Documenting In-Classroom Support and Coaching Activities of a Professional Development Program Directed toward School-wide Change: An Integral Part of an Organization's Evaluation Efforts

by

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This study examines the classroom practices of 265 elementary school teachers from the Chicago Public School system who were participating in an intensive professional development program. The program included classroom coaching and mentoring activities in support of instructional sessions conducted over time. Based on over 1,700 standardized implementation logs, a descriptive assessment looked at changes in the level of intervention by professional development staff throughout the classroom support phase of the program. Evidence related to program outcomes that address the use of standards-based curricula in mathematics and science and the use of best practices in the classroom by participating teachers were examined as well. Also examined was the degree to which varied instructional strategies were used in the classroom in support of diverse learning styles of the children who ultimately should benefit from this program. Limitations of this methodology are discussed as well as the overall results which suggest the feasibility and utility of this methodology in recording hard-to-capture data.

Posited by Kaser and Bourexis (1999), a key characteristic of a high-quality, professional development program in mathematics and science is that the learning activities for teachers are spread over time. As will be described shortly, the Academy's professional development program for elementary school teachers meets this criterion. In addition, a distinct feature of the Academy's program is the extended support that is offered through scheduled classroom visits. These classroom visits involve coaching and reflective instructional interaction between teachers and professional development staff and provide the teacher with an opportunity to try out their new knowledge and skills while receiving timely support and feedback from staff who are familiar with the underlying program content and pedagogy associated with these lessons (Kaser & Bourexis, 1999). The coaching and reflective instructional support that is provided through these visits is summarized in a standarized implementation log.

The program that will be described shortly is a professional development program for teachers. Although targeted toward teachers, the ultimate accountability of the program is likely to be evidenced by changes in the classroom experience of students as well as

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student achievement levels. The assessment of this program at the student level is beyond the scope of this work. Nonetheless, recent research suggests linking differential teacher effectiveness as a strong determinant of differences in student learning (Darling-Hammond, 1999), that quality teachers are a major influence on student achievement (Ferguson, 1991) and improved teachers' education has a significant impact on improving student achievement (Greenwald, Hedges & Laine, 1996). After brief background information, this paper will focus on the classroom support component of this program. We will then highlight what we have learned from the series of implementation logs that describe the classroom support and coaching activities, with particular attention given to the review of evidence of transference to the classrooms of students from participating schools during the first year of program intervention.

Background

The Teachers Academy for Mathematics and Science is a non-profit organization located in Chicago. The Academy offers an intensive 3-year professional development program designed to meet the needs of under-prepared elementary school teachers in Chicago and select school districts in Illinois (Brett, 1996). The program is directed toward high-risk schools, where the proportion of students that are not making grade-level standard in mathematics as well as science is high and evident across grades. The program recently underwent a major redesign effort to better serve the needs of its target audience. As revised, the program content is offered by instructional level (i.e., primary, intermediate and upper grade levels) that blends mathematics and science curricula with technology. The program is designed to provide 60 hours of professional development instruction per year for two years that is developmentally appropriate by grade-level, based on national and state standards in mathematics and science, content driven and inquiry based using nationally recognized curricula.

In addition, 15 contacts occur, which involve coaching and reflective instructional support in the classroom per year during the first two years. The intent of these classroom visits is to facilitate the transfer of program content and pedagogy by the teacher into the classroom through modeled lessons by professional development staff, co-taught lessons, and observed lessons. This implementation support offered through the Academy program differs in at least one important feature from the *clinical teaching experiences* that are reported in the literature. The latter approach involve observing and providing feedback to teachers who are attempting new methods in an environment away from the classroom where they typically teach. Assessment of these clinical teaching experiences suggests, however, that these teachers have had difficulty applying these newly learned practices once back at their home schools (Miech, Nave & Mosteller, 2001). In contrast, the Academy's program component offers this support during visits conducted *in the actual classroom where the teachers typically teach* with reflective discussion and planning conferences happening before and/or after these visits. Also, during the course of these visits it is intended that this implementation support move from a high level of intervention in the classroom by professional development staff (by modeling a lesson(s) or co-teaching) to less involvement by the professional developer based on observation-only classroom visits. Thus, the potential for transfer of best practices from program instruction to classroom teaching theoretically should be greater using this model.

The program is also supported by distributed teaching materials, student manipulatives, and technology resources (Feranchak, Avichai, Langworthy & Triana, 2001). The overall program intervention occurs within the context of a school-wide systemic effort that requires that a high percent of mathematics and science teachers within each school participate in the program and includes program outreach to principals and school administrators as well as parents and community members. The third year provides a year of transition to help the school sustain progress after the program.

Evaluation Framework

The Academy has focused its evaluation efforts in four major areas: program design, program delivery, program outcomes, and the periodic assessment of the organization as a whole (Race, 2000). In keeping with recommendations by the National Center for Improving Science Education (NCISE), the Academy recognizes that the balance between process and outcome evaluation efforts is essential (Brett & Scheirer, 1994). The intent of the outcome-based evaluation component is to begin to build a framework that will facilitate continuity of data collection and analysis over time and foster the ability to make valid inferences about the effectiveness of the Academy's professional development program (Brett & Scheirer, 1994).

Accordingly, an internal task force comprised of Academy program, operations, and evaluation staff developed a detailed outcome map. The program is based on this cohesive set of intermediate, long-term, and ultimate outcomes, which form the basis of the program outcomes component of the evaluation framework. The map builds on intermediate outcomes that address teacher performance and practices along with additional intermediate outcomes that focus on the impact of the school and community environments. Long-term outcomes focus on teacher attitudes, knowledge, and practice, and ultimate outcomes address student academic performance and enthusiasm for mathematics and science.

Purpose

A critical teacher-related program outcome concerns the transfer of instructional practices in the classroom relative to using standards-based curricula in mathematics and science, the use of best practices, and offering a variety of lesson formats. The Academy has identified two program outcomes that focus on teacher instructional practices and are of immediate concern here:

- Teachers use best practices in their instruction of mathematics, science, and integrated technology.

- Teachers demonstrate increased ability to apply national and state mathematics, science, and technology standards to their teaching.

Through descriptive analysis of over 1,700 implementation visit logs, these program outcomes are assessed. This analysis is based on implementation visit logs from observations of one cohort of elementary school teachers during one year of instruction and implementation (from 16 participating schools from the Chicago Public School system). More specifically, the focus of this analysis is to highlight the instructional processes and practices of participating teachers throughout the school year based on evidence of:

- Changes in level of intervention by the professional development (PD) staff throughout implementation support.
- Content alignment with state standards in mathematics and science.
- Use of best practices in the classroom.
- Use of a variety of instructional strategies (i.e., varied lesson formats to meet the diverse learning styles of the students in participating schools).

Method

Overview of Implementation Support

As noted, an integral part of the Academy program involves implementation support for participating teachers via 15 contacts per year. A contact consists of a combined classroom visit and a conference with the participating teacher (except for the first visit, which tends to involve either a conference or a classroom visit to start the process). This paired classroom visit-conference constitutes one implementation log as described below. The conferences allow for the teacher and professional developer (PD) to reflect and discuss classroom activities and issues as well as identify ways to improve future instruction. In addition, in-session instruction time is set aside for teachers to plan how Academy or Academy-modified instruction can be incorporated in their classrooms.

Implementation visits begin shortly after the instructional portion of the program has started and continue throughout the school year until 15 contacts have been successfully completed or scheduled (approximately one combined classroom visit and conference a month per teacher). If a teacher received all planned implementation sessions, this would result in a total of either seven completed logs for that teacher; or eight completed logs if the first visit was an introductory or get-acquainted session.

Implementation Logs

The implementation log serves to document this program component. The log is completed after a classroom visit by professional development staff of the Academy and describes a classroom lesson through a standardized set of closed- and open-ended questions. These closed-end questions include: who took the teaching lead (i.e., the lesson was modeled by Academy professional development staff; co-taught by PD staff and the teacher; or the teacher taught the lesson and the PD staff member only observed the lesson). Also queried was the content area covered in the lesson; whether the content area is aligned with state mathematics and science learning standards; the primary instructional strategy used during the lesson; observed lesson format(s); and, best practices evident during the lesson. A narrative portion of the log serves to elicit reflections from both the teacher and staff through several open-ended questions. These reflections focus on teacher progress, the next steps for implementation, and the discussion that occurred during the conference with the teacher. The gathering of this information was supported by a standardized protocol, which included as already stated a standardized form, instructions and operational definitions of terms, and a schedule for processing these forms.

Cancelled visits are documented also in the implementation log. This documentation provides a brief explanation of the reason for the cancellation, and whether the visit had been rescheduled. If a pattern of missed visits occurred for a particular teacher it was discussed by the PD and supervisory program staff as needed.

<u>Procedure</u>

During the 1999-2000 school year, an electronic database was created and maintained by the technology staff of the Academy. The implementation log is housed electronically, within this database, which is supported by Filemaker Pro software. Following a standard procedure, each professional developer completed an implementation log after each classroom visit (or scheduled but cancelled visit) using their individual database. Based on a process schedule, these data were periodically fed into an Academy-wide implementation log database. The Academy-wide database houses the completed implementation logs compiled during a given school year for all teachers receiving implementation. For analysis purposes, quantitative data were exported from Filemaker Pro into SPSS (1999).

<u>Approach to Data Analysis</u>

For present purposes, data are summarized descriptively through a series of tables and figures. Focusing largely on the quantitative data taken from the implementation logs, the current analysis examined: 1) changes in level of intervention by the program development staff throughout the implementation phase of the program, 2) whether observed content areas align with state mathematics and science standards, 3) evidence of best practices, and 4) the use of varied instructional strategies in the classroom.

To augment the quantitative assessment of these data, a small subset of implementation logs from participating primary and intermediate-level teachers were selected. That is, existing implementation visit logs from ten participating teachers from each instructional level were selected such that the sample included at least one set of logs for at least one teacher per professional development staff member. Thus a total of 159 implementation visit logs from 20 teachers were qualitatively reviewed. To this end, a hard copy of each selected implementation log summary was analyzed. General patterns were noted with

Table 1
Summary of Completed, Cancelled and Total Number of Visits by Instructional Level

Class Visit	Instructional Level					
	Primary			Intermediate		
	Yes	*No*	*Total*	*Yes*	*No*	*Total*
Log 1	137	21	158[a]	101	6	107
Log 2	149	5	154[b]	93	8	101[b]
Log 3	135	14	149[b]	82	10	92[b]
Log 4	127	14	141[b]	81	10	91[b]
Log 5	120	11	131[b]	76	13	89[b]
Log 6	99	24	123[b]	81	5	86[b]
Log 7	85	24	109[b]	64	14	78[b]
Log 8	68	23	91	43	2	45[b]
Total	**920**	**136**	**1056**	**621**	**68**	**689**

[a] Include 6 teachers that were not part of the implementation phase of the program. Three other teachers dropped out of the program after the first visit.
[b] Reflects a drop in the number of participating teachers.

particular attention given to describing how the transition from PD-modeled lessons to teacher-taught lessons occurred. Additional analytic questions (e.g., missed visits, program attrition) were explored through qualitative review of appropriate subsets of implementation logs as well.

Results

A total of 265 teachers received documented implementation support during year one of the program (across schools, this resulted in 158 primary and 107 intermediate-level teachers). A total of 1,745 documented implementation logs were completed with 82% of the planned visits completed or scheduled (if all 265 participating teachers received 8 visits); 1,541 logs represented successfully completed paired classroom-conference visits. Table 1 shows a breakdown of implementation visits by instructional level (primary or intermediate). As can be seen, a small but steady decrease in the total number of logs (documented visits) occurred from logs 2 through 6, with a larger drop off occurring for visits seven and eight. The decrease in number of logs across visits reflects a decrease in the number of participating teachers receiving implementation up to log seven. A log for the eighth visit was applicable only for those teachers whose first visit was an initial get-acquainted session.

Missed Visits. Implementation logs that documented missed visits were analyzed qualitatively for general patterns as to why a lesson did not occur. In order of most frequently mentioned, three general patterns were noted. Most often, visits were not completed as planned because the teacher was absent (due, for example, to illness, family-related issues, or absent without apparent reason); or, the teacher cancelled because they were not prepared for the lesson. Very often, this lack of preparation on the part of the teacher was also associated with not regularly attending the instructional sessions of the program. These teachers very often subsequently dropped out of both the instructional and implementation component of the program. A third general pattern involved scheduling problems or conflicts. Early in the program these scheduling problems often were associated with the teachers not fully understanding the requirements of the program. Later these scheduling conflicts often centered on school-sponsored activities such as planned assemblies, standardized test practice or actual test taking, and field trips.

Attrition. Implementation logs were examined to determine program-related reasons for teachers dropping out of the program before completion. Teacher attrition was evident as early as after the initial visit, but also well into the latter portion of implementation. The main reason teachers dropped out was the time commitment required to attend sessions, which conflicted with other after-school programs or perceived to interfere with standardized test preparation. Other teachers personally felt they did not find the professional development program useful, citing that the time and effort needed to attend the program did not outweigh its benefits. Specific reasons given were that the activities were not applicable, that they felt others were judging them, and that they were being forced to join the program. Other teachers transferred to a new school in the middle of implementation or scheduling difficulties between the professional developer and teacher also resulted in teacher attrition in a few cases.

Changes in Level of Intervention across Classroom Visits

During a classroom visit, the professional development (PD) staff of the Academy either modeled a lesson, co-taught a lesson with the teacher, or observed the teacher teaching a lesson. Figures 1 and 2 show a breakdown of this level of intervention across these classroom visits for both primary and intermediate grade-level classes. As can be seen, the number of PD-modeled lessons decreased across implementation visits, with a shift toward co-taught or PD-observed lessons occurring at or around log three. Despite the tendency for proportionally more intermediate lessons to be modeled by PD staff, the shift toward co-taught and teacher-taught lessons was evident for both primary and intermediate-level classroom visits.

Qualitative Assessment. A qualitative review of the previously mentioned subset of implementation logs suggested that there may be many factors associated with the transition from a PD-modeled to teacher-taught lesson. Although not intended to imply causality, the following factors were frequently mentioned. These included regular attendance during the professional development sessions of the program by the participating teacher. Also for some teachers, the fact that a particular aspect of the program was already familiar to a teacher (e.g., curriculum, activities, or instructional strategies) seemed to ease him or her into taking the lead. Examples here included: the teachers' existing comfort level with students working in groups, having used other activities from related curricula; already being comfortable with asking open-ended questions; and, existing comfortable level with interacting with student activities by

Figure 1. PD/Teacher Role: Primary Program

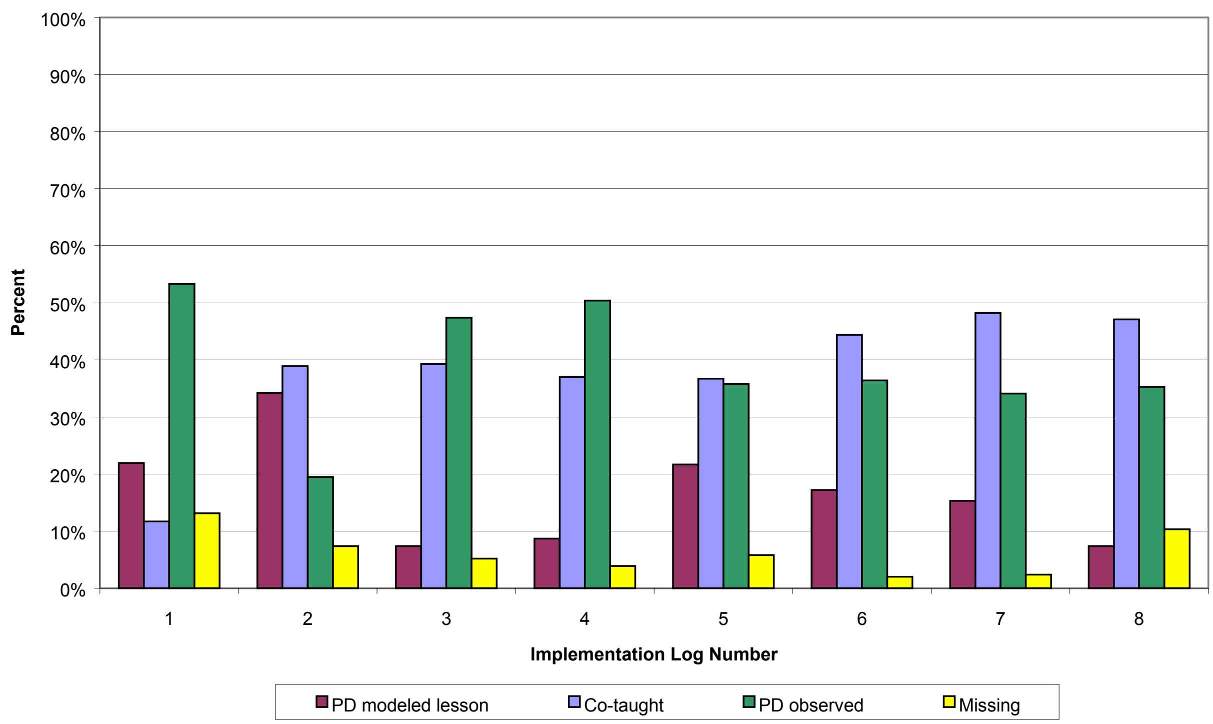
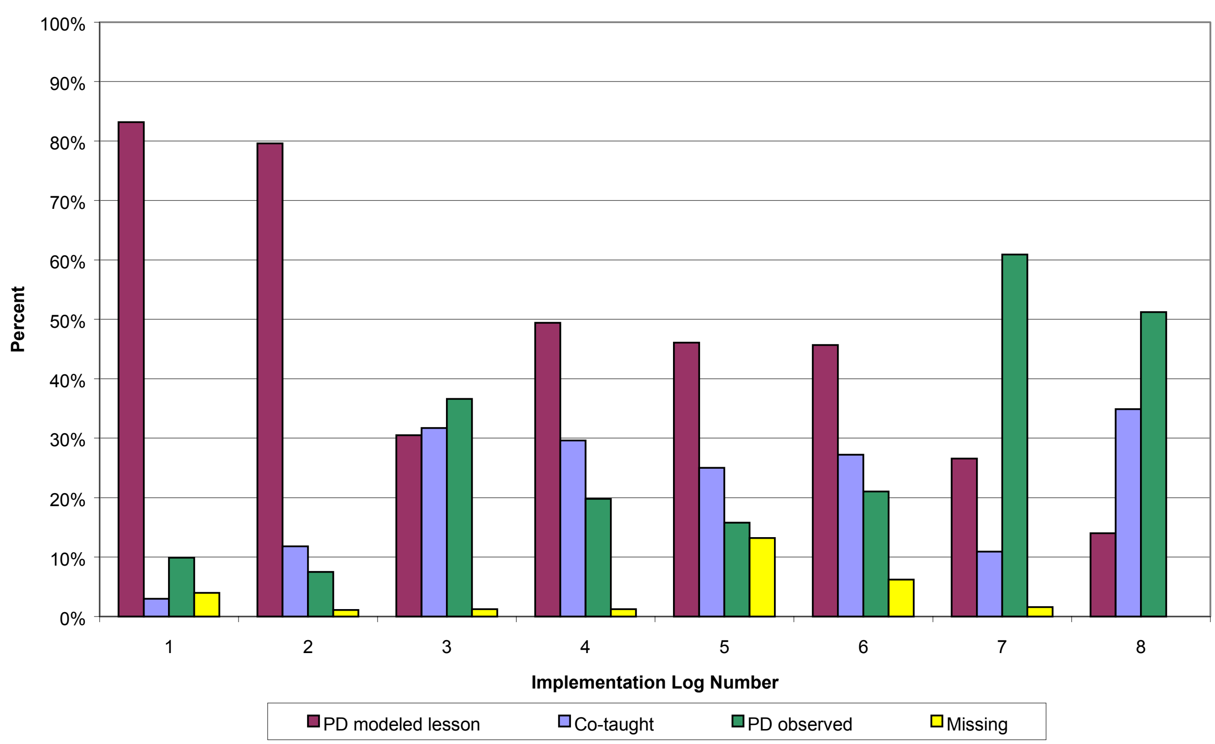


Figure 2. PD/Teacher Role: Intermediate Program



actively jumping in during an activity to make a point, clarify an issue or to encourage reflections among the students; or their own existing level of enthusiasm or willingness to try new ideas. Often, the positive reaction of their students to a PD-model lesson served to act as a catalyst for teachers to attempt something on their own. Moreover, their own willingness to take a small step forward (such as re-arranging the classroom from rows of desks into small group work stations) often led a teacher to try other ideas when their initial efforts met with favorable responses by their students (e.g., moving from group work to cooperative learning tasks within groups). In some instances, a PD had to model several lessons before a more timid or reluctant teacher would take the lead and either co-teach or lead a lesson. For one very traditional teacher, it seemed that the content of the lesson (i.e., a science lesson on volume) was a point of interest and led to his/her taking the lead.

Noted obstacles tended to involve classroom management issues for difficult to manage classes that required frequent disciplinary action. Class management issues were reduced, in some cases, by teachers using more tangible cues as guides (e.g., using a bell to signal to students that it was time for them to stop and listen) or to provide clearer instructions as to what was expected of the students during an activity. At other times, the teachers' concern regarding classroom management issues really stemmed from their reluctance to relinquish some control over the classroom to facilitate more cooperative and engaged learning among their students and to become comfortable with the noise level often associated with hands-on activities in the classroom.

Other obstacles included lack of preparation time for teachers to plan a lesson and the teacher’s own limited content knowledge in either mathematics and/or science and the need to increase their knowledge and confidence before they would/could take the lead to teach a lesson in this content area.

Instructional/Implementation Program Alignment with State Standards in Mathematics and Science

The Academy program is designed to align with state (in this case Illinois) learning standards in mathematics and science (Illinois State Board of Education, 1997). Although it is intended that the program cover all of these standards, it is not intended that each standard be addressed equally across grade levels. As developmentally appropriate, some content areas are likely to receive more emphasis than others and this pattern should change from primary to intermediate-level instruction. Such an approach is consistent with recommendations made by the National Council of Teachers of Mathematics (NCTM, 2000).

Figures 3 and 4 summarize the alignment of the instructional and implementation phases of the Academy program with state mathematics and science standards based on participating Chicago schools during the 1999-2000 school year. For the instructional program, these proportions are based on the number of program hours that cover a particular standard. By design, some lessons address both mathematics and science standards. Thus, if a lesson addressed both mathematics and science, an applicable standard is noted in each discipline. (It should be recognized that the program staff of the Academy compiled these instructional program data.) For the implementation portion of the program, the number of sessions where a mathematics or science standard was observed was divided by the total number of observations. Some variability between the instructional portion of the program and the implementation portion of the program should be expected based on how the content area aligns with state standards. The larger question, however, is how much variability can there be (or should there be) and still be within the expected parameters suggested by the instructional program. To help gauge this decision we have used a nonparametric, goodness-of-fit test, the Kolmogorov-Smirnov (K-S) one sample test (Siegel & Castellan, 1988) to assess the similarity of the instructional and implementation portions of the program.

Comparing the instructional and implementation portion of the primary program, the apportionment of Mathematics Learning Standards was statistically significant, if marginally so [$D_{(max)} = .049$, $p < .05$] based on the K-S goodness-of-fit test. This suggests that variations in lesson content observed during primary-level implementation support probably differed from what the instructional program would have suggested. In a similar manner, these comparisons were made for the intermediate-level program. Based on a goodness-of-fit test, these differences between instructional and implementation program components for year one of the intermediate-level program were statistically significant as well. This suggests that the content emphasized during the intermediate-level implementation was not entirely aligned with the content presented during the instructional program [$D_{(max)} = .087$, $p < .01$]. Regarding Science Learning Standards, the primary-level implementation support does not show the expected alignment as suggested by the instructional component of the program [$D_{(max)} = .108$, $p < .01$] and in a similar manner, the intermediate-level implementation component of the program also did not align with the instructional support relative to Science Learning Standards [$D_{(max)} = .14$, $p < .01$].

Figures 5 through 8 show a percent breakdown of the State Mathematics and Science Learning Standards across classroom visits for primary and intermediate grade levels. For these graphs, the pattern of standards-based content should be reviewed discretely within visits and not necessarily across visits. As can be seen in Figure 5, there are a mix of State Mathematics standards noted for observed primary lessons, with State Mathematics Goal 6: Number Sense/Operations, Goal 10: Data Analysis/ Probability, and Goal 7: Estimation and Measurement often marked across visits. State Mathematics Goals 8: Algebraic and Analytical Methods and State Goal 9: Geometric Methods were noted less often. A different pattern is evident for these same logs directed toward intermediate classrooms (see Figure 6), with a more blended mix across all of the State Mathematics Goals.

Regarding State Science Standards for primary lessons (see Figure 7), it is clear that State Science Goal 11: Process is most often mentioned from the early logs through log 5. Science Process and Content (State Goals 11 and 12) tend to balance out from the 6th through 8th logs. In Figure 8, the first two lessons for intermediate-level lessons (log 1 and 2) reflect a blending of State Science Goals 11 through 13. These visits, it is

Figure 3
State **Mathematics** Standards Addressed during the First Year of the Instructional Program and Implementation Participating Chicago Public Schools 1999-2000:
Primary and Intermediate Programs

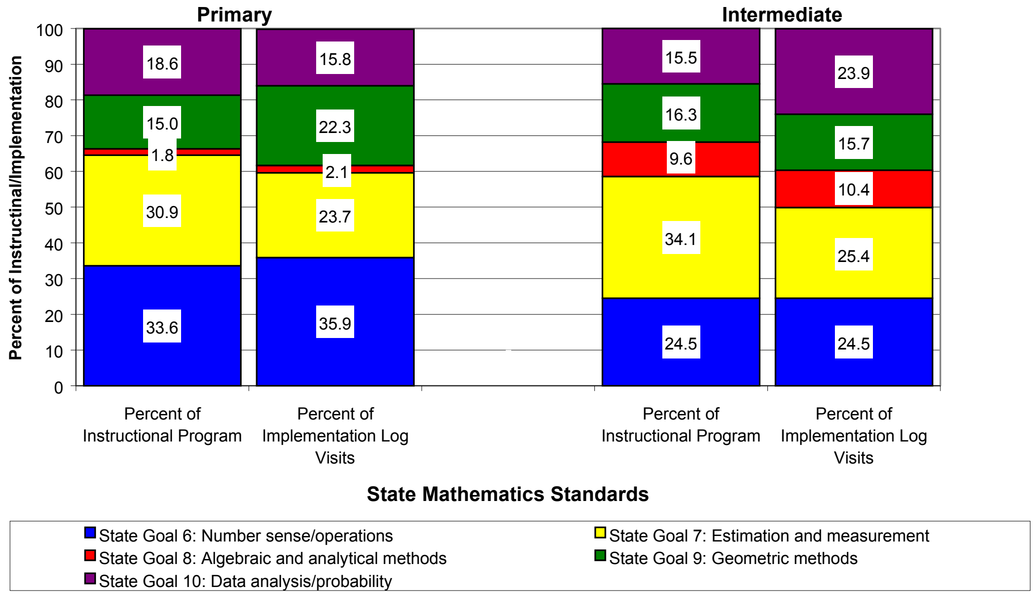


Figure 4
State **Science** Standards Addressed during First Year of Instructional Program and Implementation Participating Chicago Public Schools 1999-2000:
Primary and Intermediate Programs

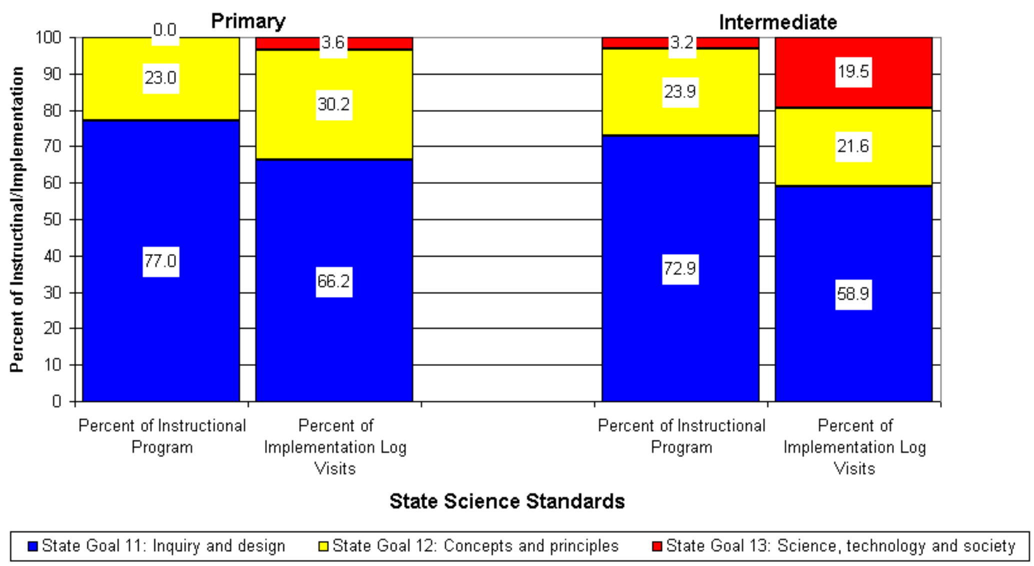


Figure 5. State Mathematics Standards Addressed: Primary Program

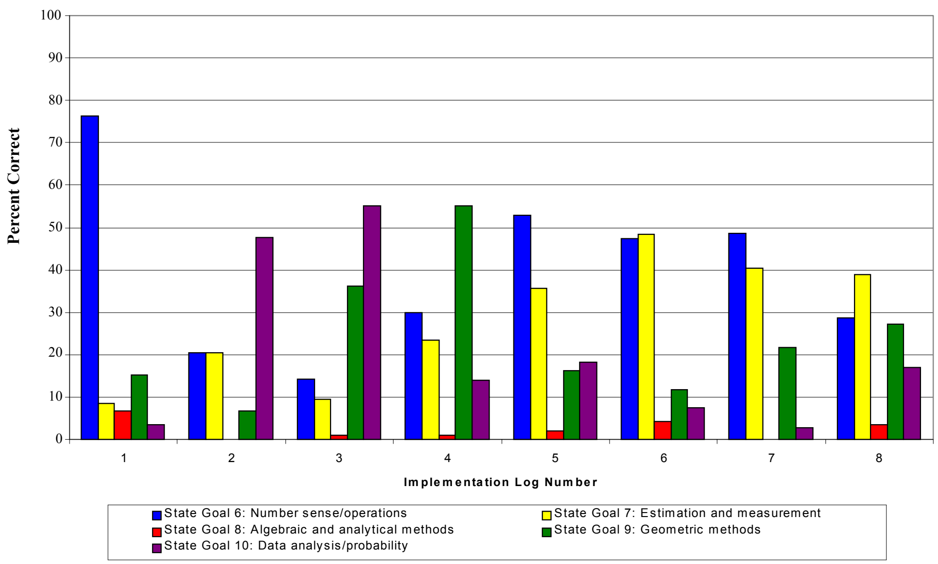


Figure 6. State Mathematics Standards Addressed: Intermediate Program

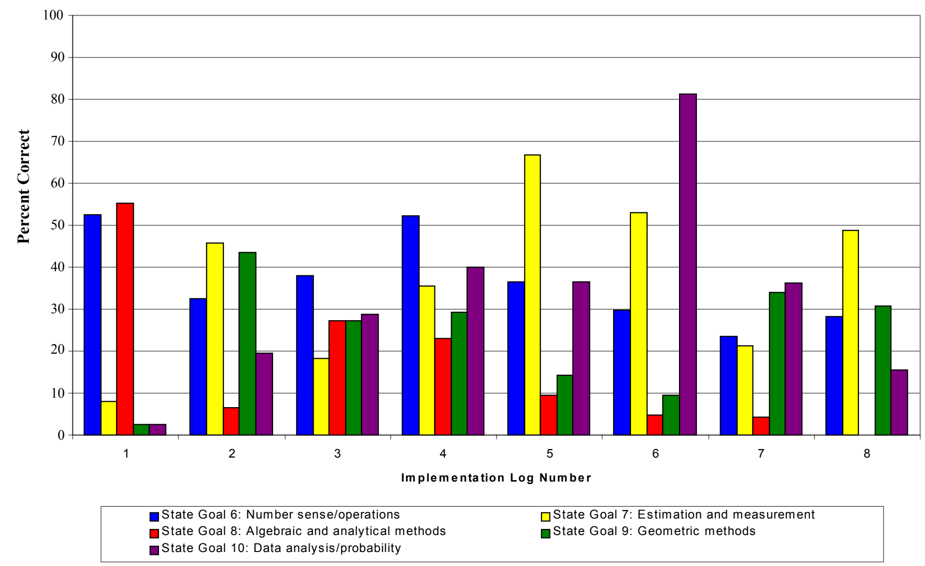


Figure 7. State Science Standards Addressed: Primary Program

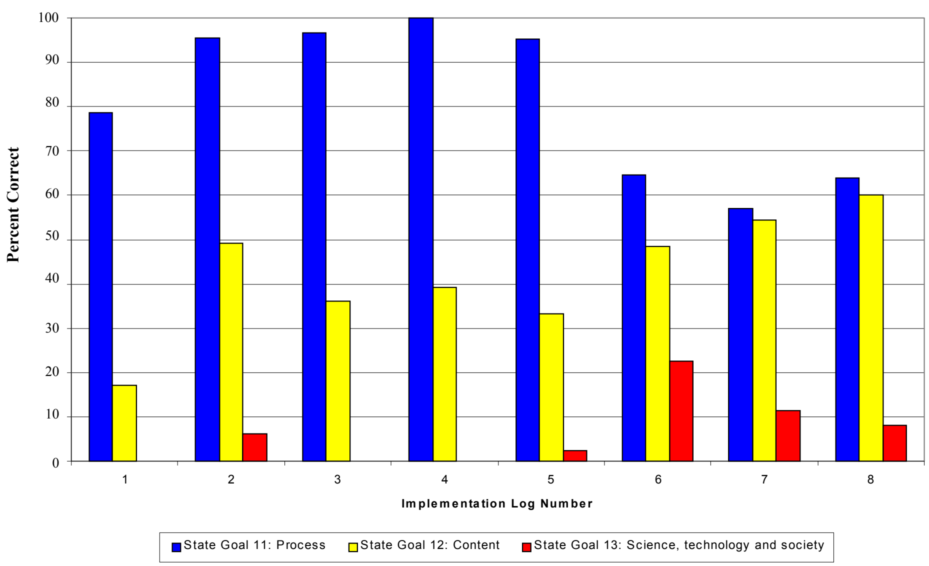
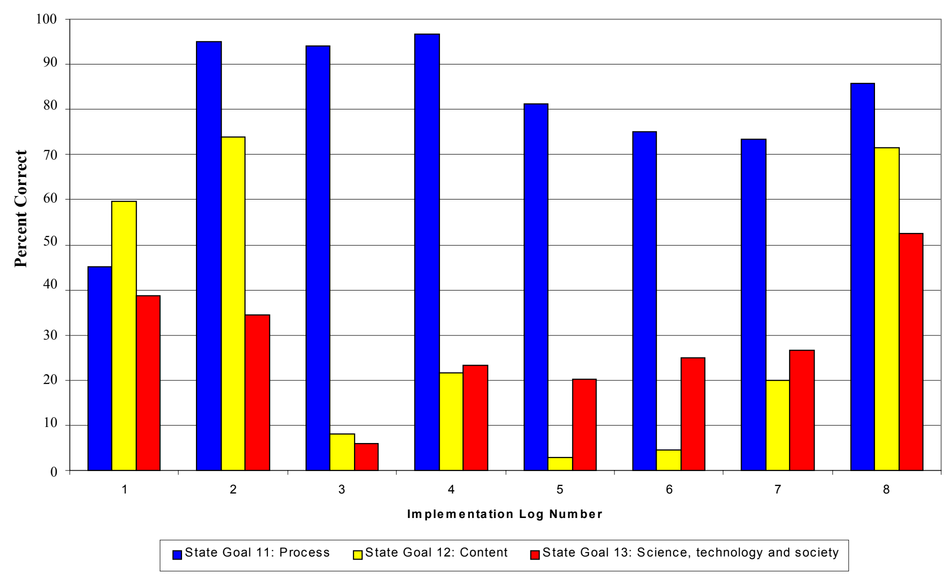


Figure 8. State Science Standards Addressed: Intermediate Program



recalled, were most often PD-modeled instruction in the classroom. Thus, these may represent an ideal and not what the teachers are doing in practice. For remaining log visits, State Science Goal 11: Process was most frequently marked, with evidence of State Science Goal 12: Content less frequently marked. State Science Goal 13: Science, Technology and Society was mentioned least frequently compared to the other science standards. It was more frequently observed, however, across visits involving intermediate grade levels as compared to observed primary lessons.

Evidence of Best Practices Observed in the Classroom and Varied Instructional Strategies

Tables 2 and 3 provide a summary of the frequency (based on percents) in which best practices were evident during observed primary and intermediate lessons, respectively. Tables 4 and 5 provide the same level of information for evidence of the use of varied lesson format styles again for primary and intermediate observed lessons. The most commonly observed best practices and instructional strategies in each log (column) are in bold face type. Across the top of the tables are labeled the most common level of intervention used for these lessons (e.g., PD-led, co-taught).

Of the nine possible best practices listed in Table 2, *Hands-on/Minds-on Approach* was mentioned most frequently across visits involving primary-level classrooms. The use of this best practice was similar when level of intervention was taken into consideration. That is, a high percent of co-taught and observed primary-level lessons often involved the best practice of *Hands-on/Minds-on Approach*. To a lesser extent, the use of the best practice of *Addressing a Variety of Learning Styles, Higher-order Thinking Skills,* and *Constructivism* were also observed. As many as 38% of the lessons that occurred during the first classroom visit, which were primarily teacher-taught lessons, incorporated *No best practices*. This percent decreased to a range of 1 to 9% as implementation support progressed.

For intermediate-level classrooms (see Table 3), the best practice of *Hands-on/Minds-on Approach* was frequently observed. When level of intervention was taken into account, this best practice was still observed at a high percent throughout log visits in both co-taught and observed intermediate-level lessons**.** To a modest extent, there was evidence of the use of *Addressing a Variety of Learning Styles*, *Higher-order Thinking Skills; Real-world Connections* and *Assessment/Feedback* was evident during select classroom visits.

Regarding instructional strategies for primary-level classroom visits (see Table 4), a variety of lesson format styles were observed with *Activity* observed most often. This high percent of lessons involving *Activity* is also evident in primary-level lessons that were co-taught or observed**.** To a lesser extent, the lesson formats of *Discussion, Teacher-directed, Group Work,* and *Experiment/Investigation* were noted. Regarding instructional strategies for intermediate classroom visits (see Table 5), instructional strategies involving *Discussion* was frequently observed. *Experimentation/Investigation* was observed frequently during co-taught and teacher-taught lessons**.** There is modest

Table 2
Best Practices by Professional Development Staff-Teacher Role: Primary Level

	PD-Observed	Mixed	Teacher Taught		Mixed	Co-taught		
Best Practice	**Log Number 1 n=158[a] (Percent)**	**Log Number 2 n=154[b] (Percent)**	**Log Number 3 n= 149[c] (Percent)**	**Log Number 4 n=141[d] (Percent)**	**Log Number 5 n=131[e] (Percent)**	**Log Number 6 n=123[f] (Percent)**	**Log Number 7 n=109[g] (Percent)**	**Log Number 8 n=91[h] (Percent)**
Hands-on/minds-on approach	**31.4**	**83.2**	**77.0**	**85.0**	**83.3**	**77.8**	**77.6**	**70.6**
Addressing a variety of learning styles	**31.4**	**65.8**	**48.9**	**51.2**	**50.8**	**48.5**	**50.6**	**54.4**
Higher-order thinking skills	**19.7**	19.5	**32.6**	33.9	**40.0**	**39.4**	**34.1**	**42.6**
Constructivism	**16.1**	**36.2**	24.4	**42.5**	**48.3**	28.3	**35.3**	17.6
Real-world connections	10.9	**63.1**	31.1	26.8	35.8	24.2	31.8	23.5
Assessment/feedback	12.4	20.1	**33.3**	27.6	21.7	23.2	29.4	26.5
Student directed	8.8	18.8	23.7	31.5	24.2	**29.3**	**34.1**	**35.3**
Cooperative learning	5.1	24.2	20.7	**36.2**	31.7	**29.3**	23.5	29.4
Interdisciplinary connections	6.6	28.9	11.9	15.0	9.2	12.1	12.9	14.7
No best practices used	**38.0**	**5.4**	**8.9**	**4.7**	**4.2**	**6.1**	**1.2**	**5.9**

[a]21 cancelled visits. 35 cases with missing data added to *No best practices*. Percents based on 137 cases.
[b]5 cancelled visits. 5 cases with missing data added to *No best practices*. Percents based on 149 cases.
[c]14 cancelled visits. 7 cases with missing data added to *No best practices*. Percents based on 135 cases.
[d]14 cancelled visits. 3 cases with missing data added to *No best practices*. Percents based on 127 cases.
[e]11 cancelled visits. 2 cases with missing data added to *No best practices*. Percents based on 120 cases.
[f]24 cancelled visits. 2 cases with missing data added to *No best practices*. Percents based on 99 cases.
[g]24 cancelled visits. 1 case with missing data added to *No best practices*. Percents based on 85 cases.
[h]23 cancelled visits. 1 case with missing data added to *No best practices*. Percents based on 68 cases.

Table 3
Best Practices by Professional Development Staff-Teacher Role: Intermediate Level

	PD-Led		Teacher Taught	PD-Led			Teacher Taught	
Best Practice	**Log Number 1 n=107[a] (Percent)**	**Log Number 2 n=101[b] (Percent)**	**Log Number 3 n=92[c] (Percent)**	**Log Number 4 n=91[d] (Percent)**	**Log Number 5 n=89[e] (Percent)**	**Log Number 6 n=86[f] (Percent)**	**Log Number 7 n=78[g] (Percent)**	**Log Number 8 n=45[h] (Percent)**
Hands-on/minds-on approach	**32.7**	**91.4**	**67.1**	**91.4**	**92.1**	**84.0**	**67.2**	**83.7**
Addressing a variety of learning styles	**53.5**	**32.3**	**58.5**	**33.3**	**36.8**	**48.1**	**45.3**	**44.2**
Higher-order thinking skills	17.8	16.1	17.1	28.4	**35.5**	**43.2**	**34.4**	**34.9**
Constructivism	5.9	**32.3**	2.4	18.5	**39.5**	**28.4**	6.3	4.7
Real-world connections	28.7	17.2	**34.1**	32.1	15.8	27.2	**35.9**	**48.8**
Assessment/feedback	**66.3**	**33.3**	**56.1**	**45.7**	22.4	14.8	23.4	18.6
Student directed	**42.6**	2.2	1.2	2.5	0.0	1.2	6.3	9.3
Cooperative learning	5.0	**33.3**	9.8	**37.0**	10.5	6.2	12.5	27.9
Interdisciplinary connections	20.8	11.8	31.7	16.0	5.3	9.9	7.8	2.3
No best practices used	**6.9**	**3.2**	**8.5**	**6.2**	**3.9**	**7.4**	17.2	2.3

[a] 6 cancelled visits. 6 cases with missing data added to *No best practices*. Percents based on 101 cases.
[b] 8 cancelled visits. 2 cases with missing data added to *No best practices.* Percents based on 93 cases.
[c] 10 cancelled visits. 3 cases with missing data added to *No best practices*. Percents based on 82 cases.
[d] 10 cancelled visits. 4 cases with missing data added to *No best practices*. Percents based on 81 cases.
[e] 13 cancelled visits. 2 cases with missing data added to *No best practices*. Percents based on 76 cases.
[f] 5 cancelled visits. 4 cases with missing data added to *No best practices*. Percents based on 81 cases.
[g] 14 cancelled visits. 9 cases with missing data added to *No best practices*. Percents based on 64 cases.
[h] 2 cancelled visits. 1 case with missing data added to *No best practices*. Percents based on 43 cases.

Table 4
Lesson Formats by Professional Development Staff-Teacher Role: Primary Level

	PD-Observed	Mixed	Teacher Taught		Mixed	Co-taught		
Lesson Format	**Log Number 1 n=158[a] (Percent)**	**Log Number 2 n=154[b] (Percent)**	**Log Number 3 n=149[c] (Percent)**	**Log Number 4 n=141[d] (Percent)**	**Log Number 5 n=131[e] (Percent)**	**Log Number 6 n=123[f] (Percent)**	**Log Number 7 n=109[g] (Percent)**	**Log Number 8 n=91[h] (Percent)**
Activity	**44.5**	**74.5**	**85.9**	**78.0**	**79.2**	**73.7**	**83.5**	**69.1**
Teacher directed	**29.2**	**14.1**	**19.3**	**24.4**	**28.3**	**33.3**	**31.8**	**30.9**
Discussion	**27.7**	**63.8**	**50.4**	**43.3**	**46.7**	**51.5**	**55.3**	**61.8**
Seat work (independent/uniform)	**23.4**	4.0	12.6	18.1	18.3	23.2	15.3	16.2
Student presentations	13.9	2.7	3.0	11.0	6.7	3.0	4.7	5.9
Group work	6.6	3.4	13.3	**23.6**	20.8	28.3	24.7	30.9
Reviewing	8.8	10.1	11.1	15.7	16.7	17.2	17.6	16.2
Teacher lecture/demo	8.8	6.0	6.7	12.6	11.7	16.2	16.5	23.5
Experiment/investigation	6.6	**49.0**	**26.7**	15.7	**23.3**	**29.3**	**25.9**	**23.5**
Games/contests	3.6	1.3	4.4	7.1	8.3	10.1	8.2	7.4
Other	**27.7**	**3.4**	**5.2**	**4.7**	**2.5**	**2.0**	**1.2**	**4.4**

[a] 21 cancelled visits. 32 cases with missing data added to *Other*. Percents based on 137 cases.

[b] 5 cancelled visits. 4 cases with missing data added to *Other*. Percents based on 149 cases.

[c] 14 cancelled visits. 6 cases with missing data added to *Other*. Percents based on 135 cases.

[d] 14 cancelled visits. 3 cases with missing data added to *Other*. Percents based on 127 cases.

[e] 11 cancelled visits. 1 case with missing missing data added to *Other*. Percents based on 120 cases.

[f] 24 cancelled visits. 2 cases with missing data added to *Other*. Percents based on 99 cases.

[g] 24 cancelled visits. 1 case with missing data added to *Other*. Percents based on 85 cases.

[h] 23 cancelled visits. 2 cases with missing data added to *Other*. Percents based on 68 cases.

Table 5
Lesson Formats by Professional Development Staff-Teacher Role: Intermediate Level

	PD-Led		Teacher Taught	PD-Led			Teacher Taught	
Lesson Format	**Log Number 1 n=107[a] (Percent)**	**Log Number 2 n=101[b] (Percent)**	**Log Number 3 n=92[c] (Percent)**	**Log Number 4 n=91[d] (Percent)**	**Log Number 5 n=89[e] (Percent)**	**Log Number 6 n=86[f] (Percent)**	**Log Number 7 n=78[g] (Percent)**	**Log Number 8 n=45[h] (Percent)**
Activity	**50.5**	**39.8**	**53.7**	25.9	**23.7**	**14.8**	**39.1**	**46.5**
Teacher directed	**18.8**	**25.8**	**47.6**	**37.0**	**27.6**	**33.3**	**40.6**	**25.6**
Discussion	**53.5**	**31.2**	23.2	**50.6**	**44.7**	**50.6**	**25.0**	20.9
Seat work (independent/uniform)	**52.5**	14.0	**45.1**	11.1	5.3	11.1	9.4	**37.2**
Student presentations	1.0	1.1	2.4	14.8	0.0	1.2	3.1	30.2
Group work	5.0	24.7	24.4	**32.1**	**23.7**	7.4	15.6	7.0
Reviewing	13.9	1.1	7.3	14.8	**23.7**	4.9	6.3	0.0
Teacher lecture/demo	1.0	6.5	0.0	1.2	13.2	4.9	0.0	2.3
Experiment/investigation	5.0	**61.3**	**37.8**	**65.4**	**68.4**	**53.1**	**23.4**	**39.5**
Games/contests	16.8	2.2	2.4	2.5	1.3	2.5	10.9	0.0
Other	**5.0**	**2.2**	**2.4**	**3.7**	**3.9**	**17.3**	**20.3**	**4.7**

[a] 6 cancelled visits. 5 cases with missing data added to *Other*. Percents based on 101 cases.
[b] 8 cancelled visits. 2 cases with missing data added to *Other*. Percents based on 93 cases.
[c] 10 cancelled visits. 2 cases with missing data added to *Other*. Percents based on 82 cases.
[d] 10 cancelled visits. 3 cases with missing data added to *Other*. Percents based on 81 cases.
[e] 13 cancelled visits. 2 cases with missing data added to *Other*. Percents based on 76 cases.
[f] 5 cancelled visits. 4 cases with missing data added to *Other*. Percents based on 81 cases.
[g] 14 cancelled visits. 9 cases with mising data added to *Other*. Percents based on 64 cases.
[h] 2 cancelled visits. 1 case with missing data added to *Other*. Percents based on 43 cases.

evidence of the use of *Activity, Experimentation/ Investigation* and *Group Work* across visits*,* whereas the percent of *Seat Work* decreased across visits. The percent of lessons that involved *Teacher-directed* activities tended to remain noteworthy across visits.

Discussion

The results of this study lend partial support for the presented program outcomes related to teachers' instructional practices. More specifically, these data suggest that participating teachers are applying standards-based curricula in mathematics and science, using select best practices, and are attempting to use a variety of instructional strategies in their classrooms. Moreover, these data suggest that there is a change in the level of intervention that occurred across time during the implementation portion of the program. Although not intended to imply causality, this change in intervention level occurred concurrently with reports of growth in content knowledge by teachers and/or an increased comfort and confidence by participating teachers with pedagogical approaches supported during the program. These reports are in turn supported by data from additional internal studies that show gains in teacher knowledge as well as increased confidence in their ability to teach mathematics and science associated with participation in the program (Race, 2001).

Present data also show that the curricula presented during classroom visits align with state learning standards in mathematics and science and that the implementation portion of the program also aligns with state learning standards in mathematics and science. Further investigation, however, suggests that the implementation portion of the program does not align or provide a "good-fit" with the instructional portion of the program relative to these learning standards. Such analyses should help program staff explore the objectives and outcomes of both the instructional and implementation portions of the program in their review of curriculum and to determine the level of alignment that is desired across these program components. Such decisions, however, are made more difficult in the absence of national (or state) benchmarks. For example, despite the fact that the National Council of Teachers of Mathematics recommends that a given mathematics standard should not receive equal emphasis across grade levels, NCTM has yet to provide a demarcation or benchmark as to the ideal apportionment of content specific standards across grade levels (NCTM, 2000).

Although aligning curriculum with state learning standards is an important first step, past research suggests that more than alignment with standards is necessary to change teaching practices and improve student achievement (Elmore & Sykes, 1992; Elmore, 1993; DeStefano & Prestine, 2000). To that end, the present findings suggest that there was frequent use of specific best practices and instructional strategies in classrooms by participating teachers across the implementation phase of the program at both the primary and intermediate level. Although it is difficult to causally tie these changes and variations in these data specifically to the program or the effects of the program *per se,* the overall picture that is presented is encouraging. It suggests evidence of the use of select best practices as well as the application of varied instructional strategies used over the time period of these visits.

Present data show that it was difficult to complete all visits as planned. Despite this difficulty, a substantial number of visits were successfully completed. A noted program-related reason for teacher attrition was the time commitment required to attend the instructional and implementation portions of the program that at times conflicted with other after-school programs or the perception that the program interfered with standardized test preparation. Based on self-report, some teachers did not feel the need for professional development or felt pressured to join the program. To some degree scheduling difficulties between the teacher and professional development staff led to this attrition. These program-related issues need and are being addressed by program staff.

The qualitative data obtained from these implementation logs provide a descriptive context from which progress made by participating teachers can be assessed. Be that as it may, the implementation logs are not always used to their full capacity by all professional development staff. Even so, the nature of these data place limits on the full depth in which we can understand the complexity of the interactions between teachers and professional development staff, and provide an in-depth understanding of what is occurring in the classroom. Despite these limitations, the standardized log and the protocol that supports this process suggest the feasibility of this methodology. That is, present data support the use of this method to record hard-to-capture data from a relatively large group of teachers across an extended period of time as well as provide insights in understanding the mechanisms that underlie how the program may impact participating teachers.

Planned research efforts will serve to link these implementation data with other data that we have collected from participating teachers such as their pre-program technology skills, content knowledge in mathematics and science as well as their attitudes toward using inquiry-based strategies, their reluctance to use traditional pedagogical approaches, use of computers in the classroom, and their confidence in teaching mathematics and science. Tying teachers' practices in the classroom to these and other data sources, including students' perspectives on activities and pedagogy in the classroom (Race & Powell, 2000), can enhance our understanding of the target audience that this program is intended to serve as well as provide a clearer and more complete picture of program-related outcomes.

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