Establishes a general principle that unifies several different theorems. ❑ Creates proofs from simple sets of axioms frequently using a model to support arguments. ❑ Gives formal deductive arguments.	❑ Rigorously establishes theorems in different axiomatic systems. ❑ Compares axiomatic systems (e.g., Euclidean and non-Euclidean geometries); spontaneously explores how changes in axioms affect the resulting geometry. ❑ Establishes consistency of a set of axioms, independence of an axiom, and equivalency of different sets of axioms; creates an axiomatic system. ❑ Invents generalized methods for solving classes of problems. ❑ Searches for the broadest context in which a mathematical theorem/principle will apply. ❑ Does in-depth study of the subject logic to develop new insights and approaches to logical inference.

Observation Checklist: Cooperative Learning

Group Size	**Purpose of Cooperative Grouping**	**Collaborative Strategies**	**Assigned Roles**
❑ 2 students ❑ 3 students ❑ 4 students ❑ Other	❑ Review homework ❑ Reteach concept or procedure ❑ Developmental lesson ❑ Review lesson ❑ Test review ❑ Alternative assessment ❑ Enrichment ❑ Other	❑ Pair check ❑ Think-Pair-Share ❑ Group Problem Solving ❑ Jigsaw ❑ Other	❑ All students ❑ Some students ❑ None
Evidence of Group Learning	**Group Success**	**Teacher**	**Closure**
❑ Positive interdependence ❑ Face-to-face promotive interaction ❑ Individual accountability ❑ Social skills ❑ Group processing	❑ Mutual dependence ❑ Verbal interaction ❑ Interpersonal and group skills ❑ Individual accountability ❑ Incentives	❑ Explain assignment ❑ Establish academic expectations for group ❑ Describe expected collaborative behaviors ❑ Describe group procedures ❑ Provides description of group success ❑ Monitor groups ❑ Asks for the group's answer to a student's question ❑ Affirms productive group behaviors	❑ Teacher prompts students to summarize learning ❑ Teacher ask students to address concepts/procedures not addressed in a student summary ❑ Teacher ties students' ideas together to draw closure to the learning experience

Observation Checklist: Alternative Assessments

Type ❑ Tasks ❑ Project ❑ Journal Entry ❑ Portfolio	**Tasks** ❑ Closed ❑ Open-ended	**Tools used during instruction available during assessment** ❑ Yes ❑ No	**Equity** ❑ Wording ❑ Contexts ❑ "sense"-able ❑ relevant ❑ accessible	**Opportunity for multiple sources of evidence** Yes No
Student participation ❑ Actively engaged throughout the class period ❑ Actively engaged for the majority of the class period ❑ Actively engaged for about half of the class period ❑ Actively engaged for less than half of the class period ❑ Actively engaged in something other than the alternative assessment	**Teacher actions** ❑ Anecdotal Record ❑ Checklist ❑ Posing questions ❑ Posing problems ❑ Answering questions with a question ❑ Answering questions with an answer ❑ Redirecting student questions to other students ❑ Addressing behavioral concerns	**Communication** ❑ Group ❑ Individual ❑ Model ❑ Picture ❑ Verbal ❑ Table ❑ Graph ❑ Equation	**Use of Rubric** ❑ Published Holistic ❑ Teacher-Made Holistic ❑ Published Analytical ❑ Teacher-Made Analytical	**Student Self-Assessment** ❑ Holistic Rubric ❑ Analytical Rubric ❑ Journal prompt ❑ Checklist
Peer assessment ❑ Yes ❑ No	**Provides data to inform instruction** ❑ Yes ❑ No	**Content** ❑ Concepts ❑ Procedures ❑ Generalizations	**TEXTEAMS Geometry Assessments** ❑ Yes ❑ No	

Self-Report: Geometry Competencies

Please rate your geometry competencies in the following areas:

Competencies	Poor	Fair	Good	Very Good	Excellent
Knowledge of measurement as a process	0	1	2	3	4
Knowledge of the results of Euclidean geometry	0	1	2	3	4
Knowledge of the uses of Euclidean geometry	0	1	2	3	4
Knowledge of the applications of Euclidean geometry	0	1	2	3	4
Knowledge of mathematical reasoning	0	1	2	3	4
Knowledge of mathematical problem solving	0	1	2	3	4
Knowledge of mathematical connections	0	1	2	3	4
Knowledge of how children learn mathematics	0	1	2	3	4
Knowledge of how to plan geometry instruction	0	1	2	3	4
Knowledge of how to organize geometry instruction	0	1	2	3	4
Knowledge of how to implement effective geometry instruction	0	1	2	3	4

Self-Report: TExES Competencies

TExES Competencies	Strongly Agree	Agree	Disagree	Strongly Disagree
VI.020.A. The beginning teacher applies research-based theories of learning mathematics to plan appropriate instructional strategies for all students.	4	3	2	1
VI.020.B. The beginning teacher understands how students differ in their approaches to learning mathematics.	4	3	2	1
VI.020.C. The beginning teacher uses students' prior mathematical knowledge to build conceptual links to new knowledge and plans instruction that builds on students' strengths and addresses students' needs.	4	3	2	1
VI.020.D. The beginning teacher understands how learning may be enhanced through the use of manipulatives, technology, and other tools.	4	3	2	1
VI.020.E. The beginning teacher understands how to provide instruction along a continuum from concrete to abstract.	4	3	2	1
VI.020.F. The beginning teacher understands a variety of instructional strategies and tasks that promote students' abilities to do the mathematics described in the TEKS.	4	3	2	1
VI.020.G. The beginning teacher understands how to create a learning environment that provides all students, including English Language Learners, with opportunities to develop and improve mathematical skills and procedures.	4	3	2	1
VI.020.H. The beginning teacher understands a variety of questioning strategies to encourage mathematical discourse and to help students analyze and evaluate their mathematical thinking.	4	3	2	1
VI.020.I. The beginning teacher understands how to relate mathematics to students' lives and a variety of careers and professions.	4	3	2	1
VI.021.A. The beginning teacher understands the purpose, characteristics, and uses of various assessments in mathematics, including formative and summative assessments.	4	3	2	1
VI.021.B. The beginning teacher understands how to select and develop assessments that are consistent with what is taught and how it is taught.	4	3	2	1
VI.021.C. The beginning teacher understands how to develop a variety of assessments and scoring procedures consisting of worthwhile tasks that assess mathematical understanding, common misconceptions, and error patterns.	4	3	2	1
VI.021.D. The beginning teacher understands the relationship between assessment and instruction and knows how to evaluate assessment results to design, monitor, and modify instruction to improve mathematical learning for all students, including English Language Learners.	4	3	2	1

References and Additional Resources

Artzt, A. F., & Newman, C. M. (1990). *How to use cooperative learning in the mathematics class.* Reston, VA: National Council of Teachers of Mathematics.

Coombs-Richarson, R. (2004). *Mentoring Basics.* Houston, TX: Region IV Education Service Center.

Davidson, N. (Ed.). (1990). *Cooperative learning in mathematics: A handbook for teachers.* Menlo Park, CA: Addison-Wesley Publishing Company.

Eisenhower National Clearing House & National Staff Development Council. (2004). *By your own design.* Retrieved April 15, 2004, from National Staff Development Council: http:// www.enc.org

Krulik, S., & Rudnick, J. A. (1989). *Problem solving: A handbook for senior high school teachers*. Upper Saddle River, NJ: Allyn and Bacon: Pearson Education Company.

National Council of Teachers of Mathematics. (1999). *Mathematics assessment: A practical handbook for grades 9 – 12.* Reston, VA: NTCM.