

WHAT DOES AN EXEMPLARY MIDDLE SCHOOL MATHEMATICS TEACHER LOOK LIKE? THE USE OF A PROFESSIONAL DEVELOPMENT RUBRIC

M. MASON, D. JOHNSON, and J. ROZELLE
College of William and Mary
Williamsburg, VA 23187
mmmaso@wm.edu

A. KOZIOL
Hampton Public Schools
Hampton, VA 23669-3570

Y. SMITH-JONES
Hopewell Public Schools
Hopewell, VA 23860-3758

R. COFER
Mecklenburg County Public Schools
Boydton, VA 23917

L. QUICK
New Kent County Public Schools
New Kent, VA 23124-0110

E. O'BRIEN
York County Public Schools
Yorktown, VA 23692-2795

W.M. GEIGER and K. GRASS
Virginia Department of Education
Richmond, VA 23218

Abstract

A School University Research Network (SURN) committee composed of current mathematics teachers, central office math supervisors, building administrators, mathematicians, and mathematics educators researched numerous sources regarding best practices in mathematics instruction. The resulting professional development rubric synthesizes their findings and can serve a professional development role by providing teachers and administrators with a tool to develop clarity and consensus on best mathematics instructional practices, and how these practices are implemented in the classroom. It is also being used as a tool for cooperating teachers in their supervision of student teachers and as a reflective method for self-evaluation.

Introduction

The effort to improve student achievement in mathematics has caused many teachers to critically reflect on their current instructional practices and examine these practices in light of research findings. It is also important for the principal, as the key instructional leader, to “provide staff with the information, training, and parameters they need.” [1] While it is impossible for an administrator to be an expert in all fields, he or she is obligated to aid staff in improving their methods of instruction in all areas. In order to support these efforts, the Mathematics Study Group of the School University Research Network (SURN) at the College of William and Mary formed a committee to design a research-based instrument for teachers to employ in reflecting on their mathematics teaching, and to assist administrators in the area of mathematics. The committee included current mathematics teachers, math supervisors, building administrators, mathematicians, and math educators from the twenty-four school divisions in the consortium. This committee developed a model rubric designed to generate self-reflection by teachers and make classroom observations more meaningful (SEE Appendix A).

The William and Mary Mathematics Study Group committee researched numerous sources regarding best practices in mathematics instruction. The resulting rubric synthesizes their findings and is consistent with the recommendations of the National Council of Teachers of Mathematics (NCTM) found in *Principles and Standards for School Mathematics* and of *Mathematics Standards of Learning for Virginia Public Schools* [2,3]. It can serve a professional development role by providing teachers and administrators with a tool to develop clarity and consensus on best mathematics instruction practices, how these practices are implemented in the classroom, and what is needed to facilitate teachers employing these practices in service. Rubrics are typically thought of as tools to use with students that provide criteria for assessing the quality of an assignment. However, in this context, rubrics can also offer teachers and administrators a means to more thoughtful and meaningful classroom observations while also serving as a tool to assist in planning professional development. Personalizing the following rubrics should provide a staff with the opportunity to clarify the components of excellent mathematics instruction at their school site.

The manner in which this rubric or any other method is implemented at school levels is instrumental to the success of improving instruction. Research indicates teachers become better equipped to meet the challenges in today's classrooms if they have the opportunities to work together to improve their practice, time to reflect, and strong support from colleagues and other qualified professionals [4]. This rubric was designed to be the beginning of the process, not the end product. An example of a process for implementing this rubric is described below.

Implementation

This example is not the only method, but it does reflect current thinking on collaborative working relationships that are necessary in the change process.

Rubric Shared with Teachers and Administrators — The rubric was designed to be shared by teachers or administrators with mathematics departments or teams at a school site. It is important that all parties understand that the rubric is not an evaluation tool, but a guide for professional development.

Relation of the Rubric to the Site — Teachers and administrators may collaboratively revise the rubric to reflect their understanding of best practices in mathematics instruction as they relate to the values, needs, and mission of the site. Since it is the teachers that will implement action plans to improve instruction, they should be part of the process in determining what needs to be changed. The rubric should also help in self-assessment, as well as being a vehicle for teachers to deepen their knowledge of pedagogy while seeking to include aspects of teaching that are important to the specific site. For example, a site might be heavily committed to the “Dimensions of Learning” model advocated by Marzano [5]. In this instance, the inclusion of aspects of this model would be added at this site.

Terminology of the Rubric — Teachers and administrators should discuss terminology of the rubric, agreeing on common definitions for teams, such as “consistently” and “rarely,” as well as mathematical concepts. Since the rubric was designed to assist an administrator in analyzing classroom observations, in working with a teacher on professional development, and in monitoring the progress of improvement, it is essential that teachers and administrators agree on definitions of terms at the beginning of the process. This procedure should help avoid misunderstandings as the rubric is used for action plans and for monitoring progress. For example, if the rubric is going to be used in classroom observations, the administrators and

teachers should decide in advance how each of the best practices decided upon can be shown on a “consistent” basis since it would be impossible for a teacher to use all of the practices in one-half hour observation. Additional methods of documentation might be used, such as lesson plans, logs of phone calls or use of computer programs, samples of student work, and written memos or letters from students, parents, or staff.

Professional Development Action Plan — The administrators and teachers should devise a professional development action plan to assist all teachers of mathematics to reach the highest levels of the revised rubric for a site. A goal is usually only reached when there is a plan of action. In this plan of action, the first step should be to decide which aspect or aspects of best practices should be selected. A description of what the teachers should be doing is included. This description should assist in assessing the effectiveness of the initiative. Key to the success of a plan of action is determining the steps, who is responsible, and a reasonable timeline for implementation. It might take several months and much staff development for teachers to feel comfortable enough with a device, such as a graphing calculator, to use it in innovative ways on their own.

Monitoring/Adjusting the Rubric and Action Plans — The administrators and teachers should implement, monitor, and adjust the professional development rubric and the action plans on a regular basis. “In most organizations, what gets monitored gets done. When a school devotes considerable time and effort to the continual assessment of a particular condition or outcome, it notifies all members that the condition or outcome is considered important.” [1] The successful implementation of any action plan includes monitoring the results, sharing data with the entire staff, revising and adjusting the rubric, revising action plans to include new strategies for achieving the objectives more effectively or including strategies for achieving additional objectives, and monitoring the new plans. This process should be ongoing.

Summary

The rubrics and the process for implementation presented here should assist in helping a school site determine what practices constitute excellent mathematics instruction and devise methods for these practices to be implemented. As these rubrics are revised at a school site, the staff should gain a clearer understanding of the elements of excellent instruction in mathematics.

The action plans should help the staff continue to improve individually while working together for school-wide improvement.

The committee that worked on these rubrics and the process for implementation is interested in feedback from other educators, especially from educators who use these ideas. ■

References

- [1] R. DuFour and R. Eaker, *Professional Learning Communities at Work: Best Practices for Enhancing Student Achievement*, Association for Supervision and Curriculum Development, Alexandria, VA, 1998.
- [2] *Principles and Standards for School Mathematics*, National Council of Teachers of Mathematics, Reston, VA, 2000.
- [3] *Mathematics Standards of Learning for Virginia Public Schools*, Virginia Department of Education, Richmond, VA, 2001, Internet: <http://www.pen.k12.va.us>
- [4] C. Brown and S. Smith, "Supporting the Development of Mathematical Pedagogy," *Mathematics Teacher*, **90** (1997) 138-43.
- [5] R. Marzano, *A Different Kind of Classroom: Teaching with Dimensions of Learning*, Association for Supervision and Curriculum Development, Alexandria, VA, 1992.

Appendix A
SURN MIDDLE SCHOOL MATHEMATICS CLASSROOM RUBRIC

This instrument was developed by the SURN Mathematics Study Group at The College of William and Mary in Virginia. **IT IS NOT AN EVALUATION INSTRUMENT!!** This rubric is intended for professional development only. Each school is encouraged to revise this document to suit its needs

Look Fors				
<p>Planning</p> <ul style="list-style-type: none"> • Uses SOL Blueprints and local curriculum to guide planning • Develops long and short range lesson plans • Provides purpose and relevancy • Uses a variety of resources and materials to expand student learning • Uses appropriate pacing • Provides closure/summary • Plans activities that embed practice with ideas and skills from previous units • Includes appropriate homework, projects, and activities for both home and school settings 	Consistently uses good planning skills	Uses good planning skills	Occasionally uses good planning skills	Rarely uses good planning skills
<p>Learning Objectives</p> <ul style="list-style-type: none"> • Follows the curriculum to determine course content 	Consistently and clearly states and explains a higher cognitive level objective that is linked to the SOL	States and explains learning objective on a regular basis. May write on the board, but does not explain at a higher cognitive level	Writes learning objective on board but does not explain or connect to the day's activities	Rarely states and explains a higher cognitive level objective that is linked to the SOL

<p>Assessments</p> <ul style="list-style-type: none"> • Uses a variety of assessments based on stated objectives e.g., written, oral, demonstration forms and SOL-like evaluation • Uses assessment results to affect instruction • Maintains an efficient record of assessment • Assesses during instruction through listening, watching, and questioning • Encourages students to analyze and correct errors • Ensures that assessment addresses higher level thinking, focusing on problem-solving, application, and analysis rather than memory and speed 	<p>Monitors, enhances, and evaluates the mathematical learning of all students in a variety of ways on a consistent basis</p>	<p>Monitors, enhances, and evaluates the mathematical learning of all students in a few ways on a consistent basis</p>	<p>Monitors, enhances, and evaluates the mathematical learning of all students in a few ways some of the time</p>	<p>Rarely monitors, enhances, and evaluates the mathematical learning of all students</p>
<p>Classroom Management</p> <ul style="list-style-type: none"> • Uses time efficiently and effectively • Establishes an environment where students feel comfortable asking for help, seeking solutions, and learning from mistakes • Makes physical environment as safe and conducive to learning as possible • Maintains appropriate standards of behavior and promotes fairness • Encourages participation of all students • Provides classroom materials that are organized and accessible to student usage 	<p>Class is on task and actively participating in appropriate ways on a consistent basis</p>	<p>Class is usually on task and actively participating</p>	<p>Class is sometimes on task and actively participating</p>	<p>Many students are not on task or are not participating</p>

<p>Equity</p> <ul style="list-style-type: none"> Communicates through a variety of means the expectation that all students are capable of learning mathematics Includes both genders, all ethnicities, all socioeconomic statuses, etc. 	Consistently motivates and encourages all students to actively participate in the learning	Motivates and encourages most students to actively participate in the learning	Includes the actively participating students and frequently ignores the others.	Rarely motivates and encourages all students to actively participate in the learning
<p>Diverse Learners</p> <ul style="list-style-type: none"> Provides for the different abilities, backgrounds, and needs of students Provides for differentiation of instruction and assessment—in context, process and/or product Encourages and provides opportunities and activities for creativity, growth, enrichment, and success 	Provides for the diversity of learners in the classroom on a consistent basis	Provides for the diversity of learners in the classroom on a frequent basis	Provides for the diversity of learners in the classroom on an occasional basis	Provides for the diversity of learners in the classroom on a rare basis
<p>Instruction</p> <ul style="list-style-type: none"> Facilitates learning Relates day's lesson to prior instruction Listens and asks questions, more than telling Monitors and adjusts lesson plans to reflect needs and progress of students 	Consistently acts as a facilitator of learning rather than a transmitter of information	Acts as a facilitator of learning rather than a transmitter of information most of the time	Acts as a facilitator of learning rather than a transmitter of information some of the time	Rarely acts as a facilitator of learning as opposed to a transmitter of information
<p>Mathematical Communication</p> <ul style="list-style-type: none"> Encourages students to communicate their mathematical ideas to each other through examples, demonstrations, models, drawings, and logical argument Includes written communication as part of classroom activities e.g., math journals Ensures that students can explain, either verbally or 	Consistently facilitates students' communication and justification of mathematical ideas using correct terminology	Facilitates students' communication and justification of mathematical ideas using correct terminology most of the time	Facilitates students' communication and justification of mathematical ideas using correct terminology some of the time	Rarely facilitates students' communication and justification of mathematical ideas using correct terminology

<p>in writing, the different ways they reach their solutions and can defend their choices</p> <ul style="list-style-type: none"> • Uses language of problem solving on a regular basis • Always uses correct terminology and requires students to do so also 				
<p>Questioning Techniques</p> <ul style="list-style-type: none"> • Provides adequate wait time • Solicits multiple approaches • Asks students to explain and justify • Includes all students • Dignifies errors • Uses cues and prompts as appropriate • Provides immediate, specific, and positive feedback • Asks higher level thinking questions requiring higher level thinking and responses 	<p>Consistently facilitates students' communication and justification of mathematical ideas, using correct terminology</p>	<p>Facilitates students' communication and justification of mathematical ideas, using correct terminology most of the time</p>	<p>Facilitates students' communication and justification of mathematical ideas, using correct terminology some of the time</p>	<p>Rarely facilitates students' communication and justification of mathematical ideas, using correct terminology</p>
<p>Cooperative Learning</p> <ul style="list-style-type: none"> • Includes the use of Positive Interdependence, Group Goals, Group Interaction (Face-to-Face Interaction), Individual Accountability, Group Processing, and Teacher Monitoring • Ensures that students are working in teams to challenge each other and to test and defend their own possible solutions 	<p>Consistently uses good questioning techniques</p>	<p>Usually uses good questioning techniques</p>	<p>Infrequently will check for understanding by using questioning techniques OR calls on the same students most of the time.</p>	<p>Rarely uses questioning techniques.</p>

<p>Problem Solving</p> <ul style="list-style-type: none"> • Develops concepts and skills through a problem centered curriculum, rather than delaying problem solving until students have mastered a procedure • Uses key instructional strategies-problem identification and clarification, analysis of information or data, clear communication of results • Encourages multiple approaches to solving problems • Encourages students to propose new problems that are variations or extensions of a given problem 	<p>Consistently provides problem solving situations and encourages alternative approaches and extensions to a given problem</p>	<p>Provides problem solving situations and encourages alternative approaches and extensions to a given problem most of the time</p>	<p>Provides problem solving situations and encourages alternative approaches and extensions to a given problem some of the time</p>	<p>Rarely provides problem solving situations or encourages alternative approaches and extensions to a given problem</p>
<p>Application</p> <ul style="list-style-type: none"> • Shows applications of mathematics in the workplace, in careers, and in the home • Helps students apply mathematics to real-life problems, and not just practice a collection of isolated skills 	<p>Shows a variety of applications of mathematics to the workplace, careers, and home on a consistent basis</p>	<p>Occasionally extends mathematics to the workplace, careers, and home</p>	<p>Infrequently extends applications of mathematics to the workplace, careers, and home</p>	<p>Rarely shows applications of mathematics to the workplace, careers, and home</p>
<p>Integration with other subject areas</p> <ul style="list-style-type: none"> • Works with other teachers to determine areas where connections can be made across subject areas • Notes connections to other strands in the curriculum 	<p>Consistently demonstrates in a variety of ways the connections between mathematics and other subject areas</p>	<p>Consistently demonstrates in a few ways the connections between mathematics and other subject areas</p>	<p>Demonstrates the connections between mathematics and other subject areas some of the time</p>	<p>Rarely demonstrates the connections between mathematics and other subject areas</p>

<p>Manipulatives</p> <ul style="list-style-type: none"> • (e.g., Hands on Equations™, Algebra Blocks™, Algebra Tiles™, geoboards, 3-dimensional figures, rulers, compasses, etc.) • Begins with manipulatives (concrete) prior to moving to pictorial and abstract • Shows students when and how to use specific manipulatives • Encourages students to use manipulatives as a tool for discovery, rather than simple “answer getter” 	<p>Uses a large variety of manipulatives on a consistent basis</p>	<p>Uses manipulatives in a few ways on a consistent basis</p>	<p>Uses manipulatives some of the time</p>	<p>Rarely uses manipulatives</p>
<p>Technology/ Graphing Calculators</p> <ul style="list-style-type: none"> • Uses for class demonstrations, investigations, problem solving, calculations and independent research • Uses technology to help all students to understand mathematics and to prepare to use mathematics in an increasingly technological world • Guides students in the appropriate use of technology 	<p>Uses technology to extend and expand the mathematics curriculum and instruction on a consistent basis</p>	<p>Uses technology to extend and expand the mathematics curriculum and instruction in a few ways on a consistent basis</p>	<p>Uses technology to extend and expand the mathematics curriculum and instruction some of the time</p>	<p>Rarely uses technology to extend and expand the mathematics curriculum and instruction</p>
<p>Opportunities for practice</p> <ul style="list-style-type: none"> • Uses modeling and guided practice before independent practice teaching • Provides appropriate practice at appropriate times • Encourages students to use a notebook to keep practice work in a useful fashion with errors analyzed 	<p>Provides appropriate opportunities for practice on a consistent basis</p>	<p>Provides appropriate opportunities for practice on an inconsistent basis</p>	<p>Provides few appropriate opportunities for practice</p>	<p>Rarely provides appropriate opportunities for practice</p>

<p>Parental Involvement</p> <ul style="list-style-type: none"> • Communicates the needs and progress of an individual student to his/her parents • Communicates objectives and expectations to parents • Encourages parents to use their home environment to provide their children with opportunities for mathematical thinking (patterns in floor tiles, recipes, money, puzzles, etc.) and with opportunities for counting, sorting, measuring, etc. • Encourages parents to play games (such as Monopoly, concentration, cards, etc.) with their children that provide opportunities for number and operation sense and with blocks and tinker toys to provide spatial sense 	<p>Consistently involves parents in the education of their child and communicates with them</p>	<p>Frequently involves parents in the education of their child and communicates with them</p>	<p>Occasionally involves parents in the education of their child and communicates with them</p>	<p>Rarely involves parents in the education of their child and communicates with them</p>
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