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ABSTRACT

One of the major accomplishments of the New Teacher Assessment and Support Consortium (INTASC) sponsored by the Council of Chief State School Officers has been the development of a set of standards describing what beginning teachers should know, be like, and be able to do. These standards have been translated into content-specific standards for teaching mathematics. Ten states joined in the INTASC Performance Assessment Development Project (PADP) to develop a prototype performance-based assessment linked to the INTASC core principles for mathematics. The product of PADP was a portfolio-based teacher assessment that includes prepared lessons, samples of student work, videotaped teaching segments, reflective writings, and a preliminary professional development plan. A pilot test of this assessment was conducted in 1995 with approximately 80 beginning mathematics teachers from 10 states. A final field test used results from approximately 200 beginning mathematics teachers. The final Mathematics Teacher Assessment handbook, scoring framework, performance benchmarks, and training documentation have been refined through these studies, and are available for the participating states. An appendix presents quotes from the standards of the National Council of Teachers of Mathematics. (Contains two figures and six references.) (SLD)

LICENSING BEGINNING MATHEMATICS TEACHERS:

A PERFORMANCE-BASED ASSESSMENT

AMERICAN EDUCATIONAL RESEARCH ASSOCIATION
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Running Head: PERFORMANCE-BASED ASSESSMENT

Reforming Teacher Preparation

The education necessary to live and work in the 21st century is in many ways much different from that needed only a few years ago. Today's schools must be able to ensure that all students are able to solve problems, think quantitatively, synthesize information, learn on their own, and work in cooperative groups. If schools are to be successful in providing this type of quality education to all students, a highly qualified and committed teaching force is necessary. To ensure success in the classroom, teachers must have a deeper understanding of subject matter they teach, a deeper understanding of how knowledge is developed, and a deeper understanding of how specific teaching strategies can build on the strengths of individual learners (Interstate New Teacher Assessment and Support Consortium [INTASC], 1995).

These new expectations and increased knowledge base for teaching require changes in teacher preparation programs, teacher assessment, and professional development programs. To promote collaboration between states interested in improving education and rethinking teacher preparation and professional development, the Interstate New Teacher Assessment and Support Consortium (INTASC), was established in 1987.

One of the major accomplishments of INTASC, sponsored by the Council of Chief State School Officers, has been the development of a set of standards describing what beginning teachers should know, be like, and be able to do. Explicitly linked to standards developed by the National Board for Professional Teaching Standards, the INTASC standards serve as the foundation for the proposed teacher education and certification standards in several states (Maine, Arkansas, Kentucky, Alabama, Ohio, Indiana, Kansas, North Carolina, Pennsylvania, New, York, Texas, Connecticut).

As a next step in the effort to reform teacher preparation, the INTASC standards were translated into content specific standards for teaching mathematics (see figure 1).

The Curriculum and Evaluation Standards for School Mathematics (National Council of Teachers of Mathematics [NCTM], 1989), Professional Standards for Teaching Mathematics (NCTM, 1991), A Call for Change: Recommendations for the Mathematical Preparation of Teachers of Mathematics (Mathematical Association of America [MAA], 1991), and the National Board for Professional Teaching Standards served as resources for the development of ten INTASC core principles for mathematics teaching. These principles, focusing on both mathematical content and pedagogical content knowledge, were developed to portray what it means to be a well-prepared mathematics teacher.

Insert Figure 1. About Here

Performance-Based Teacher Assessment

Early in 1994, ten states (Ohio, Connecticut, Delaware, Indiana, Kentucky, Louisiana, New York, Pennsylvania, Rhode Island, and Texas) joined in the INTASC Performance Assessment Development Project (PADP) for beginning mathematics teachers. A team of mathematics teachers, mathematics educators, assessment developers, psychometricians, and state licensing personnel from participating states was convened to develop a prototype performance-based assessment linked to the INTASC core principles for mathematics.

The product of the PADP team's effort was a portfolio-based teacher assessment. A portfolio format was utilized because it was felt it could more accurately capture the complexities of teaching, allow beginning teachers to document their best efforts in the classroom, to reflect on their teaching and ways to improve it, and to learn more about teaching and learning mathematics.

The INTASC Portfolio includes the following items documenting a teacher's knowledge of mathematics and teaching skills. However, the beginning teacher must

make many decisions concerning the specific materials to be included in the portfolio to ensure it represents their best effort in teaching mathematics.

- a series of eight to ten lessons focusing on one mathematical topic
- samples of students' daily work
- sample assessments used for student evaluation
- videotaped segments of teaching during the ten lessons in both whole class and small group situations
- reflective writings concerning teaching in general, the lessons taught, and student learning
- written background information about the school and the students
- a preliminary professional development plan

The evaluation framework of a beginning teacher's performance focuses on six categories (see figure 2). The first category corresponds to INTASC Mathematics Principal 1 and is connected to the mathematics content specified in the Curriculum and Evaluation Standards for School Mathematics (NCTM, 1989). The other five categories were developed to represent the relationships between the INTASC core mathematics principles and standards for classroom teaching outlined in the Professional Standards for Teaching Mathematics (NCTM, 1991) (see Appendix A).

Insert Figure 2. About Here

The evaluation of an INTASC portfolio is based on the belief that mathematics teachers and mathematics educators can best evaluate the complexities and subtleties of teaching mathematics. A team of two trained evaluators, with expertise in mathematics teaching and learning, evaluates each portfolio. Working independently, each reviewer reads through the written text of the portfolio taking notes and citing specific evidence and counter examples related to each evaluation category. These

initial notes are primarily descriptive in nature and will serve as the basis for discussion with the other reviewer.

After the independent review, the evaluation team comes together to view the videotaped lessons. Each reviewer independently takes notes concerning these specific lessons, records specific teachers and student dialogue, and looks for additional evidence and counter examples to assess the teacher's performance.

After reviewing the videotaped lessons, the evaluation team begins discussion of the evidence gathered and writes a written summary statement for each of the six performance categories describing the beginning teacher's performance in teaching mathematics. A final step in the evaluation process is to compare the beginning teacher's performance to specific benchmark performances of mathematics teaching and assign a final performance rating. The final rating is descriptive and outlines specific characteristics of the teacher's performance.

Field and Pilot Tests

A pilot test of the INTASC Mathematics Portfolio Assessment was conducted in the spring of 1995 with approximately 80 beginning mathematics teachers from ten states completing portfolios. The portfolios were evaluated by members of the PADP team and modifications made to the portfolio handbook, the evaluation framework, and the specific scoring criteria.

A final field test was conducted in the spring of 1996 with approximately 200 beginning mathematics teachers from ten states completing portfolios. During the summer, the PADP team established performance benchmarks for beginning mathematics teachers, evaluated the field test portfolios, and compared teacher performances to these benchmarks. Extensive data were also gathered to complete the research agenda designed to address reliability and validity issues.

The Future of the INTASC Portfolio Assessment

The final Mathematics Teacher Assessment Handbook, scoring framework, performance benchmarks, and training documentation are in final form and in the hands of the participating states. Each state is free to use this assessment to fit its own particular set of teacher licensure standards.

The state of Connecticut has implemented a performance assessment for beginning mathematics teachers as a component of its Beginning Educator Support and Training (BEST) Program. Central to the assessment for mathematics teachers are major components of the INTASC Portfolio. This high-stakes assessment is currently on line and is being used to grant a provisional teaching license for teaching mathematics in Connecticut.

In Ohio's Final Recommendations of the Standards Revision Committee for Teacher Education and Certification (ODE, 1994), it is recommended to expand the current model of assessing beginning teachers to include a performance component. It is proposed that a beginning teacher's performance be assessed during the first year of teaching as part of an induction program. After successful completion of this performance assessment and meeting other induction program criteria, the beginning teacher would then be issued a professional license to teach in Ohio. The INTASC Portfolio Assessment is one of several projects currently under consideration in Ohio that could be used to assess a beginning teacher's performance in the induction year.

Other INTASC states are in different stages of developing policies and procedures for performance assessments for beginning teachers. It is believed that many other states will use the INTASC Portfolio or major components of it as a measure of beginning teacher's performance in the mathematics classroom. It is believed that the INTASC Portfolio has great potential for ensuring that beginning mathematics teachers can "stand and deliver".

References

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Figure 1. INTASC Mathematics Core Principles

Principle 1: Teachers responsible for mathematics instruction at any level understand the key concepts and procedures of mathematics and have a broad understanding of the K-12 mathematics curriculum. They approach mathematics and the learning of mathematics as more than procedural knowledge. They understand the structures within the discipline, the past and the future of mathematics, and the interaction between technology and the discipline.

Principle 2: Teachers who teach mathematics at any level understand how children learn and develop and can provide learning opportunities that support their intellectual, social, and personal development.

Principle 3: Teachers who teach mathematics at any level understand how students differ in their approaches to learning and create instructional opportunities that are adapted to diverse learners.

Principle 4: Teachers who teach mathematics at any level understand and use a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills.

Principle 5: Teachers who teach mathematics at any level use an understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation.

Principle 6: Teachers who teach mathematics at any level use knowledge of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom.

Principle 7: Teachers who teach mathematics at any level plan instruction based upon knowledge of subject matter, students, the community, and curriculum goals.

Principle 8: Teachers who teach mathematics at any level understand and use formal and informal assessment strategies to evaluate and ensure the continuous intellectual, social, and physical development of the learner.

Principle 9: Teachers of mathematics are reflective practitioners who continually evaluate the effects of their choices and actions on others (students, parents, and other professionals in the learning community) and who actively seek out opportunities to grow professionally.

Principle 10: Teachers of mathematics foster relationships with school colleagues, parents, and agencies in the larger community to support students' learning and well-being.

Figure 2. Evaluation Framework for Portfolios

1. Teacher's Knowledge of Mathematics
    - What is the teacher's understanding of and fluency with mathematical procedures and conventions?
    - What is the teacher's understanding of the field of mathematics?
    - How does the teacher view mathematics?

2. Mathematical Tasks
    - What kinds of mathematical tasks does this teacher select?
    - How are the tasks implemented?

3. Mathematical Discourse
    - Describe the nature of the discourse in the classroom.
    - What role does the teacher play in fostering the discourse in the classroom?
    - What role do the students play in the discourse in the classroom?
    - What tools and modes of discourse are used in the classroom?

4. Learning Environment
    - How does the teacher use and manage the physical, time, and social aspects of the classroom?
    - How does the teacher use and manage the instructional environment?
    - How does the teacher treat students and encourage them to treat one another and thereby create a classroom in which learning by all students is valued?

5. Analysis of Learning
    - How does the teacher assess students' learning?
    - How does the teacher communicate with students about assessment?

6. Analysis of Teaching.
    - How does the teacher analyze and learn from and for teaching?

Appendix A

Knowing Mathematics

Knowledge of both the content and discourse of mathematics is an essential component of teachers' preparation for the profession. Teachers' comfort with, and confidence in, their own knowledge of mathematics affects both what they teach and how they teach it.. Their conception of mathematics shapes their choice of worthwhile mathematical tasks, the kinds of learning environments they create, and the discourse in their classrooms. (NCTM, 1991, p. 132)

Mathematical Tasks

The mathematical tasks in which students engage - projects, problems, constructions, applications, exercises, and so on - and the materials with which they work frame and focus students' opportunities for learning mathematics in school. Tasks provide the stimulus for students to think about particular concepts and procedures, their connections with other mathematical ideas, and their applications to real-world contexts. Good tasks can help students develop skills in the context of their usefulness. Tasks also convey messages about what mathematics is and what doing mathematics entails. (NCTM, 1991, p. 24)

Mathematical Discourse

The discourse of a classroom - the ways of representing, thinking, talking, and agreeing and/or disagreeing - is central to what students learn about mathematics as a domain of human inquiry with characteristic ways of knowing. Discourse is both the way ideas are exchanges and what the ideas entail. The discourse is shaped by the tasks in which the students engage and the nature of the learning environment; it also influences them. (NCTM, 1991, p. 34)

Learning Environment

The mathematics teacher is responsible for creating an intellectual environment in which serious engagement in mathematical thinking is the norm, for the environment of the classroom is fundamental to what students learn. (NCTM, 1991, p. 56)

Analysis of Learning and Teaching

A central question for which teachers must be responsible is, "How well are the tasks, discourse, and environment working to foster the development of every student's mathematical literacy and power?" Trying to understand as much as possible about the effects of the classroom on each student is essential to good teaching. Teachers must monitor classroom life using a variety of strategies and focusing on a broad array of dimensions of mathematical competence as outlined in the Curriculum and Evaluation Standards for School Mathematics Curriculum and Evaluation Standards for School Mathematics. What teachers learn from this should be a primary source of information for planning and improving instruction in both the short and long term. (NCTM, 1991, p. 62)

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