Section IV: Trends in Teaching Practice

Excerpted From: Does Professional Development Change Teaching Practice? Results From a Three-Year Study

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In this section, we put our results on the effects of professional development in context by examining how much average change over time there is in different dimensions of teaching practice. In particular, we use our three years of data on teaching practice to describe trends and differences across teachers and schools in the three broad aspects of teaching practice that we discussed in Section III:

- The overall alignment of teaching with national standards, using the National Assessment of Education Progress (NAEP) as the national standard
- Teachers' emphasis on the six performance goals (i.e., memorize, understand concepts, perform procedures, generate hypotheses, collect, analyze/interpret, and make connections)
- Teachers' use of the four pedagogical strategies (i.e., teacher-centered instruction, individual seatwork, active instruction, and discussion-oriented instruction)

First we report patterns in teacher change over the three-year period of our study on alignment, performance goal emphasis, and pedagogical strategies. Then we analyze differences in teaching practice between subjects and school levels, schools, and teachers and for individual teachers over time.

Do Teachers Change Their Teaching Practice?

- In our longitudinal sample, we find little change in overall teaching practice from 1996 to 1999. In particular, there was little change in teachers' average degree of alignment with the NAEP, in patterns of emphasis on performance goals, and in pedagogy.

Exhibit 18 shows the mean, or average, levels of emphasis for all 11 measures of teaching practice for each of the three years of the study. These mean levels of emphasis reflect teaching practice across all teachers in our longitudinal sample. (See Appendix E for mean levels of emphasis by subject and school level.) Using hierarchical linear modeling, we tested whether there were significant changes in these mean levels of emphasis, controlling for subject, school level, and the interaction of subject and school level. We found that generally, teachers' classroom practice remains stable across the three years of the study. For example, the first row in Exhibit 18 indicates that in 1996–97, on average, 21 percent of teachers' content coverage was aligned with the NAEP. (This exhibit is identical to Exhibit 7 in Section III.) Although the alignment of content coverage with the NAEP drops to 20 percent in 1997–98 and 1998–99, this difference is not statistically significant. The exhibit also shows that teachers' average emphasis on higher-order performance goals and topics and on good pedagogical strategies also do not increase over time. [1,2]

Systemic reforms foster multiple signals, and many of the signals may conflict, which could create a tension that causes teachers to be resistant to change (Cohen & Spillane, 1992).

There may be several explanations for the lack of change in overall teaching practice. First, it is not unreasonable to think that teachers teach in ways that they believe to be effective and appropriate and do not make substantial changes in their practice from year to year, as a result of either professional development or other influences. We would not expect other professionals, in fields such as law or medicine, to make substantial changes in their behavior on the basis of one or even several professional development experiences. Second, teachers may be getting too many signals to teach in conflicting ways, and the tensions may have the effect of canceling each other out. Systemic reforms foster multiple signals, and many of the signals may conflict, which could create a tension that causes teachers to be resistant to change (Cohen & Spillane, 1992).[3]

It also is possible that teachers may be changing, but slowly. We measured teaching at only three points in time over three years, and thus we may not have measured teachers long enough to capture substantial change. Further, teachers may be changing, but in ways not captured by our study. For example, teachers may be increasing their alignment with state standards, but not with the NAEP.[4] Finally, teachers may be shifting in a particular direc-

These results also highlight the measurement and theoretical complexities in the study of teacher change.

Exhibit 18.

Average Characteristics of Teachers' Instruction for 1996-97, 1997-98, and 1998-99.

Dimension of Teaching Practice	1996-97	1997-98	1998-99
	Mean (SD)	Mean (SD)	Mean (SD)
Alignment of content Coverage with the NAEP			
Scale: From 0 to 100% alignment with the NAEP			
Alignment Index	21% (9)	20% (9)	20% (8)
Performance Goals			
Scale: From 0 to 100% emphasis on the performance goal			
Memorize	15% (7)	16% (6)	15% (6)
Understand Concepts	23 % (6)	22% (5)	22% (5)
Perform Procedures	20% (6)	20% (6)	20% (7)
Generate Hypotheses	11% (5)	12% (5)	12% (5)
Collect, Analyze, Interpret	13% (5)	13% (4)	13% (5)
Make Connections	17% (5)	17% (4)	17% (4)
Pedagogy			
Scale: Standardized scale where mean=50 and standard deviation=10, in 1996-97			
Didactic Instruction	50.1 (5.6)	50.6 (5.8)	49.9 (6.2)
Individual Seatwork	49.5 (5.4)	49.4 (5.5)	49.1 (5.6)
Active, Project-centered Instruction	49.7 (5.7)	49.5 (5.8)	49.1 (6.4)
Discussion-oriented Instruction	50.0 (10.8)	49.6 (9.3)	49.4 (8.7)

How to read this exhibit: The percent alignment of teachers' content coverage with the NAEP decreased from 21 percent in 1996-97 to 20 percent alignment in 1997-98 and 1998-99. These changes are not statistically significant. The percent emphasis that teachers give to the performance goal of memorization increased from 15 percent in 1996-97 to 16 percent in 1997-98; it decreased to 15 percent in 1998-99. These changes are not statistically significant. Teachers' use of the pedagogical strategy of didactic instruction increased from 50.1 to 50.6 in 1997-98; it decreases to 49.9 in 1998-99. These changes are not statistically significant. Pedagogy is on a standardized scale where 50 is the mean level of use of each of the four strategies; this number is not a percent, but rather a general metric designed to provide a point from which to show increases or decreases in teachers' use of a particular pedagogical strategy. The mean was standardized in 1996-97, but could vary in 1997-98 and 1998-99.

tion, but to increase emphasis on certain types of performance goals or pedagogy, teachers have to de-emphasize other strategies. This may result in the overall appearance of no change when the data are aggregated, when actually changes in one direction may offset changes in another direction.[5]

These results also highlight the measurement and theoretical complexities in the study of teacher change. There may be important differences between measures designed to capture teachers' instruction at one point in time and measures that are designed to detect teacher growth (see Rowan, 2000). For example, as seen in Section III of this report, we were able to detect the effects of professional development on teachers' use of specific strategies intended to foster higher-order student learning, but we found relatively few effects on global measures of teaching. We do not have any working paradigms for teacher growth—either theoretical or empirical frameworks for what types of changes one would expect, their magnitude, and when these changes would occur. This is an area where more theoretical and empirical work is needed. Despite these caveats, our findings provide strong evidence of the stability of teachers' classroom practice.

Variation in Teaching Practice Between Schools, Between Teachers Within Schools, and Across Time

Although we observe little change in classroom practice on average, individual teachers differ substantially in their classroom practice. We found the following:

- Despite little *average* change over time in teaching practice in our longitudinal sample, individual teachers

Exhibit 19.

Percent Variation in Teaching Practice (1996-97, 1997-98, 1998-99).

Dimensions of Teaching Practice	Percent of Variation in the Quality of Professional Development Explained by Differences Across:				Unexplained Year-to-Year Variation in Individual Teaching Practice
	Subjects and School Level	Teachers in the Same School	Schools	Years	
Alignment					
Alignment Index *Scale:* From 0 to 100% alignment with the NAEP	42.4%	27.2%	0.0%	0.0%	30.4
Performance Goals					
Scale: From 0 to 100% emphasis on the performance goal					
Memorization	0.0%	39.1%	2.2%	0.0%	58.7
Understanding concepts	0.0	30.0	2.5	0.0	67.5
Performing procedures	27.9	29.7	0.0	0.0	44.2
Generating hypotheses	6.7	40.0	0.0	0.0	53.3
Collecting/analyzing/ interpreting data	10.3	34.5	0.0	0.0	55.2
Making connections	3.7	29.6	0.0	0.0	66.7
Pedagogy					
Scale: Standardized scale where mean=50 and standard deviation=10, in 1996-97.					
Traditional	25.3	40.9	6.2	0.0	27.6
Individual seatwork	10.1	40.6	9.6	0.4	39.3
Active project-centered learning	16.7	36.2	8.6	0.0	38.5
Discussion-oriented instruction	2.6	30.7	4.8	0.0	61.8

How to read this exhibit: Forty-two (42) percent of the variation in alignment is due to teachers' subject and school levels; none of the variance is due to differences between schools or average differences in teaching practice across years; 27 percent of the variation is between teachers within the same school, and 30 percent of the variation is unexplained year-to-year variation. Thus, teacher and subject/level differences account for most of the variance, and the remaining 30 percent is unexplained year-to-year variance.

in our sample do vary in their classroom practices, and moderate variation does occur in the classroom practice of individual teachers from year to year.

Although there is very little change across years in average teaching practice, there still are considerable differences between teachers, as illustrated by the standard deviations reported in Exhibit 18. For example, the exhibit indicates that on average, teachers gave 15 percent of their instructional emphasis to the performance goal of memorization in 1996–97. The standard deviation of 7 percent indicates that many teachers gave as little as 8 percent emphasis to this performance goal, whereas many others gave 22 percent emphasis to this goal. Similarly, if we look again at alignment, the exhibit shows that in 1996–97, the average alignment of teachers' content coverage with the NAEP was 21 percent. The standard deviation of 9 percent, however, indicates that for many teachers, only 12 percent of content coverage was aligned with the NAEP, whereas for many other teachers, 30 percent of their content coverage was aligned with the NAEP. So, although we observe considerable stability in classroom practice on average, individual teachers differ substantially in their classroom practice.

Our longitudinal data enable us to answer many questions about the variation in teachers' classroom practice. For example, do teachers who teach different subjects or levels of school have different patterns of content alignment, performance goals, and pedagogy? Do

teachers in some schools differ systematically in their classroom practice from teachers in other schools? Do teachers within the same school differ from one another in their classroom practice?

Our longitudinal data also enable us to answer questions about changes in individual teachers' instruction over time. Are teacher differences consistent across years? For example, do individual teachers who emphasize active, project-centered instruction in 1997–98 also emphasize this aspect of their classroom practice in 1998–99?

Using a statistical technique called "hierarchical linear modeling" we were able to use our longitudinal data to estimate what proportion of the "variation" in teachers' classroom practice (i.e., the 11 aspects of teaching that we measure) could be attributed to (1) average differences between teachers who teach different subjects or levels of school, (2) average differences between schools, (3) average differences between teachers in the same school, and (4) average differences between one year and the next. (See Appendix E for an explanation of the analyses undertaken for this section of this report.) For each dimension of teaching practice shown in the first column of Exhibit 19, we show the percent of the variation in teachers' professional development experiences that we can attribute to each of these differences.

The last column of Exhibit 19, labeled "unexplained year-to-year variation in individual teaching practice," shows the percent of the variation in individual teachers' practice between years that cannot be explained by any of the differences listed above. If teachers' classroom practice were totally consistent from one year to the next, all of the variation in their instruction would result from differences between teachers' subject and school levels; differences between teachers in the same school; differences between schools; and differences in the average teaching practice between one year and the next. None of the variation would be left unexplained.

The data reported in Exhibit 19 indicate that depending on the specific dimension of teaching practice, a substantial part of the variation in teaching practice can be explained by differences in teachers' subjects and school levels. For example, over 40 percent of the variation in alignment is due to subjects and levels. This may reflect the fact that, for example, elementary school mathematics instruction is more aligned with the NAEP than are other subjects and grades. (See Appendix E.) The exhibit also shows that almost 30 percent of the variation in emphasis on the performance goal "performing procedures" is due to subjects and levels. This supports our earlier finding from the analysis of our first year of longitudinal data, reported in Garet et al., 1999, that teachers of mathematics emphasize this performance goal significantly more than other teachers. Finally, about 25 percent of the variation in teachers' emphasis on traditional pedagogy is explained by teachers' subjects and school levels. This probably reflects the fact that high schools tend to have more traditional pedagogy than do middle or elementary schools. Apart from these differences between teachers' subjects and school levels, most of the variation in teaching practices is between teachers within the same school. (See Appendix E for a discussion of these results.)

Despite the consistency of teaching practice over time, we found variation between individual teachers.

There is practically no variation across schools in alignment and performance goal emphasis, and there is a small difference across schools in pedagogy. This difference may be due to the adoption of whole-school reform designs, which often focus on pedagogical strategies (e.g., some designs hinge on project-centered learning).

Finally, Exhibit 19 indicates that there is essentially no year-to-year variation in average teaching instruction. This reflects our earlier finding of little change in average overall teaching practice over time. Although there is substantial variation across teachers in their teaching practice, this variation can be attributed to differences across individual teachers in the same school to teachers who teach mathematics instead of science, or to teachers who teach at different levels of school.

A substantial amount of year-to-year variation in the teaching practice of individual teachers remains unexplained in our analysis. This unexplained year-to-year variance is higher for the six performance goals than for alignment or for the four measures of pedagogy. The high year-to-year variation in emphasis on performance goals may indicate that teachers adjust these goals to changes in the specific student composition of their classes each year.[6]

Summary

Although teachers may be changing on dimensions or qualities of practice that we did not measure, it is evident that on many central dimensions of classroom practice, teachers in

the 30 schools we studied did not change from 1996–97 through 1998–99. However, despite the consistency of teaching practice over time, we found variation between individual teachers. We found differences in teaching practice by school level and subject, and we found that most of the variation in teaching practice is between individual teachers within the same schools, rather than between schools. Greater differences in teaching practice between schools might indicate consistent, systematic school-level instructional plans, but evidence of such planning was not found in our data.

Our findings highlight the value of conducting studies with increased power to measure change (for example, measuring teachers for more than three years). The findings also highlight the value of studies that incorporate models of teacher growth that would indicate what types of changes we would expect in teaching practice, as well as their timing and magnitude. For example, it would be helpful to have information on the type of dimensions on which we expect teachers to change and by how much we would expect them to change during a one-year period versus a two-year period.

Lastly, although teachers do not report changing their teaching practice in ways we might consider desirable, the fact that they are consistent over a three-year period in reporting their instructional practices lends strong support to our survey instrument as a reliable measure of teachers' instruction.

In the final section of this report, we summarize and synthesize our findings on teachers' professional development experiences and the effects of professional development on instruction and trends in teaching practice, and we suggest implications for designing and supporting professional development through the Eisenhower and other programs.

References

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The previous excerpt is Section IV of the following document: U.S. Department of Eduction, Office of the Under Secretary, Planning and Evaluation Service, Elementary and Secondary Education Division, *Does Professional Development Change Teaching Practice? Results from a Three-Year Study, Executive Summary*, Washington, D.C, 20202.

Endnotes

1 At the outset of the study we targeted several topics to monitor over time. These were subjects, such as probability, statistics, measurement, and geometry, that have been identified as special weaknesses for students in the United States (Beaton et al., 1996). We conducted analyses of these and an exhaustive list of topics by subject and school level, and the only topic for which there was even a marginally significant increase was advanced algebra in high school ($p<.07$, $n=28$). These analyses were done separately by school level and subject and had sample sizes of approximately 30 teachers, which limits the power to detect effects.

2 The only significant change over time effect is an interaction between year and subject for teachers' emphasis on memorizing and understanding concepts. See Appendix E for the results of these analyses.

3 We observed during our site visits in 1996–97 that many of the schools were engaged in multiple reform efforts.

4 AIR is currently conducting a study, *Moving Standards to the Classroom*, sponsored by the Planning and Evaluation Service, which is focused on examining the extent to which teachers' instruction in mathematics is aligned with state standards; in addition, the Wisconsin Center for Education Research, in collaboration with the Council of Chief State School Offices (CCSSO), has conducted a study of the alignment of teaching with state assessments and is planning a study of the alignment of teaching with state standards.

5 This also might help explain the random variation in individual teachers' trajectories that we found.

6 The fact that only 30 percent of the variation in alignment is due to unexplained year-to-year variation indicates that the "test-retest" reliability of our measure of content coverage is relatively high. If all the year-to-year variation were due to measurement error, the implied reliability would be .70.