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Mathematics Teachers' Familiarity With Standards and Their Instructional Practices: 1995 and 1999

In 1995, half of the states (25) had content standards in mathematics; by 1998, this number had increased to 42 (Council of Chief State School Officers 2000). Forty-five states had student assessments in mathematics in 1994; by 1999, 47 states had such assessments. The existence of standards and assessments at the state level does not guarantee that classroom teachers are familiar with the standards or with the specifications of assessments (Cohen and Hill 2000). Neither does it guarantee that classroom instruction reflects the standards and assessments. In fact, mathematics standards have created significant controversy over the efficacy of different types of instruction for improving student performance (Loveless 2001, see, especially, Loveless chapter).

The Third International Mathematics and Science Study (TIMSS), 1995, and the 1999 Trends in International Mathematics and Science Study in Repeat (TIMSS 1999) take a representative sample of eighth-grade students. This Brief draws on surveys administered to these students' mathematics teachers. Using the survey results, this analysis examines the degree of teacher familiarity with various standards and assessments in 1995 and 1999. It then compares teacher reports of their instructional practices in classrooms with teacher reports of their familiarity with standards and assessments. Instruction is compared on the kinds of problem-solving activities advocated by national and state standards during the mid-1990s and on computational skill practice, which received more emphasis in the standards at the close of the 20th century (Loveless 2001).

How familiar are teachers with standards, curriculum guides, and assessment specifications?

Teacher familiarity with state education department documents, such as curriculum guides and assessment specifications, appears to have increased between 1995 and 1999 (table 1). Fewer students had teachers who were not familiar with assessment specifications (44 percent in 1999 compared with 57 percent in 1995). In 1999, students were also less likely to have teachers who reported they were not familiar with their state education department curriculum guides (20 percent) compared with students in 1995 (33 percent).*

Table 1. Percentage of public school mathematics students taught in eighth grade, by teachers' level of awareness of mathematics standards, curriculum guidelines, and assessment specifications: 1995 and 1999

Standards, guidelines, and specifications	1995	1999
National Council of Teachers of Mathematics Standards		
Not familiar	13.4	15.7
Fairly familiar	47.8	44.1
Very familiar	38.8	40.2
State Education Department Curriculum Guides		
Not familiar	33.3	19.9
Fairly familiar	37.9	42.7
Very familiar	28.8	37.5
State Education Department Assessment Specifications		
Not familiar	57.4	44.2
Fairly familiar	25.3	35.5
Very familiar	17.2	20.2
School District Curriculum Guide		
Not familiar	8.4	4.3
Fairly familiar	37.7	32.4
Very familiar	53.9	63.3
School Curriculum Guides		
Not familiar	8.7	8.3
Fairly familiar	27.9	27.7
Very familiar	63.4	64.0

NOTE: Not all apparent differences in this table are statistically significant because many estimates have large standard errors. Standard errors are available at <http://nces.ed.gov/pubsearch/pubinfo.asp?pubid=2003022>. Teachers who reported "No such document" are not included. There may be overlap among those reporting "no such document" and those reporting "not familiar." In some cases, teachers unfamiliar with standards documents may have incorrectly reported "no such document;" in other cases, teachers may have reported "not familiar" when, in fact, a document existed. The data did not allow checking of these responses for accuracy.

SOURCE: Third International Mathematics and Science Study, 1995, and Trends in International Mathematics and Science Study in Repeat, 1999.

Did teachers who reported greater familiarity with national, state, and local standards report different practices from other teachers in 1999?

Students with teachers who were more familiar with national, state, and local standards for practice were more likely to be asked to do problem-solving activities. For example, in 1999, students with teachers who were very familiar with state education department assessment specifications were more likely than students with teachers who were fairly or not familiar with these documents to be asked

to represent and analyze relationships using tables, charts, or graphs in most or every lesson (41 percent, 22 percent, and 19 percent, respectively; table 2). In 1999, students with teachers who were very familiar with these documents were also more likely to be frequently asked to write equations to represent relationships than students with teachers who were not familiar with these documents (69 percent and 44 percent, respectively). Similarly, students with teachers who reported being very familiar with state education department curriculum guides were more likely than students with teachers who were fairly or not familiar to be asked to explain their reasoning behind an idea in most or every lesson in 1999 (86 percent, 68 percent, and 62 percent, respectively). However, there were no significant differences in 1999 in the percentages of students who were asked to practice computational skills in most or every lesson by teacher familiarity with state education department assessment specifications (not familiar = 70 percent, fairly = 65 percent, very = 68 percent).

Did relationships between teacher awareness and classroom practices change over time?

There were stronger relationships between teacher awareness of standards and assessments and classroom practices in 1999 than in 1995 on several measures. These stronger

relationships were especially apparent for students with teachers who were familiar with state education department documents, such as curriculum guides and assessment specifications. Students with teachers who were very familiar with state education department curriculum guides were more likely to have teachers who reported asking their students to work on problems for which there is no obvious method of solution in most or every lesson in 1999 than in 1995 (22 percent and 9 percent, respectively). Students with teachers who reported being very familiar with these guides were more likely to be asked to write equations to represent relationships in most or every lesson in 1999 compared to 1995 (58 compared with 33 percent and 49 percent compared with 30 percent, respectively).

Similarly, students with teachers who were very familiar with the state education department assessment specifications were more likely to be frequently asked to represent and analyze relationships using tables, charts, or graphs, to write equations to represent relationships, and to practice computational skills in 1999 than in 1995 (41 percent compared with 20 percent, 69 percent compared to 45 percent, and 68 percent compared with 38 percent, respectively). Students whose teachers were fairly familiar with this type of document were more likely to be frequently asked to work on problems for which there is no obvious method of solution

Table 2. Percentage of public school mathematics students taught in eighth grade by teachers who reported using various instructional practices in most or every lesson, by teachers' level of awareness of mathematics standards, curriculum guidelines, and assessment specifications: 1995 and 1999

Standards, guidelines, and specifications	Explain reasoning behind an idea		Represent and analyze relationships using tables, charts, or graphs		Work on problems for which there is no immediately obvious method of solution		Write equations to represent relationships		Practice computational skills	
	1995	1999	1995	1999	1995	1999	1995	1999	1995	1999
Total	67.0	72.6	12.3	25.3	11.6	19.8	36.4	52.7	59.3	66.5
National Council of Teachers of Mathematics Standards										
Not familiar	42.2	67.6	4.6	20.9	3.7	6.3	26.9	31.2	67.6	81.7
Fairly familiar	69.1	66.9	11.3	18.7	13.3	25.9	36.1	50.6	61.3	60.4
Very familiar	73.9	83.1	17.0	32.7	13.1	20.6	41.2	64.3	53.3	70.2
State Education Department Curriculum Guides										
Not familiar	57.2	62.3	5.6	13.7	11.9	19.9	47.0	54.5	54.3	74.1
Fairly familiar	70.9	67.7	15.8	26.8	15.0	20.1	29.6	48.7	67.6	66.3
Very familiar	75.5	86.3	17.7	29.6	8.9	22.2	33.4	57.7	54.4	68.3
State Education Department Assessment Specifications										
Not familiar	61.3	65.0	10.7	19.4	16.2	14.9	40.9	44.4	64.3	69.7
Fairly familiar	77.6	78.5	10.8	22.2	5.7	26.3	25.6	53.0	65.1	64.7
Very familiar	72.2	81.6	20.1	40.9	8.2	16.6	44.6	68.7	37.9	68.0
School District Curriculum Guide										
Not familiar	37.6	72.9	6.4	0.5	9.0	13.9	16.2	36.4	52.4	65.8
Fairly familiar	66.6	60.2	10.0	24.7	11.4	22.5	43.0	44.8	67.6	72.4
Very familiar	77.0	80.8	17.0	26.7	14.2	19.6	36.7	57.4	51.0	65.0
School Curriculum Guides										
Not familiar	74.3	38.9	7.1	5.6	19.8	8.6	42.0	44.2	57.0	86.6
Fairly familiar	51.0	61.9	7.3	16.2	5.2	14.8	27.1	31.7	70.1	69.4
Very familiar	74.4	85.2	15.3	27.6	12.2	23.6	37.9	58.5	56.3	70.0

NOTE: Not all apparent differences in this table are statistically significant because many estimates have large standard errors. Standard errors are available at <http://nces.ed.gov/pubsearch/pubinfo.asp?pubid=2003022>. Teachers who reported "No such document" are not included. There may be overlap among those reporting "no such document" and those reporting "not familiar." In some cases, teachers unfamiliar with standards documents may have incorrectly reported "no such document;" in other cases, teachers may have reported "not familiar" when, in fact, a document existed. The data did not allow checking of these responses for accuracy.

SOURCE: Third International Mathematics and Science Study, 1995, and the Trends in International Mathematics and Science Study in Repeat, 1999.

and to write equations to represent relationships in 1999 than in 1995 (26 percent compared to 6 percent and 53 percent compared to 26 percent, respectively).

At the school level, students with teachers who were very familiar with school curriculum guides were more likely to be asked to represent and analyze relationships using tables, charts or graphs, to work on problems for which there is no obvious method of solution, and write equations to represent relationships in most or every lesson in 1999 than in 1995 (28 percent compared with 15 percent, 24 percent compared with 12 percent, and 59 percent compared with 38 percent, respectively). At the level of standards promulgated nationally, however, students with teachers who reported being not familiar with the National Council of Teachers of Mathematics standards or school district curriculum guides were more likely to be asked to do problem-solving activities, such as explain reasoning behind an idea in most or every lesson in 1999 than in 1995 (68 percent compared with 42 percent and 73 percent compared with 38 percent, respectively).

Methodological Issues

Change in teachers' instructional practices may not equal change in students' achievement. In fact, researchers are divided on the relative benefits of problem-solving and computation emphases. A cautionary note is also needed on the measurement of classroom instruction. The analysis of instructional practices relied on teachers' reports of the activities in which they engaged their students. Self-reports of instruction may lack a universally understood vocabulary with which to describe practice (Loveless 2001, see, especially, Shouse chapter). Measures of frequency, absent indicators of content, quality, and rigor, can provide only limited information to suggest whether teaching is moving in a particular direction.

Conclusion

This analysis shows that teacher awareness of state curriculum guides and state assessments increased between 1995

and 1999. At the end of the last decade, teachers who were very familiar with these policy instruments were more likely than their peers to employ instructional practices that are consistent with the current state curriculum guides and state assessments. In addition, the Brief provides modest support for the existence of a relationship between familiarity with policy instruments and teacher practices (see also Cohen and Hill 2000). In particular, students with teachers who were more familiar with state education department curriculum guides and assessment specifications were more likely to be frequently given various instructional tasks reflecting the problem-solving and computation emphases of the current policies in 1999 than in 1995.

Footnote

*Some of the estimates presented here have large standard errors because of small sample sizes and the clustered sampling design of TIMSS. Therefore, large apparent differences may not be statistically significant. All differences reported in this Brief are significant to the .05 level. Complete standard errors for this *Issue Brief* are available at <http://nces.ed.gov/pubsearch/pubinfo.asp?pubid=2003022>.

References

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The *Issue Brief* series presents information on education topics of current interest. All estimates shown are based on samples and are subject to sampling variability. All differences are statistically significant at the .05 level. In the design, conduct, and data processing of National Center for Education Statistics (NCES) surveys, efforts are made to minimize the effects of nonsampling errors, such as item nonresponse, measurement error, data processing error, or other systematic error. For more information on the TIMSS studies, visit <http://nces.ed.gov/timss>.

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