Final Report

The Impact of the Washington State Title II Improving Teacher Quality Professional Development Program on Changes in Teachers' Practices and in Students' Achievement—Cycle I

Prepared for

The Washington State Higher Education Coordinating Board

Prepared by

Lynde Paule, Ph.D.

With assistance provided by Organizational Research Services
Marc Bolan, Ph.D.
Sarah Stachowiak, MPA

Editorial assistance provided by Carolyn Lane

July 2005

Table of Contents

Section	Pages
Executive Summary	i
Introduction	1
Evaluation Activities and Methods of Analysis	15
Findings and Recommendations	20
Evaluation Question #1: Did professional development activities improve the quality of K-12 teachers and paraprofessionals?	20
Evaluation Question #2: Did professional development provided to K-12 teachers and paraprofessionals result in improvement in students' academic achievement?	56
Evaluation Question #3: What aspects of professional development had the greatest impact on changes in teaching practices and student achievement?	74
Evaluation Question #4: Did professional development provided to K-12 teachers and paraprofessionals affect teaching and learning at the school organization level?	76
References	77
Appendix	78

Executive Summary

America is awash in efforts to improve the academic performance of students. Governors, state legislatures, business leaders, presidents, members of Congress, and educators have all urged improvement through reform legislation and new academic standards and assessments. In addition, standards-based) reforms have been enacted in every state.

The most profound legislation of the last decade created President Bush's No Child Left Behind program. The federal No Child Left Behind Act of 2001 (NCLB) reauthorized the Elementary and Secondary Education Act (ESEA) but is more comprehensive in its scope and expectations than the ESEA. NCLB is based on principles of increased flexibility and local control, stronger accountability for results, expanded options for parents, and an emphasis on effective teaching methods based on proven, scientifically based, professional development strategies that have been shown to increase student academic achievement

NCLB also authorizes (under Title II of the legislation) institutions of higher education (IHEs), specifically the division of the institution that prepares teachers and principals, to provide the professional development for teachers, paraprofessionals, principals, and assistant principals as part of a partnership arrangement. Partnerships may include one or more institutions of higher education with one or more districts, plus one or more schools served by the district. Institutions of higher education are to provide high-quality, research-based professional development activities in the core academic subjects "for the purpose of improving teaching and learning at low-performing schools." Recipients of the professional development are expected to use the new skills and knowledge to improve instructional practices and improve student achievement.

The 2002-2004 Washington State Title II Teacher Quality Professional Development Grant Program

The Washington State Higher Education Coordinating Board (HECB) authorized a Title II Improving Teacher Quality Professional Development grant program that provided, through partnerships among institutions of higher education and school districts throughout Washington, professional development in math and/or reading to teachers, school administrators, and paraprofessionals in high-need Title I schools. Through a competitive RFP process, eight partnerships were formed between IHEs and school districts across the state. The focus of the professional development varied project by project but typically included training in State policy, subject matter knowledge, instructional strategies, assessment, and a category called special topics, which included training in areas extraneous to math or reading such as building professional learning communities, behavior management, feelings about math, and the like.

The majority of the eight grants were awarded to partnerships that included schools located in rural areas in Washington. A total of 139 teachers, 25 administrators, and 82 paraprofessionals across 139 elementary, middle, and high schools in 46 school

districts participated in professional development activities in math and/or reading during the 2002-04 school years. The training of teachers and/or paraprofessionals impacted approximately 2,700 students.

Evaluation Activities and Methods of Analysis

The HECB evaluation requirements called for both a formative and summative evaluation conducted at the project and State levels. A series of four evaluation questions and sub-questions dictated the types of data that were collected at the individual project and State levels.

Evaluation Questions

1. Did professional development activities improve the quality of K-12 teachers and paraprofessionals?

2 Did professional development provided to K-12 teachers and paraprofessionals result in improvement in students' academic achievement?

3. What aspects of professional development had the greatest impact on changes in teaching practices and student achievement?

4. Did professional development provided to K-12 teachers and paraprofessionals affect teaching and learning at the school organization level?

Four major sources of information were used to answer the evaluation questions: project specific pre- and post-training surveys, pre- and post-focus group transcripts, pre- and post-classroom observation protocols, and students' scores on the State's assessment tests.

Pre- and Post-Training Surveys: Participants were asked the degree to which they had specific skills, knowledge, and experience with teaching the subject matter prior and subsequent to the training, using a four-point scale where 1 = no degree, 2 = small degree, 3 = moderate degree, and 4 = large degree. The number and percentage of responses to each of the four ratings were calculated for each item and then grouped by category. Comparisons were made of responses from pre to post training.

Classroom Observations: Using information about the training foci of each project as a guide to understanding teachers' and paraprofessionals' classroom application, a content analysis of the observation notes was conducted. Patterns of implementation, particularly patterns of challenges and successes (i.e., ways of behaving) faced by participants and their students were identified. Comparisons of patterns of behavior made during the first and second site visits and used, along with the analyses of focus group discussions, to understand both how participants translated their learning into

classroom practice and how the nature and extent of the issues they encountered created obstacles as well as promoted success in implementation.

Focus Group Discussions: As with the classroom observations, the content of the training, as well as the evaluation questions, guided the discussions among teachers and paraprofessionals. A content analysis of each transcript was conducted for the purpose of identifying patterns of responses and topical themes. Comparisons of patterns and themes from the first to the second site visit were conducted for each project and used, along with the analyses of focus group discussions, to understand both how participants translated their learning into classroom practice and how the nature and extent of the issues they encountered that created obstacles as well as promoted success in implementation.

State Assessments: Originally the evaluation design included comparing the performance of students of participating teachers and paraprofessionals with student data of non-participating teachers and paraprofessionals located in other schools. Following a review of the comparative data from both types of classrooms, a decision was made to use instead, and where possible, data from non-participating teachers who taught the same grade as the participating teacher working within the same school.

Findings

1. Did professional development activities improve the quality of K-12 teachers and paraprofessionals?

    a. Did the academic content knowledge and instructional skills of K-12 teachers and paraprofessionals increase in the areas of mathematics and/or reading?

Unequivocally, the professional development activities improved the quality of K-12 teachers and paraprofessionals and increased the academic content knowledge and instructional skills of those teachers and paraprofessionals. Participants learned and practiced new instructional strategies, they learned about State policy related to reading and math, they learned different assessment strategies, they learned how to integrate curriculum and instructional strategies across content areas, and they overcame negative experiences they had had with certain subject matter. Their learning increased exponentially and solidified because they were able to meet together as a group during monthly meetings to discuss what they were learning, how this affected their students, what strategies were effective, and how to adapt what they had learned to make it more effective with the students they taught.

However, there were some unfounded assumptions made about participants' knowledge of the subject matter that affected their potential to use everything they had learned. Many teachers, particularly in math, lacked conceptual knowledge about the subject matter they were teaching. Had participants been able to spend time during their monthly meetings analyzing student work samples, it would have been obvious to

trainers that many participants simply lacked a coherent understanding of the concepts and skills they needed to know to help students learn

In addition to including analyses of student work during training, trainers could have used the State's EALRs and GLEs to frame the professional development. The State standards are linked to the State assessment, and participants could have learned how to link subject matter content at the grade levels they taught with specific instructional and assessment strategies. With the exception of the EWU-P project, there was no real professional development curriculum taught to participants. Although each trainer carefully prepared what she or he wanted participants to learn, the majority of the training simply introduced participants to instructional strategies, which resulted in participants selecting specific strategies or elements of strategies and weaving them into their existing teaching repertoire. Given how elements of the professional development in each project were selected for inclusion in teachers' and paraprofessionals' work, it was hard to discern a change in teaching practices and even more difficult to attribute any change in students' achievement directly to the professional development.

2. Did professional development provided to K-12 teachers and paraprofessionals result in improvement in students' academic achievement?

    a. Did students' academic achievement improve in the areas of math and/or reading?
    b. Did student achievement improve for all students?

Overall, the math and reading scores of students from classrooms of project participants increased from pre training to post training, with the most dramatic changes occurring on the WASL rather than the ITBS.

However, when data from both the WASL and ITBS were disaggregated and comparisons were made between only two sets of teachers—project participants and non-participants from within each school, for the current school year only—the otherwise dramatic differences observed between the pre and post training years were not nearly as evident. This suggests that the observed school level differences may have had more to do with wholesale changes within each school's curriculum and instructional practices and less to do with the professional development training of a few teachers and paraprofessionals in each school. Locally administered assessments revealed the same differences that emerged from the analyses of WASL and ITBS data.

In some projects, in some grades, and in some strand areas, students of participating teachers scored better than their peers in non-participating teachers' classrooms. The reverse was also true in some projects; that is, the students of non-participating teachers outperformed student of participating teachers. Again, a host of teacher and student influences likely contributed to the observed differences. This was true for both math and reading projects.

3. What aspects of professional development had the greatest impact on changes in teaching practices and student achievement?

Several features of different HECB projects had a strong impact on changes in the practices of participants. First, projects that included instruction *both* subject matter content and instructional strategies resulted in deliberate and purposeful changes in teachers' and paraprofessionals' classroom practices. This did not occur in reading projects but did occur in several of the math projects

Second, providing professional development during monthly meetings resulted in participants' sharing what they were learning, particularly about the implementation of what they had learned, then practicing what they had learned. The design of the HECB professional development project with a week-long summer institute involving all participants, followed by monthly meetings throughout the school year for additional training and practice, was quite effective. Two projects in particular—SMC reading and EWU-P math and reading—had very effective professional development designs.

Third, having several teachers and/or paraprofessionals from the same school participate together in the professional development was very effective. Participants helped one another with the implementation of practices, brainstormed adjustments to strategies with one another, shared materials, and encouraged colleagues to try out new practices. When administrators from the schools in which teachers and paraprofessionals worked also attended the training, new practices were even more likely to be tried and implemented because of the support and encouragement administrators could render at their schools.

The fourth and final feature of professional development that had a strong impact on changes in teachers' and paraprofessionals' practices was the inclusion of professional networks built into the training. Participants in two circumstances benefited particularly from the creation of a viable network: One circumstance was when more than one participant from each school attended training, and the other was when participants worked in small rural districts as the only particular subject content teacher in their school. The WSU project did a very effective job with this aspect of their professional development.

4. Did professional development provided to K-12 teachers and paraprofessionals affect teaching and learning at the school organization level?

    a. Did the teaching/learning environment in schools change as a result of professional development?

The nature of the training provided by each project precluded the possibility of observing any school-wide effects. Several factors affected the potential for school-wide changes in practice. First, the design of each professional development model targeted individual teachers and/or paraprofessionals, not an entire school's teaching staff.

Individual participants from several districts and schools attended the training activities provided by project staff.

Second, the professional development model employed by each project provided training in discrete topics, not in a reading or math curriculum that could be used school-wide. Such training results in participants picking and choosing elements of training to use with their students, with different strategies selected at different times by different participating teachers, even teachers of the same subject at the same grade. Training in a single curriculum that focused, for example, on math inquiry or literature-based instruction, would have had a more potent effect on teachers' ability to share their learning with an entire staff, thus empowering everyone in a school to use the curriculum.

Third, professional development training did not include school visits to assist teachers and paraprofessionals in their classrooms to implement what they were learning. Even though several teachers and paraprofessionals from different schools and districts participated in training activities provided by each project, the training process was not monitored and supported at the classroom level by the trainer staff in six of the seven projects. Only WSU conducted site visits to assist teachers and paraprofessionals.

Fourth, professional development training did not take place at the school level. Although schools were used as training venues, they were used only to house all of the participants for meetings. Participants had to take their learning from this general context back into their schools and classrooms where they had no support for implementing what they had learned. In projects where multiple districts, schools, and grade levels were involved, very few teachers/paraprofessionals attended from a single district, which added to the difficulty of participants being able to transport what they had learned to an entire school staff.

The fifth and final factor affecting changes in practice at the school organization level was the lack of an explicit connection between the training activities and the State's EALRs and GLEs. One of the stated goals of the HECB Title II training was to increase students' performance on the State's assessment tests. However, the type of professional development training provided by each HECB project focused on discrete topics. Therefore, it was difficult to determine the effects of changes in practice on changes in students' performance, either on the WASL or ITBS/ITED, since different practices were selected by different participants to use with different students.

Although project training was not designed to impact changes in practice at the school organization level, there would have been an increased likelihood for such change to occur if training had been designed differently. Had any of the projects incorporated several of these five factors, it is likely that changes in practice at the school organization level would have occurred.

Introduction

America is awash in efforts to improve the academic performance of students. Governors, state legislatures, business leaders, presidents, members of Congress, and educators have all urged improvement through reform legislation and new academic standards and assessments (Cohen and Hill, 2001). The impetus for this sweeping reform effort began with the publication of *A Nation At Risk* in the early 1980s. Even though the data on which the recommendations of *A Nation At Risk* have been questioned and criticized (see Worthen, Sanders, and Fitzpatrick, 1997), broad-scale reforms, at least on paper, were underway shortly after the manuscript was published.

Standards-based reforms have been enacted in every state. In most states, standards have been aligned with assessment instruments that are used to hold schools accountable for students' performance. Political and economic interests, including the desire to be competitive in a larger market, have often driven the demands for new policies that focus on improvements in students' knowledge and skills. With new political leaders at the national, state, and district levels, teachers have found themselves beholden to new sets of requirements for doing things differently in their classrooms, often without a data-based rationale or the guidance necessary for implementing the new policies and/or practices. Unfortunately, reform policies, regardless of their level of origin, rarely have included budgetary provisions for the type of sustained school improvement efforts that have the capacity to make a difference.

The most profound legislation of the last decade created President Bush's No Child Left Behind program. The federal No Child Left Behind Act of 2001 (NCLB) reauthorized the Elementary and Secondary Education Act (ESEA) but is more comprehensive in its scope and expectations than the ESEA. NCLB is based on principles of increased flexibility and local control, stronger accountability for results, expanded options for parents, and an emphasis on effective teaching methods based on proven, scientifically based, professional development strategies that have been shown to increase student academic achievement. NCLB is intended to ensure that "all children have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum, proficiency on challenging State academic achievement standards and State academic assessments" (www.ed.gov/nclb). The legislation further states that all children, in particular low-achieving children in schools serving populations most stricken by poverty, are to make annual yearly progress commensurate with their more advantaged peers. NCLB holds schools, districts, and states responsible to improve the academic achievement of all students, as well as to "identify and turn around low-performing schools that have failed to provide a high-quality education to their students…" (www.ed.gov/nclb).

In order to maximize the potential for school and student improvement, NCLB authorizes resources to "significantly elevate the quality of instruction by providing staff in participating schools with substantial opportunities for professional development" (www.ed.gov/nclb). To increase student achievement, professional development is to be

designed to increase the number of highly qualified teachers and paraprofessionals in the classroom and highly qualified principals and assistant principals in schools. The legislation is specific in its mandate that "teachers and paraprofessionals in particular are to have subject matter knowledge in the academic subjects that teachers teach, and principals are to have the instructional leadership skills to be able to work effectively with teachers to help students master core academic subjects" (www.ed.gov/nclb).

NCLB also authorizes (under Title II of the legislation) institutions of higher education (IHEs), specifically the division of the institution that prepares teachers and principals, to provide the professional development for teachers, paraprofessionals, principals, and assistant principals as part of a partnership arrangement. Partnerships may include one or more institutions of higher education with one or more districts, plus one or more schools served by the district. Institutions of higher education are to provide high-quality, research-based professional development activities in the core academic subjects "for the purpose of improving teaching and learning at low-performing schools." Recipients of the professional development are expected to use the new skills and knowledge to improve instructional practices and improve student achievement.

However, limited resources, as well as minimal guidance, have been made available for professional development. Indeed, the only guidance given by NCLB has been the requirement that grant-funded activities are to be based upon a review of scientifically based research. The following is a synopsis of the definition of "scientifically-based research" as stated in NCLB, Section 910(37):

- Research that involves the application of rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs.

- Research that employs systematic, empirical methods; involves rigorous data analysis; relies on measurements that provide reliable and valid data; is evaluated using experimental designs; can be replicated; and has been accepted by a peer review journal.

Each state is charged with developing its own NCLB higher education partnership grant program. States not only determine their own criteria and guidelines for awarding the grants, but they also make their own decisions about the scope and content of the professional development, the only requirement being that the content of the training be research-based, subject-matter oriented, and focused on the needs of teachers, paraprofessionals, and school administrators. States also decide on the nature and extent of any evaluation activities they might use to determine the impact of partnership activities on changes in teachers' practices and on students' achievement in specific subject areas.

Unlike the research rigor applied to reading programs, and to a minor extent math programs, in order to determine their ability to produce changes in students' skills and knowledge, professional development programs for teachers have not undergone the

same degree of scrutiny. Research has been limited in assessing program capacity to produce significant changes in teachers' practices, particularly the practices that can be causally linked to changes in students' academic performance.

To date, research on professional development has identified specific elements that make a difference in teacher learning and understanding, such as sustained and focused training in particular areas. Different types of practice and application are important. For example, to improve students' performance on assessment tasks, practice needs to include review and analysis of student work to build an understanding of how students think and how they make sense of subject matter. This understanding then can be used to help students acquire new knowledge and skills. In addition, practice needs to be iterative, with teachers meeting over time to learn from one another about the cognitive processing of their students as they acquire new skills and knowledge (Cohen and Hill, 2001). Finally, critical elements—such as making sure that teachers are knowledgeable about the subject-matter content they teach, that they learn about how students make sense of new curriculum and instruction, and that they learn how to help students learn new subject matter content and processes—need to be included in training packages.

Despite the importance of these essentials in professional development, state education departments have been wary of making demands on individuals responsible for training, particularly in requiring what must be included with any professional development for teachers, regardless of the subject matter area, and have left important decisions about content and format up to those who provide the training. As a result, professional development trainers have had unlimited discretion in picking and choosing specific practices they feel ought to be included in a training package. Indeed, the critical elements in professional development are not always built into training programs. Training that tinkers around the edges of curriculum, instruction, and/or assessment, or that focuses on issues extraneous to teaching subject matter—such as training that purports to increase teachers' self-esteem about math in order to teach math—gives short shrift to what students absolutely need to know about and be able to do with subject matter in order to become literate in the subject matter.

It is possible that the lack of research on professional development programs—unlike that of reading programs—has been at least one source of the problem. Isolating professional development as an independent variable that may result in changes in student achievement in a specific content area is a complex undertaking that is fraught with measurement difficulties and problems. Then, there is also the matter of implementation.

Even if, for example, a math or reading professional development program for elementary teachers could be determined to positively affect student achievement, the issue of its acceptance and wholesale adoption carries with it a new and different set of issues. As Cohen and Hill (2001) report, "teaching practice remains private in nearly all schools, and privacy is protected by powerful norms: closed classroom doors and teacher autonomy. Most teachers in the United States believe that their approach to instruction is

a matter of personal style rather than evidence on effectiveness" (page 64). Personal and professional discretion in the implementation of reading programs such as *Open Court* are a good example of how a research-based program can be and has been "implemented" differently by different teachers.

Despite the scientifically based research on the *Open Court* reading program, many teachers selectively pick and choose the elements of the program that they like, ignoring or disregarding those elements that do not coincide with their own views and beliefs about what is important to include in their curriculum. Because of differences in implementation, the full potential of the program is undoubtedly attenuated. Thus, while research on professional development programs is critical, it too may run the risk of being dissected for the parts that fit with the trainer's conception about what is important for teachers to know and then further scrutinized by teachers who make their own professional decisions about what elements of the training they will transport to their classrooms.

Another issue that affects the design and implementation of professional development programs is the context-free environment in which the training takes place. Teaching occurs in context-specific environments (teachers' own district or school sites), while most professional development takes place outside the milieus and therefore cannot anticipate or accommodate them. The organizational environment of schools and districts can complicate the direct translation of what is learned during training into teachers' classrooms. Even if there is agreement on the student learning outcomes that the training is designed to meet, what works best in one context with a particular community of educators and a particular group of students may not work equally well in another context with different educators and different students. As Guskey (2005) notes, "The influence of these varied contexts is what makes developing universal best practices in professional development so difficult. What works always depends on where, when, and with whom" (page 17).

Dealing with all of these issues can be a tall order for any professional development program that seeks to increase teachers' knowledge and skills.

The 2002-2004 Washington State Title II Teacher Quality Professional Development Grant Program

The Washington State Higher Education Coordinating Board (HECB) authorized a Title II Improving Teacher Quality Professional Development grant program that provided, through partnerships among institutions of higher education and school districts throughout Washington, professional development in math and/or reading to teachers, school administrators, and paraprofessionals in high-need Title I schools. Higher education/school-district partnerships applied for funding through HECB in spring 2002, and eight grants were awarded. The grants were issued to partnerships comprised of, at minimum, a school of education at a public or private institution of higher education, a school of arts and sciences, and a high-need local educational agency. Grantees were required to meet specific criteria in the NCLB legislation, as well as meet the

requirements established by the HECB and the Washington Office of the Superintendent of Public Instruction.

According to the criteria established by the Washington HECB, professional development partnerships were required to:

- focus on the needs of teachers (and principals as appropriate) in high-need schools, although other schools may participate in the university/school partnerships;

- incorporate professional development activities that are high quality, sustained, intensive, and focus on a classroom, school, and/or district in order to have a positive and lasting impact on classroom instruction, the teacher's performance in the classroom, or principal's leadership in the school and community (one-day, short-term workshops or conferences are not considered to be effective professional development activities);

- demonstrate how grant-funded professional development activities are based upon a review of scientifically based research; and

- include in the development of the professional development proposal teachers and/or principals with college/university teacher and administrator preparation programs and arts/sciences experts.

In addition, an eligible partnership might include additional local education agencies (LEAs), a private school, a public elementary or secondary school, a community or technical college, an educational service agency, a nonprofit educational organization, a nonprofit cultural organization, another accredited IHE, a division, school, or college of arts and science within that IHE, the division of that IHE that prepares teachers and principals, a teacher organization, or a business. At a minimum, the partnership had to reflect a joint effort among an IHE's department (or college) of education, the department of arts and sciences, and the partner school and/or district. This federal requirement was intended to ensure that the professional development activities integrated teaching skills with substantive content knowledge.

A variety of professional development formats was encouraged to facilitate the widest possible access to professional development opportunities for teachers (and principals as appropriate). These could include:

- courses in core academic subject areas that were focused on classroom reforms, or were aligned with state standards, as well as those that met identified needs of school districts;

- intensive institutes offered in the summer;

- shorter workshops offered over time during the school year (e.g., 1-2 days per month over a period of months);
- telecommunication opportunities offered during the summer and/or school year;
- training opportunities delivered on site at schools, education service districts, or other nearby sites;
- one-to-one technical assistance; or
- a mix of these or other formats.

Also required were follow-up components that encouraged teachers (and principals as appropriate) to continually apply new knowledge and skills in the classroom.

The majority of the eight grants were awarded to partnerships that included schools located in rural areas in Washington (see Figure 1). A total of 139 teachers, 25 administrators, and 82 paraprofessionals across 139 elementary, middle, and high schools in 46 school districts participated in professional development activities in math and/or reading during the 2002-04 school years. The training of teachers and/or paraprofessionals impacted approximately 2,700 students.

Figure 1
HECB Title II Improving Teacher Quality Grantees 2002-04

Institution of Higher Education	School Districts	Professional Development Audience	Subject Area Focus
Eastern Washington University (EWU)	Curlew, Cusick, Inchelium, Mary Walker, Northport, Selkirk, Wellpinit, Columbia, Republic, St. George's School, St. Michael's School	Teachers	Math
EWU and Salish-Kooteni College	Wellpinit, Spokane, Mary Walker	Paraprofessionals	Math and Reading
Heritage College (HC)	Sunnyside, Grandview	Paraprofessionals	Reading
St. Martin's College (SMC)	Elma, Hoquiam, McCleary	Teachers and Paraprofessionals	Reading
University of Washington (UW)	Bethel, Cape Flattery, Crescent, Franklin Pierce, Montesano, Mukileto, North Franklin, Ocosta, Pioneer, Port Angeles, Port Townsend, Queets-Clearwater, Quillayute Valley, Sequim, and Tacoma School Districts, NOVA School, Charles Wright Academy	Teachers	Math
Washington State University (WSU)	Centerville, Glenwood, Klickitat, Lyle, Roosevelt, Skamania, Trout Lake, White Salmon, Wishram	Teachers	Math
Western Washington University (WWU) and Mathematics Education Collaborative	Cape Flattery	Teachers, Paraprofessionals	Math
Yakima Valley Community College (YVCC)	Sunnyside	Paraprofessionals	Math and Reading

Each of the proposals prepared by the eight partnerships included information about the content and format of the professional development and provided a rationale for the professional development training. Nearly all of the projects began their intensive training with a 10- to-14 day Summer Institute. For example, the UW math proposal stated that the program would:

> …utilize a combination of strategies to enrich professional learning, tying professional development to teacher practice, linking professional

> development to local concerns, resources, and aims, connecting instruction to assessment, extending learning over a significant length of time, and developing skills and understandings in teachers that will sustain continued self-development after the formal professional development experiences are over (page 3).

The professional development activities were to take place from spring 2003 through spring 2004, over 13 days, and included an intensive 5-day Summer Institute that brought teachers together to learn about "standards-based activities situated in the context of authentic problems that involve the use of local environmental resources" (page 3) and to "adapt existing curricula to reflect authentic questions and intellectual challenges associated with the mathematics Essential Academic Learning Requirements (EALRs)…" (page 4).

St. Martin's College wrote that its professional development would focus on "research-based instruction in the teaching of reading, reading comprehension, reading strategies, and assessment" (page 4). The professional development was to begin with a Summer Institute that was designed to "increase [teachers'] knowledge and skills of reading" (page 4). Throughout the school year there were monthly study groups proposed for intermediate- and middle-school teachers, principals, and paraprofessionals during which participants were to "learn about effective reading instruction, to see strategies modeled, to plan for instruction, to problem-solve, to discuss professional books, and to reflect on their learning" (page 4).

One of two EWU projects was to provide training to paraprofessionals in both reading and math. This proposal stated that:

> The curriculum for the project will cover introductory reading and math curriculum interwoven with introductory methods for the teaching of that curriculum….both courses have been aligned with Washington State standards and the Essential Academic Learning Requirements. Students will learn the EALRs, they will learn to connect these to reading and math curriculum, and they will learn specific methods and best practices that work. Further, these will be practiced in the classroom, and observed and evaluated by master teachers, administrators, and EWU professors (page 1).

These EWU project activities were conducted over 60 hours of instruction that began in April 2003 and culminated in June 2004, incorporating an intensive Summer Institute in summer 2003. Meetings that brought all participants together took place once a month from Friday evening through Saturday afternoon.

As these examples illustrate, the professional development activities provided to project participants varied by partnership, with some partnerships providing training to both teachers and paraprofessionals and others providing training only to teachers or paraprofessionals. The content of the training also varied by partnership, with training

provided in both reading and math or in only one or the other. Although principals were included as potential participants in the professional development training in the legislation, none of the eight grantees specifically targeted school administrators in their proposals. Without exception, the biggest strength of the design of the professional development programs in the eight projects was teachers' and paraprofessionals' opportunities to learn and practice the new skills and knowledge they acquired during the school year.

Math Professional Development

Four projects focused exclusively on professional development in math, and two included math as part of their overall professional development. Although all of the professional development in math focused on participants learning about math, including math assessment, the activities teachers and/or paraprofessionals engaged in varied considerably in content and structure. The materials used also varied by project. In addition, despite statements in proposals that the math activities were research-based, no research on the effectiveness of the specific activities in producing changes in students' math achievement was cited in any of the proposals. Indeed, the lack of citation and discussion of the research, including how information from the research would be incorporated into the design of the professional development, were glaring omissions. Nevertheless, the activities identified in the math proposals and reported by participants during focus groups fell into four categories: state policy, math knowledge, math skills, and math assessment.

The state policy category included providing information to participants about Washington's EALRs, their associated Grade level Expectations (GLEs) and Benchmarks, and the Washington Assessment of Student Learning (WASL). The math knowledge category focused on teaching participants an understanding of math content in specific areas such as algebra or fractions. The skills category was broad and consisted of teaching participants a variety of instructional strategies to use with students to increase their knowledge and skills in mathematics. These included, for example, teaching participants techniques, strategies, and materials such as how to use pattern blocks, base-ten blocks, or unifix cubes to help students learn math. Participants also were taught how to incorporate different environmental venues into math lessons to facilitate the learning of math, how to develop WASL-like assessments and rubrics, how to develop math projects, how to develop and use math curriculum replacement units, how to increase student participation in math, how to assess students' mathematical understanding, and how to link EALRs and State standards to math activities to ensure that there was adequate coverage. Finally, the math assessment category attended to introducing participants to methods for assessing students' mathematical understanding, how to create and adapt WASL-like assessments, and how to create and use scoring rubrics.

In addition, some projects structured learning communities or networks for teachers. These communities of learners regularly met to work on math activities and issues. The learning communities bridged the three categories. A few projects—WWU,

EWU, and YVCC—focused on increasing the comfort level and self-esteem participants felt about mathematics as one of their goals or objectives. These projects used a variety of instructional techniques to achieve this goal. One project, YVCC, employed counseling strategies to attenuate participants' anxiety about taking courses on a college campus.

Finally, as part of a major math reform effort in Washington, all participants worked in schools in which the teaching of math had been or was undergoing a shift from teaching conventional math facts and skills to teaching a constructivist approach to learning math. As part of the adoption of new curriculum in schools, many participants had attended curriculum workshops sponsored by the textbook companies. Projects augmented the knowledge and skills participants had acquired or were learning as part of the transition to the new mathematics curriculum.

State Policy

All of the math project proposals stated that projects would address the EALRs, GLES, and/or Benchmarks that pertained to the math content focus covered during professional development, albeit in different ways and to different degrees. Some projects also made reference to specific goals and standards of the National Council of Teachers of Mathematics (NCTM). For example, the UW proposal stated that "the proposed project addresses EALRs two through five as we investigate mathematical content embedded in real world problems" (page 4). Similarly, the WWU proposal stated that "participants in the summer course will investigate mathematics from the EALR strand of "Patterns, Functions, and Algebraic Thinking," as well as the process strands of problem solving, reasoning, making connections, and communicating in a math context" (page 6).

Other projects, such as the EWU Rural School Math Project, noted that after teachers reviewed their school's WASL scores, teachers would focus on the specific EALRs that received the lowest scores. Still other projects, such as WSU, made a general reference to the EALRs, stating that the curriculum replacement units, which participants would develop and implement, would address and incorporate specific EALRs, Washington State standards, and NCTM principles and standards. This project introduced reform-based teaching ideas to participants unfamiliar with them and reinforced reform-based teaching activities to project teachers who had participated in previous math staff development activities provided by WSU.

The EWU paraprofessional (EWU-P) project that focused on both math and reading aligned its course of study to the EALRs and GLEs in both reading and math. Other projects were not as explicit in their proposals about introducing participants to the State's standards. However, during focus group discussions and classroom observations, many participants described learning about the State's requirements as part of their project activities.

Math Knowledge

The importance of becoming literate in math, that is, acquiring a deeper knowledge and understanding of mathematics, was not a focus of the majority of math projects. Three projects—WWU, WSU, and EWU paraprofessional (EWU-P)—explicitly taught participants a conceptual understanding of math within the parameters of specific math topics (e.g., fractions; algebra; measurement; geometry, etc.). In the three projects, the math instructors believed strongly that for students to acquire an understanding of math, teachers had to have a conceptual understanding of math. Instructors also believed that teachers had to unlearn their existing notions of mathematics, student learning, and instruction and absorb new knowledge and beliefs concerning each point. In the WWU and EWU-P projects, participants acquired a conceptual understanding of math via the same constructivist approach they would then use with students.

Three math projects—UW, EWU, and YVCC—assumed that participants had sufficient background knowledge in math and instead focused on reform-based instructional strategies that participants could use with their students. For example, the EWU Rural School Math Project taught its participants how to develop WASL-like math assessment tasks to use instructionally with their students. The assessment task was used as the vehicle to teach participants how to give students practice to improve their WASL scores. EWU instructors assumed that participants had sufficient knowledge about math concepts to help their students improve on the State test. Similarly, the UW project taught participants how to develop their students' mathematical understanding in areas such as decimals, fractions, and percentages, but assumed that participants had a mathematical understanding of the concepts.

Math Instructional Strategies

Across the six projects that provided professional development in math, the primary focus was teaching participants various instructional strategies to use with their students. The instructional strategies taught to participants are all associated with the math reform movement. Participants' attitudes, knowledge, and practices have been shifting as districts have adopted new constructivist-based curricula. Teachers' acceptance of the new curricula has varied, with some unwilling to completely part ways with conventional practices, but the training in instructional strategies has augmented the new curricula as they were being adopted in the districts of the participants. The instructional strategies participants learned about and practiced included how to:

- apply mathematics to real world problems;
- create a learning environment in which students can study mathematics in the context of everyday situations:
- introduce students to different approaches to solving a task;

- help students learn to write about how they solve mathematical problems, including justifying their ideas and answers;
- help students become independent learners, able to figure things out for themselves without the teacher telling them how to solve a mathematics problem;
- develop and use alternative means of assessments, for example, portfolios, performance assessments, or projects, to document student learning;
- listen and observe students as they think about mathematics;
- analyze student work to determine the best way to help students learn mathematical concepts:
- use manipulatives to teach math concepts;
- use a concrete example or model prior to teaching a mathematical concept;
- develop a challenging, problem-solving, and conceptually oriented math curriculum;
- help students learn from one another when they work together on mathematics problems; and
- develop and use curriculum replacement units in specific math content areas.

Math Assessment

Although all four math projects included training in assessment, only two projects—UW and EWU—explicitly linked instruction with assessment, and both were very specific in the nature of the assessment activities they taught to project participants. EWU's focus was on increasing the WASL math assessment scores of students in rural school districts in eastern Washington. Participants learned how to create WASL-like assessments and scoring rubrics to use with the assessments. The UW project taught participants how to assess students' understanding of math using a variety of methods, such as discussions with students and performance tasks. The training also introduced participants to the skills of using information from formative assessment to inform instruction and how to using the KWL model to structure math inquiry lessons.

Each project selected its specific math assessment focus based on the identified needs of the participants and/or of the students the participants taught. For example, the EWU project assessed the needs of its teachers and then focused instruction in

assessment on the areas in the WASL where their students had had the greatest difficulty. Other projects such as WSU, WWU, and the two paraprofessional projects incorporated training in assessment with training in math instruction, with an emphasis on math instruction.

Reading Professional Development

The reading professional development projects assumed that participants were literate in reading and focused their attention on two primary areas for training: State policy and instructional strategies. Two projects—SMC and HC—focused exclusively on reading, and two projects— EWU-P and YVCC—included reading in their overall professional development program. All four projects identified or made reference to the State standards and EALRs related to the areas within reading to be covered during training. For example, the EWU-P project proposal stated:

> … Standards and EALRs will explicitly be part of the academic instruction….Reading EALRs that will be specifically targeted will be those on understanding and application (1.1-1.5), understanding meaning in reading (2.1-3), chooses to read widely for a variety of purposes (3.1-4), and evaluates their own reading progress (4.1-3) (page 5).

Similarly, the SMC project stated in its proposal that "…objectives are linked to the Essential Academic Learning Requirements in Reading 2.0 and 3.0 that require students to read with comprehension and to read and comprehend a variety of texts" (page 4). Other projects such as HC made a general reference to State policy:

> The Academy course curriculum will focus on paraeducators working with their supervising teachers to enhance their instructional support strategies and goals for early reading improvement of K-4 students in consideration of WASL and other test measures of their respective students' reading performance, with a particular focus on the state's Essential Academic Learning Requirements for Reading (page 1).

The primary focus of the training in reading was on teaching project participants the use of instructional strategies to improve students' abilities in various areas such as reading comprehension, vocabulary, and fluency. The selected State standards and EALRs dictated the content of the training sessions. How the training was structured and how participants were organized for acquiring new skills influenced the amount of practice they had with one another and the amount of time they had for sharing challenges and successes they experienced when applying the skills with their students.

Participants in some projects, for example, SMC, came from several different content areas, including language arts, English, social studies, math, and science. The HC project focused exclusively on teaching reading in the elementary grades, whereas other projects— EWU-P and YVCC—focused on teaching reading across all grade levels. The SMC project taught reading strategies that could be used across the

curriculum in elementary, middle school, and/or high school. Reading comprehension strategies were the most frequently taught at all three school levels and in content areas other than language arts and English.

Reading programs, unlike math programs, have been the subject of considerable research, particularly regarding their effectiveness in improving the academic performance of students. Programs such as *Open Court* have undergone extensive research and have demonstrated that, if implemented as designed, students' ability to read does improve and results in an increase in students' vocabularies, fluency, and reading comprehension.

Many of the HECB reading projects introduced strategies that are part of research-based reading programs. However, in every project, the strategies were isolated and presented as tools teachers and paraprofessionals could use at their discretion. In these instances, information about how much time should be spent using each strategy, which specific strategies should be used under what conditions, or how strategies should be combined to be effective—information that is included in research-based reading programs such as *Open Court* and *Read Well*—were not included with the training. A few projects did introduce strategies to be used before, during, and after a reading session but included only limited information about how to make decisions concerning frequency, duration, and student context. Reading project participants learned about and had practice with strategies such as how to help students:

- activate relevant prior knowledge before, during, and after reading text;
- determine the most important ideas;
- create visual images from text during and after reading;
- draw inferences from text;
- provide phonics instruction;
- improve reading fluency through vocabulary development;
- create meaning from text;
- use pre-reading strategies such as making predictions and brainstorming;
- during instruction, use reading strategies such as think-alouds, making connections, asking questions, visualizing, inferring, and clarifying information; and
- use after-reading strategies such as QAR.

When professional development training focuses on teaching specific strategies without information on how to make prudent decisions about the strategies in terms of frequency, duration, quantity, and student context, it leaves the responsibility for the selection of appropriate strategies with the teacher and paraprofessional. The reading projects, perhaps unwittingly, encouraged this practice.

As with some of the math projects, the professional development training in some reading projects included training that instructors felt was important in areas other than reading that instructors felt were important. The SMC project was dedicated to teaching instructional strategies but also recognized the importance of developing communities of learners. Although the project did not emphasize learning communities as one of its objectives, the fact that groups of teachers and paraprofessionals, and occasionally a principal, from the same school attended the training together augured well for the individuals to work together and consult one another when they returned to their schools. SMC also had its participants reading books and presenting lessons during training.

The HC project also went beyond simply providing training in reading strategies and included information about the roles and responsibilities of paraeducators, as well as information about ethical and professional standards. Participants also received training in how to communicate with teachers and other adults about students, how to work with teachers, and how to manage student behavior. Finally, in addition to providing instruction in both math and reading, the EWU-P project introduced the history of American Indian education to its participants. Participants also received training in the Salish language.

Evaluation Activities and Methods of Analysis

The HECB evaluation requirements called for both a formative and summative evaluation conducted at the project and State levels. A series of four evaluation questions dictated the types of data that were collected at the individual project and State levels. Originally there had been five evaluation questions. The fifth question pertained to whether there were achievement differences between project schools and a set of comparable schools. The lack of adequate and sufficient data from comparison schools and the difficulties associated with matching project schools with comparison schools resulted in a joint decision by the contractor and HECB to eliminate that evaluation question.

Evaluation Questions

1. Did professional development activities improve the quality of K-12 teachers and paraprofessionals?

    a. Did the academic content knowledge and instructional skills of K-12 teachers and paraprofessionals increase in the areas of mathematics and/or reading?

2 Did professional development provided to K-12 teachers and paraprofessionals result in improvement in students' academic achievement?

    a. Did students' academic achievement improve in the areas of math and/or reading?
    b. Did student achievement improve for all students?

3. What aspects of professional development had the greatest impact on changes in teaching practices and student achievement?

4. Did professional development provided to K-12 teachers and paraprofessionals affect teaching and learning at the school organization level?

    a. Did the teaching/learning environment in schools change as a result of professional development?

Evaluation Instruments

Three site visits were conducted at each project site. During the initial round of site visits in fall 2003, conversations were held with project directors and coordinators about the State and local data to be collected at the project level. Logic models were developed with project staff to depict each project's benchmarks, activities, and associated sources of data. The logic models for each project were used to develop *project-specific surveys*. Participants were asked the degree to which they had specific skills, knowledge, and experience with teaching the subject matter prior and subsequent to the training, using a four-point scale where 1 = no degree, 2 = small degree, 3 = moderate degree, and 4 = large degree. Project staff administered both the pre- and post-training surveys to participants in seven of the eight projects. YVCC did not provide information from which to develop a survey.

In addition to working with project staff in the development of logic models and surveys during the first site visit, site visits were scheduled for the first round of on-site data collection to take place during the period from November 2003 through January 2004. During this time, site visits were made to several schools within in each project to collect *focus group* and *classroom observation* data. A focus group and observation protocol were developed with questions that aligned with the evaluation questions. The

purpose of conducting classroom observations and focus group discussions was to understand how the training at each project was being translated into classroom practice, with a specific interest in identifying and illustrating challenges and successes. A total of 13 focus groups and 72 classroom observations were conducted. With the exception of the YVCC project, all projects provided information and access to the schools where participating teachers and paraprofessionals taught. Project directors and school administrators assisted with the scheduling of each site visit.

During the second round of data collection (April to June 2004), an attempt was made to observe each teacher and paraprofessional and to conduct focus groups with the same groups of teachers and paraprofessionals who had participated in the first round of on-site data collection. Some participants who participated in data collection activities in the first on-site visit were unavailable in the spring, either because they had left the project, changed teaching positions, or had conflicts with the schedules for observations or focus groups. In a few cases, project participants who had not been available in the fall participated in the spring observations and/or focus group discussions. A total of 12 focus groups and 69 classroom observations were conducted. As with the fall site visits, project directors and school administrators in seven of the eight projects provided access to and assisted with the scheduling. YVCC did not cooperate with scheduling the observations or focus groups, and no data were collected from that project.

In addition to collecting survey, focus group, and classroom observation data, the HECB required an analysis of State achievement data of students in classrooms of participating teachers and paraprofessionals. Discussions were held with school administrators to identify school and State math and reading assessment data, to determine who to contact within each district for the data, as well as to identify potential comparison schools where State math and reading assessment data would also be collected.

.

Methods of Analysis

Four major sources of information were used to conduct the final evaluation of the Washington HECB project: pre- and post-training surveys, pre- and post-focus group transcripts, pre- and post-classroom observation protocols, and students' scores on the State assessment tests.

Pre- and Post-Training Surveys

Survey data were entered into project-specific FileMaker Pro databases. The number and percentage of responses to each of the four ratings were calculated for each item and then grouped by category. Comparisons were made of responses from pre to post training.

Classroom Observations

Using information about the training foci of each project as a guide to understanding teachers' and paraprofessionals' classroom application, a content analysis of the observation notes was conducted. Patterns of implementation, particularly patterns of challenges and successes (i.e., ways of behaving) faced by participants and their students were identified. Comparisons of patterns of behavior made during the first and second site visits and used, along with the analyses of focus group discussions, to understand both how participants translated their learning into classroom practice and how the nature and extent of the issues they encountered created obstacles as well as promoted success in implementation.

Focus Group Discussions

As with the classroom observations, the content of the training, as well as the evaluation questions, guided the discussions among teachers and paraprofessionals. Each discussion was audio-taped with the permission of the participants and transcribed by a graduate student not associated with the project. Transcripts were reviewed for accuracy, and a content analysis of each transcript was conducted for the purpose of identifying patterns of responses and topical themes.. Comparisons of patterns and themes from the first to the second site visit were conducted for each project and used, along with the analyses of focus group discussions, to understand both how participants translated their learning into classroom practice and how the nature and extent of the issues they encountered that created obstacles as well as promoted success in implementation.

State Assessments

Originally the evaluation design included comparing the performance of students of participating teachers and paraprofessionals with student data of non-participating teachers and paraprofessionals located in other schools.

Following a review of the comparative data from both types of classrooms, a decision was made to use instead, and where possible, data from non-participating teachers who taught the same grade as the participating teacher working within the same school. This was not always possible because some small rural schools had only one teacher at a grade level or subject area, but it presented a cleaner comparison than using non-participating schools. Although non-participating schools could be matched on similar geography, size, demographic, and socioeconomic (percent of students receiving free/reduced lunches) variables, using teachers in non-participating schools created too many unknowns that could have affected the assessment performance of their students. In particular were concerns that teachers in non-participating schools might easily have participated in similar types of professional development or their schools might have undergone major reform efforts that incorporated many of the elements of the professional development utilized in the projects.

Since a number of the projects—UW, WSU, EWU, and EWU-P—provided training to teachers or paraprofessionals located in many schools, a purposive sampling strategy was employed for choosing schools from which assessment data would be collected. The sample was chosen based on a variety of factors, including "critical mass" of teachers involved in grades with standardized assessment data (grades 3, 4, 6, 7, 9, and 10). Attempts also were made to sample a cross-section of school levels and geographic regions when appropriate.

Project sites identified which assessment data were available for the schools and students in each of the projects. Principals initially were asked: (1) whether the impact of the project participants within the school would be adequate to make an in-school comparison possible or appropriate, (2) whether other standardized assessments were used and if those data could be made available, and (3) whether they could recommend the most appropriate comparison schools. In addition, principals were informed of the need for individual student-level data in fall 2004 with identification of those students who had received instruction from project participants during the preceding school year.

The primary data used for analysis were WASL and ITBS scores. In most cases, standardized test data were not available in grades that did not have mandatory testing. In addition, most sites were not using other standardized assessments, particularly in the math-focused projects. There was more widespread use of additional reading assessments, including STAR, MASI-R, and others; these were used and analyzed as appropriate.

The analyses included comparisons between the 2002-03 and 2003-04 aggregate student scores and comparisons between 2003-04 and 2003-04 scores from students of participants and non-participants. In addition, the student WASL strand scores pertaining to participants' classrooms was compared with the student strand scores from non-participants' classrooms for each project. Finally, comparisons were made between students of participants and non-participants on the local assessments used in specific projects.

Throughout the process, there were a few challenges. While some reading projects used alternative assessments, such as DIBELS and MASI-R, schools involved in math projects did not use alternative assessments from which to draw data. Therefore, the evaluation analysis is largely based on comparing WASL and/or ITBS scores within the school, when possible.

One final challenge was how best to analyze achievement data results for projects that focused on training paraprofessionals. Because of the variable time and ways in which paraprofessionals worked with students, it was more difficult to identify and attribute academic changes to their activities.

Findings

1. Did professional development activities improve the quality of K-12 teachers and paraprofessionals?

    a. Did the academic content knowledge and instructional skills of K-12 teachers and paraprofessionals increase in the areas of mathematics and/or reading?

Three sources of data—surveys, focus group discussions, and classroom observations—were used to answer this evaluation question. Information from all three data sources confirmed that the knowledge and skills of project participants increased and improved from the beginning to the end of each project cycle. Indeed, overall, teachers and paraprofessionals alike credited the training they received with significant changes not only in their knowledge and skills but also in the application of what they had learned.

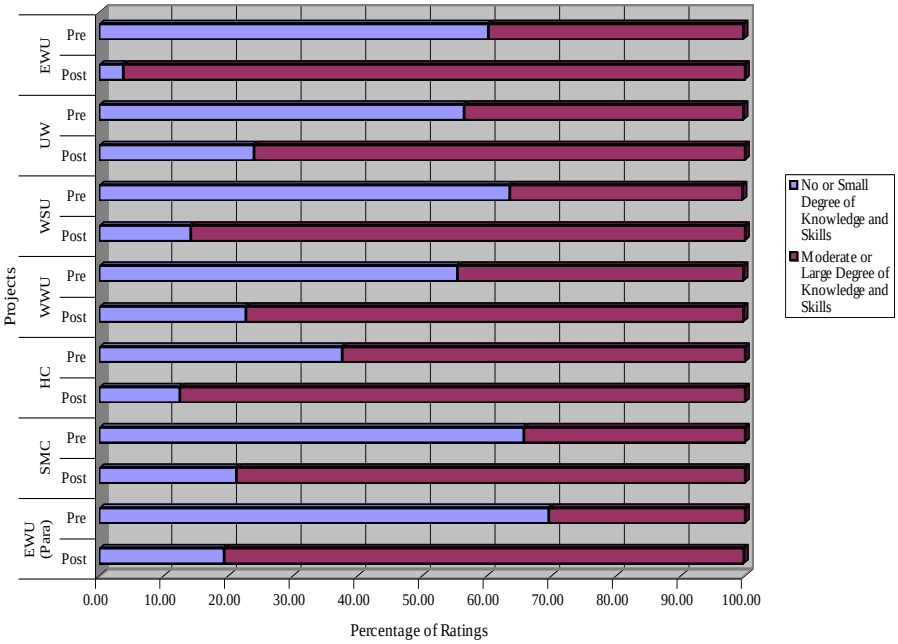
Eighty-six percent of the participants across the seven projects completed the pre- and post-training surveys. What was learned from the survey data analyses is discussed n the following section. The categories of survey items and findings are then used as a framework for the discussion of findings from the site visits conducted in seven of the projects.

Each survey was specifically designed with project directors to reflect the unique aspects of the training in each project. For ease of response, survey items were grouped by the different topics or emphases of training in each project. For example, on the WWU math survey, items were grouped around the four emphases of training: Feelings About Math, Understanding Math, Making Sense Out of Math, and Teaching Math. Similarly, the SMC reading survey included items that reflected the project's four emphases of training: Knowledge About Reading Strategies, Use of Reading Strategies, Reading and Writing Across the Curriculum, and Inquiry-Based Instruction.

The greatest changes in learning occurred in math projects.

Figure 2 illustrates the overall degree of perceived change in participants' knowledge and skills from pre to post training as reported on surveys. Participants were asked the same set of questions on both the pre and post survey. Responses of "no" or "a small degree" of change were combined, as were the responses of "a moderate degree" or "a large degree" of change to illustrate the shifts from pre to post training. The greatest shift from pre to post training occurred for participants in the EWU-P math and reading project, followed by shifts from pre to post in math projects—EWU, UW, WSU, and WWU—and then in reading projects—HC and SMC.

Figure 2
Participants' Perceived Degree of Change in Knowledge and Skills
from Pre- to Post-Training



In math, the greatest changes in learning occurred in the area of State policy, followed by math assessment, special topics, math instructional strategies, and math content knowledge.

The emphases of training in each project were regrouped into four common categories—State Policy, Content Knowledge, Instructional Strategies, Assessment, and a category called Special Topics that included areas of training not directly related to the project foci of math or reading—in order to analyze change across projects. To illustrate the regrouping of items, in the WWU survey, items associated with Understanding Math and Making Sense Out of Math were placed in the category Content Knowledge, Teaching Math was placed in the category Instructional Strategies, and Feelings About Math were placed in the Special Topics category.

Using the combined ratings of "moderate or large" degree of knowledge and skills that respondents perceived they had at two points in time—pre and post project—the percentages of change from pre to post training were calculated in each of the major areas—State Policy, Content Knowledge, Instructional Strategies, Assessment, and Special Topics—for both math and reading. Figure 3 illustrates the perceived changes from pre to post training for math. According to survey respondents, the greatest degree of learning from pre to post training was in the area of State Policy, followed by Math Assessment, Special Topics, Math Instructional Strategies, and finally Math Knowledge.

As the figure shows, not only did respondents indicate that they began their training with the least amount of knowledge and skills in State policy, but also they said that during their training they acquired the most learning in that area. In stark contrast is

their perceived amount of knowledge and skills between pre and post training in math content. Respondents reported that they had the most knowledge and skills in this area before they began their training and so gained, in comparison to the other areas, and the least amount of knowledge and skills in this area during their training. The perceived sufficiency of math content knowledge was not corroborated during classroom observations.

Not every math project provided training in all five areas. Moreover, with the exception of the EWU-P, projects that provided training in one area, such as State policy, did not take advantage of a natural transition to provide training in other areas, such as math content knowledge or instructional strategies. Where a focus of State policy, such as the EALRs, could easily have been used in professional development to train participants in the math content, knowledge, and skills associated with specific EALRs, this training did not typically occur in math (or reading) projects. These issues are discussed in the section that introduces data from the focus groups and classroom observations and again when qualitative data are integrated with the survey findings.

Figure 3
Percentage of Perceived Change in Respondents' Math Knowledge and Skills From Pre to Post Training

Training Focus	Pre Training	Post Training	Change From Pre to Post Training
	Moderate or Large Degree	Moderate or Large Degree	
State Policy	26.3%	92.7%	+66.4%
Assessment	36.0%	88.7%	+52.7%
Special Topics*	34.8%	80.8%	+46.0%
Instructional Strategies	47.8%	81.8%	+33.9%
Content Knowledge	48.9%	76.8%	+27.9%

* Special Topics category includes: Student participation, building a professional learning community, American Indian education, and feelings about math

In reading, the greatest changes in learning occurred in State policy, followed by instructional strategies and special topics.

Figure 4 illustrates the perceived change from pre to post training for reading. According to survey respondents, the greatest shift in learning from pre to post training was in area of State policy, followed by instructional strategies and finally special topics. However, only one project—EWU-P—provided information about Washington State policy. In addition, the SMC project focused entirely on reading instructional strategies, whereas the HC project focused almost exclusively on special topics that only

tangentially affected reading. As with the findings in math, participant responses show that State policy was the least understood at the beginning of training. Their largest gains were therefore in the area of State policy.

Although nearly all of the respondents indicated that as a result of their training they had a moderate or large degree of knowledge and skills in the area of instructional strategies, over two-thirds of the respondents reported that they began their training with a moderate degree of knowledge and skills in that area, so they perceived their gains as being smaller.

Figure 4
Percentage of Perceived Change in Respondents' Reading Knowledge and Skills From Pre to Post Training

Training Focus	Pre Training	Post Training	Change From Pre to Post Training
	Moderate or Large Degree	Moderate or Large Degree	
State Policy	9.0%	86.0%	+77.0%
Instructional Strategies	39.5%	98.2%	+58.0%
Special Topics*	57.7%	83.0%	+25.3%

* Special Topics category includes: Roles and responsibilities of paraeducators, working with teachers, ethical and professional standards, communication with teachers and other adults, behavior management, and American Indian education.

Several 45- to 60-minute focus group discussions were held with a sample of participants from each of the projects. Discussants were asked a series of questions about the training they had received in their specific content area—math and/or reading—with particular emphasis on what skills and knowledge they had acquired, how they were using what they had learned with the students in their classrooms, what changes they had observed in their students that resulted from their implementing new practices and how they assessed those changes, what challenges they had faced in implementing what they had learned, and what successes they had experienced in applying their learning with students. The common protocol included questions that were aligned with the major areas used in the survey analyses, with specific emphasis on the training participants received in each area: State policy, instructional strategies, content knowledge, assessment, and special topics.

Forty-five- to sixty-minute observations were made in the classrooms of as many teachers and/or paraprofessionals as possible who had participated in focus group discussions. The same focus group and observation protocols were used for both math and reading. All activities and interactions between teachers/paraprofessionals and

students and among students were recorded, and materials used during the observation period were collected.

State Policy

Washington Essential Academic Learning Requirements (EALRs) were cited the most often in discussions about State policy.

Although survey respondents reported that their biggest changes in knowledge and skills occurred within the category of State policy, there was only minimal reference to State policy during focus group discussions, during observations, or in the review of materials used in classrooms. During training, participants who received information about State policy learned about the State EALRs, their associated Grade Level Expectations (GLEs) and Benchmarks in reading and/or math, and the two primary State assessments—the WASL and the ITBS/ITED.

On the one hand, the lack of acknowledgement about State policy during conversations with and observations of teachers and paraprofessionals is understandable. State policy was used to provide the focus and content of professional development training; it was not referenced specifically in the descriptions of what participants would learn about during their training. Thus, although the EALRs often drove the direction and content of the professional development (an implicit expectation in the RFP for the focus of training in each of the partnerships), the actual EALRs themselves were not the subject of the training.

However, one project—EWU-P—actually introduced its participants to the EALRs and taught paraprofessionals how to develop lesson plans that were directly related to the EALRs. In using this format, participants not only became familiar with the EALRs, but they also learned how to use a standard to develop lessons for students at specific grade levels. As one focus group participant commented when the group was asked how they made decisions about extracurricular books they used with students, "We've all done lesson plans and made ourselves aware of the EALRs…. We identify the ones that we worked with on our lesson plans…. That in turn makes us aware of what skill we're working towards." By using EALRs to guide decision making about lesson design and instruction, the choices about activities was purposeful and intentional.

On the other hand, by not explicitly connecting the training in math and/or reading to specific EALRs and GLEs, all eight projects missed an opportunity to make State policy more central to what teachers and paraprofessionals did in their classrooms. The EALRs and their associated GLEs have the capacity to structure the content of lessons and to inform teachers and paraprofessionals about instructional strategies that can be used to teach students. The GLEs in particular provide specific learning standards for students in grades K-10, clarifying the skills and strategies all students need to demonstrate proficiency in for each content area. The GLEs can be used to support curriculum development, instructional practices, and assessment of student learning. Benchmark indicators at grades 4, 7, and 10 provide even greater detail about what

students are expected to know and be able to do at each of the State assessment's three grade levels.

To illustrate the potential for using State policy to guide the development of curriculum, instruction, and assessment, at grade 2, math EARL 1 states: "The student understands and applies concepts and procedures of mathematics." There are several components within each EARL. For math EALR 1 at grade 2, component 1.1 states: "Understand and apply concepts and procedures from number sense." There are three GLEs for component 1.1: numbers and numeration, computation, and estimation. Within each GLE there are specific learning standards. For example, within numbers and numeration there are two standards: "understand place value in whole numbers" and "understand sequential relationships among whole numbers." Further specification of the standards is also provided. For example, GLE 1.1.1: Understand place-value in whole numbers states: "Group and regroup objects into 1's, 10's, and 100's and explain relationships, determine the value of a digit based on its position in a number, and read and write numbers to at least 1,000." This type of detailed information is included with each EALR. Although there was reference to specific EALRs in the proposals, there was, according to most respondents, no reference to the EALRs or GLEs during training.

The EWU-P project is the only project that explicitly used this type of information during its training and expected its participants to demonstrate their understanding of it in the development of lesson plans. Paraprofessionals noted during discussions that, when they were given opportunity in the classes in which they worked to implement the lesson plans, the structure served an important purpose: they knew what to teach and what to expect from students. Participants were also taught math concepts and instructional strategies as part of their professional development training.

One other project—EWU—did make the EALRs explicit during training by showing teachers how to research the EALRs in which their schools had performed poorly, as well as how to use the identified EALRs to design WASL-like tasks and scoring rubrics to give their students additional practice before they were scheduled to take the WASL the following spring. Teachers discussed these activities during the first round of focus groups in Fall 2003 (see HECB Interim Report, 2004). In this project, as well as the WWU, WSU, and UW math projects, participants' understanding of, knowledge about, and skills in the math they were expected to teach, was presumed but not assessed to determine if teachers had adequate and sufficient knowledge, skills, and understanding of math to teach their students what they needed to know to perform well on the WASL. This omission became problematic when teachers tried to connect their understanding of the math they needed to teach their students and the design of lessons, WASL tasks, and scoring rubrics.

Teachers and paraprofessionals voiced concern about State and Federal policy regarding WASL and ITBS/ITED scores.

The one area of State policy that received a lot of attention during focus group discussions with many project participants was the State assessment, specifically the

WASL. The topic of assessment came up in discussions about State policy requirements and also during discussions about assessment activities teachers and paraprofessionals engaged in with their students. From a policy perspective, discussion centered on the relationship among the WASL, the EALRs, and curricula/instruction, in particular district math textbook adoptions that focus on inquiry-based instruction. Discussion among participants also focused on how to interpret and use data from the WASL to inform instruction. The State's focus on WASL and ITBS/ITED scores, particularly how scores are used to determine if NCLB requirements are being met, generated anxious discussion during focus groups. With the emphasis in schools on how to "get scores up," teachers and paraprofessionals reported feeling pressure to help students improve their performance on State tests, particularly on the WASL in both math and reading.

Assessment

Explicit training in assessment strategies was included in math but not in reading projects.

All four math projects, and to a much lesser extent the two paraprofessional projects, incorporated some type of assessment training in their project activities. Three of the four—WWU, UW, and WSU—integrated the assessment training with other activities, and one of the projects—EWU—focused exclusively on assessment in its training. With the exception of EWU, the focus of assessment was specifically on the classroom: how to use assessment strategies to help students increase their knowledge and skills and to determine students' level of knowledge and understanding. The EWU project used the State assessment, specifically the WASL, to teach its participants how to design WASL-like practice tests and scoring rubrics to help students improve their WASL scores.

The UW project taught participants how to design assessments, how to use formative assessment to inform instruction, and how to assess students' mathematical understanding using a variety of sources of information such as student work, classroom discussions, and assessment tasks. Participants also were taught the KWL model and how to use it during instruction to structure math inquiry. The KWL model requires students to show they understand a topic. Teachers ask students a series of questions to probe students' knowledge and understanding and use the information to build "classroom knowledge" about a topic. Although KWL is designed to increase students' overall knowledge abut a topic by encouraging broad participation of students in the generation of information, classroom observations revealed that the knowledge gained by students was primarily at the detailed, factual level rather than at the patterned, conceptual level of understanding a topic.

The WWU project was similar to the UW projects with its focus on assessment. WWU taught its participants how to use sources of student information such as rubrics, portfolios, and on-demand assessment tasks to assess student learning. Participants also were taught how to probe students' thinking about mathematical ideas and how to judge the quality of students' work. According to the lead trainer in the WWU project, the

primary emphasis was to make participants comfortable with math so that they could teach their students. The trainer felt that teachers were phobic about math because of their own experiences with learning math. As participants increased their conceptual understanding of math and became more confident about their math knowledge and skills, they were expected to transfer their understanding to the design of instruction for students.

Participants in both the UW and WWU projects shared their learning about assessment during focus group discussions; however, the application of their learning in assessment was observed to only a minimal degree in the WWU project. Elementary teachers in the UW project were observed peppering their students with different types of questions during instruction, both to further their students' understanding of math concepts and to assess what students knew and understood. This assessment strategy was observed much less frequently in high school classes.

The WSU project explicitly built assessment into its standards-based math instruction. Training included teaching participants how to assess their students' mathematical understanding using a variety of sources of information such as students' work, classroom discussions, and assessment tasks that mimicked the WASL. Participants also were taught how to embed assessment into regular classroom activities and how to use assessment information to inform the content of their instruction. Although focus group discussions did not elicit information about participants' use of assessment in these ways, classroom observations, particularly in several middle schools, provided evidence of the use of reading comprehension strategies to help students solve complex story problems.

According to teachers, one of the greatest difficulties students have on the WASL is knowing how to decode a story problem, make sense of it, and explain in writing how they solved the problem. Several middle school teachers were using a strategy designed by WSU to help students with these difficulties. The strategy appeared quite effective, at least in getting students as a group to describe verbally how they solved math story problems. At the elementary and high school levels, teachers incorporated assessment into their instructional activities by constantly asking students questions. This was done at the classroom level so as to involve all students. However, unlike instruction, which often used manipulatives to help students understand math at a conceptual level, questions asked during instruction required more recitation of math facts than concepts. Students displayed difficultly in explaining the solution of math problems where inferential comprehension was required.

When training focuses on giving students practice with WASL-like assessments without attention to what students need to know to perform well on the WASL, students are not likely to improve their scores

The EWU math project focused its training exclusively on assessment, specifically the WASL test administered each spring to students in grades 4, 8, and 10. Participants first were asked to identify their district's EALR area of focus in math, for

example, number sense or problem solving. Then they were asked to interpret math WASL data, as well as other formal assessment data, and combine the assessment information from these sources with WASL data to identify areas where students experienced difficulty at the grade level(s) participants taught. Participants were to use the identified areas of difficulty to determine what students needed to know and understand to satisfactorily solve a WASL task.

Following this diagnosis, participants were taught how to develop math questions that required students to 1) interpret a situation mathematically, 2) show their mathematical logic using tables, graphs, and/or equations, and 3) explain, justify, or describe their answers in writing, showing how they solved each math problem. In addition, participants were taught how to develop a scoring rubric that 1) would clearly describe for each rating what students needed to do to demonstrate their understanding of and ability to do the task, 2) would be reliable and therefore result in similar scores regardless of who was using it, and 3) could be used by students to redo their work for a higher mark. Finally, participants were taught to use the assessment tasks and the scoring rubrics they developed to design instructional activities to use with their students. Needless to say, the goals of the EWU project were ambitious and to be successfully achieved depended not only on good instruction from EWU staff but also on a level of mathematical understanding that few teachers possess. It is one thing to identify areas of weakness in students' performance on the WASL, but it is quite another to use the information to design WASL-like assessment tasks and scoring rubrics and to use them with students.

Participants brought to the training sessions what strategies they used in their own classrooms, what materials they had received from other teachers in their building, and what information they could find on the Internet. EWU did provide training in the areas it proposed, but instructors quickly realized that many teachers lacked a mathematical understanding of what they were expected to teach and a clear enough understanding of the WASL to design similar types of tasks. As a result, there was a lot of reliance on artifacts brought in and shared, and EWU staff spent a lot of time teaching teachers the math content needed for students to perform well on the WASL. Areas that were completely overlooked in designing the training and that likely contributed to students' poor performance on the WASL included students' 1) being unable to read the items, 2) not understanding language concepts used in items, 3) only comprehending story problems at a literal level, and 4) not understanding what was being asked of them in the problems.

Cris Tovani, in her book *Do I Really Have To Teach Reading?* (2004), argues persuasively that content comprehension needs to be taught in grades 6-12 in every content area. This is particularly true in the area of mathematics where students must be able to read, comprehend, and solve story problems. Performance assessment tasks require students not only to be able to read a problem but also to understand language concepts. They must be able to segregate what information is important to solving a problem from what information is extraneous to solving the problem, and it is these tasks which are particularly difficult for ELL students. Indeed, performing well on the WASL

requires as a prerequisite that students be able to comprehend the story problem so that they do not waste time focusing on words they do not know or on words that may or may not have bearing on the problem they are being asked to solve. For example, a 2004 fourth-grade WASL Mathematics (Released) Item states:

> Thirty boys and twenty girls attended the pep rally last Friday. What was the ratio of girls to the total number of students at the pep rally?

In this problem, students were told to show how they solved the problem, explain in writing the process they used, and provide their answer. The WASL learning target for that item stated that students were to "demonstrate an understanding of and apply the concepts of ratio and direct proportion." Another WASL Mathematics (Released) Item placed an even greater demand on students' knowledge of and experience with language concepts:

> In which situation would it be appropriate to estimate rather than accurately calculate or measure?
>
> A. A tailor altering a suit for a customer
> B. A groundskeeper laying out lines for a football field
> C. A painter deciding how much paint to buy for a house
> D. A butcher weighing meat for a customer

In addition to needing to know the math concepts of estimate, measure, and calculate to answer the question, students needed to know the meaning of specific words—language concepts—in each potential answer: tailor, groundskeeper, painter, butcher, customer, altering, weighing, and football field in order to make sense of the alternatives and make a correct judgment. If students are unfamiliar with what altering a suit, laying out lines for a football field, deciding on an amount of paint needed to paint a house, or weighing meat means, they are going to have difficulty deducing the correct answer (Endsley, 2004).

While it is important for students to have practice with solving these types of items, what is more important and a prerequisite to performing well on a practice test is that students be able to 1) read the problem, 2) visualize the situation, that is, create in their minds a mental image of what is being asked, 3) understand math and language concepts, and 4) know what is being asked. They must also know what words and concepts in the problem are irrelevant to solving the problem. For example, in the first problem, if students think that a pep rally that took place on a specific day is important to solving the problem, or do not know what a pep rally is but think it is important to solving the problem, they will be confused by what they need to attend to in order to arrive at the correct answer. Moreover, if students apply only literal comprehension to items like this, they will not be able to solve problems that require higher inferential levels of understanding. EWU did not attend to these important issues. As a result, teachers, particularly those teaching at the elementary grade levels, but also those

teaching at the middle and high school levels, focused on issues that were not salient to solving WASL problems.

As an example, elementary teachers reported that their students were not used to seeing problems that were not printed in a box with lines for the written responses; therefore, teachers focused their attention on making sure that the practice problems they designed or borrowed were contained within a box or frame and included lines for students' written responses. Classroom observations revealed that, although the problems included lines for responses, students just rewrote the problem in this area. Teachers' focus was misguided. Another example is that teachers who used scoring rubrics from other sources were unable to tell their students the differences between ratings of 0 and 1 and between 1 and 2 and thus could not help students during a scoring session where they scored one another's practice assessments.

Professional development in assessment fell short of including training in key areas related to students doing well on performance-based assessments.

It is arguably difficult if not impossible to teach students how to perform well on a math assessment if teachers themselves do not have an adequate understanding of the subject matter. Indeed, to help students perform well on any assessment, and in particular a performance-based assessment where students must demonstrate a conceptual understanding of mathematics, teachers must be literate in the mathematics they are teaching. This means that teachers and paraprofessionals must themselves have sufficient knowledge about the mathematics to be taught to the students at a span of grade levels below and beyond the grade level they teach. This is because a class of students in a specific grade typically represents math knowledge and skills that span several grades from several below to several ahead. For example, a fourth grade class typically has students whose math skills and knowledge range from the first grade level to the middle school level. Many teachers at the elementary and middle school levels appeared to lack an understanding of the math curriculum they were expected to teach, let alone the math skills and knowledge of the range of levels represented by their class of students. Without a sufficient conceptual understanding of math, teachers and paraprofessionals will not be able to assist their students in learning the skills and knowledge they must have to perform well on the WASL or the ITBS/ITED.

Instructional Strategies

Professional development training in instructional strategies figured prominently in both reading and mathematics projects.

Training in specific math and reading instructional strategies took place in every math and reading project, albeit to different degrees. Reading projects typically presented specific strategies that were to be used at distinct times during instruction such as before a reading session, during a reading lesson, and after a reading session ended, as well as instructional strategies that could be used across the curriculum. Math projects also taught an array of instructional strategies, but the strategies tended to focus almost

exclusively on teaching participants how they could help students solve math problems as opposed to when to teach what during a math lesson. However, even with a primary focus on how to solve math problems, math projects did teach a variety of strategies to be used in different math settings. For example, math professional development included training in: 1) strategies that teachers could use to design authentic curriculum replacement units that required math problem solving, 2) strategies and steps students could use to solve different types of math problems, 3) methods to help students communicate how they solved math problems both verbally and in writing, and 4) ways to structure inquiry-based learning opportunities for students. Figures 5 and 6 illustrate the main instructional strategies taught to reading and math participants in each of the projects.

Reading

Figure 5
Instructional Strategies Taught in Reading Projects

Instructional Strategies	SMC*	HC	EWU-P
Pre-reading strategies (e.g., making predictions, brainstorming)	X		
During-reading strategies (e.g., think-alouds, making connections, asking questions, visualizing, inferring)	X		
After-reading strategies (e.g., QAR)	X		
Reading and writing across the curriculum	X		
Inquiry-based instruction	X		
Phonics		X	X
Reading fluency		X	X

* SMC: St. Martin's College, HC: Heritage College, EWU-P: Eastern Washington University-Paraprofessional

For elementary teachers, the reading instructional strategies reinforced the approach used with in their district-adopted reading programs. For middle and high school teachers, the strategies were new and required assistance that was unavailable from the projects for successful implementation.

As Figure 5 illustrates, two projects focused their instructional training on two interrelated reading areas—phonics and reading fluency—and one project trained its participants in a variety of reading instructional strategies. Coincidentally, teachers and paraprofessionals in all three projects worked in schools where the district-adopted reading program (*Open Court Reading*) in the elementary grades utilizes all of the

instructional strategies taught in the three reading projects. *Open Court Reading* is a research-based curriculum grounded in systematic, explicit instruction of phonemic awareness, phonics and word knowledge, comprehension skills and strategies, inquiry skills and strategies, and writing and language arts skills and strategies.

In *Open Court Reading*, students use the skills and strategies to read different forms of literature. Through the reading of various genres, students progressively deepen their understanding of thematic learning units presented in each grade level. *Open Court Reading* also provides explicit information to teachers about how to modify instruction to accommodate ELL and special education students. Teachers and paraprofessionals in all three reading projects regularly used the *Open Court Reading* program in their work with elementary students. However, during classroom observations it was clear that both teachers and paraprofessionals chose the strategies they felt would help their students and did not follow the program as it was designed, therefore nullifying the research on which it was based.

Paraprofessionals in the HC project also taught a research-based reading program called *Read Well*. *Read Well* is designed for primary students and was adopted for grades K-2 by one of the districts in the HC project. The *Read Well* program emphasizes similar elements as the *Open Court Reading* program does, but it is designed specifically for students in the primary grades. The program combines systematic phonics, mastery-based learning, and rich content. During classroom observations, the *Read Well* program was implemented exactly as it was designed.

Thus, with the exception of the middle and high school teachers in the SMC project, the majority of participants in all three reading projects were in the propitious position of being able to augment their classroom experiences with very focused professional development in instructional strategies that are used in both the *Open Court Reading* and *Read Well* programs in their districts. For middle and high school teachers who represented different content areas and grade levels, the training in reading strategies provided new ways to help students with the reading required in science, math, and social studies courses. However, unlike the elementary teachers who taught in reading programs utilizing the instructional strategies that were part of the professional development training, middle and high school teachers were faced for the most part with integrating on their own what they were learning into their curricula with no hands-on assistance from the professional development instructors. This was particularly true for science and math teachers in middle schools.

Participants' familiarity and prior experience with instructional strategies affected implementation.

The fact that so many of the reading project participants were already using the majority of instructional strategies taught during professional development may account for the comparatively modest increase in ratings from pre to post training in this area. Prior to participating in the training, nearly 40% of the survey respondents reported that

to a moderate or large degree they were knowledgeable about and using the instructional skills to be taught during training.

Having prior knowledge and experience with the instructional strategies introduced during professional development generally augurs well for implementing what is being taught, because teachers and paraprofessionals are already familiar with the strategies and are using them during reading lessons. Participants reported during focus group discussions that the professional development was a good review for them and that they appreciated being able to discuss with one another how they used the strategies during reading. Teachers in the SMC project described the "refresher" aspect of what they were learning and discussed how they used different strategies at different times in their work with students. Although the EWU-P paraprofessionals were not explicitly taught the strategies introduced in the SMC project, they too, were using them in their work with students during *Open Court Reading* lessons. Similarly, the HC project participants were using the same strategies when they worked with students. Participants in all three projects exuded enthusiasm and confidence about the decisions they were making as they used particular instructional strategies with students during reading.

Two problems did occur, however, as a result of the way in which reading strategies were taught during training. Both affected implementation and therefore the potential for students to improve their reading skills and knowledge.

The first problem is the way the strategies were introduced. The HECB Title II RFP required research-based practices. Individual strategies are not research-based. When strategies are taught in isolation from the larger context of reading and without attention to how they should be used within a specific reading lesson, they lose their potency and effectiveness. They are not part of a reading program, which is what is research-based. Teachers and paraprofessionals end up using their professional judgment about what strategies to use and when to use them on a "trial and error" basis, picking and choosing what they feel is best at a particular time with particular students. If one strategy does not "work," they turn to another. When asked how they chose specific strategies to use during reading lessons, participants reported that they selected the strategies based on their knowledge of the students and what worked and didn't work. They described changing strategies if one did not seem to work well.

Thus, teachers reported that they now were using strategies more purposefully and gave examples of using strategies, such as think-alouds, to help students make connections to prior knowledge and experiences. However, teachers' techniques to help students make predictions, their methods to help students learn vocabulary and increase their reading fluency, and their strategies for increasing comprehension were not linked to specific reading problems and were not part of a reading program. An unfortunate example is that the *Open Court Reading* program was not implemented with program fidelity in any of the classrooms where it had been adopted. Rather, individual strategies were given to students for their use as needed.

The second problem is also related to implementation. If strategies are taught in isolation from a reading program and are to be selected and used at the discretion of teachers and paraprofessionals when they work with students, teachers and paraprofessionals need to learn how to adapt these strategies to meet the particular needs of students. The most effective way to teach this is to use student work samples—performance assessments—as the vehicle for introducing participants to different types of reading problems and illustrating how to adapt instruction to remedy students' reading problems. Participants then acquire a conceptual understanding of the relationships between specific reading problems and appropriate strategies to remedy these problems. Participants learn how to scaffold instruction to meet the needs of all students. While professional judgment is an important aspect of good teaching, the judgments teachers and paraprofessionals make should be predicated on a clear understanding of the nature of the reading problems students are exhibiting and the remedies for those problems.

When professional development training is provided outside a classroom context with no classroom observations or implementation assistance, teacher, school, and district factors easily mitigate the potential for sustainable changes in practice.

The professional development literature has identified several key factors that have the greatest potential for effecting changes in teachers' instructional practices. The factor that has received the most attention has been the duration of the professional development. Replacing the traditional one-day inservice is a variety of training configurations that range over time from week-long events to year-long and even multi-year programs. Another factor that has been demonstrated to have an enduring effect on changes in teachers' classroom practices is the location of training. Not surprisingly, training that is closest to the classroom has the greatest potential for being the most effective.

The closer the training is to the location of the individuals who will be implementing what they are learning, the greater the likelihood that the training will be tailored to the classrooms in which it will be used. Teachers' philosophies about teaching and learning, the way they organize their classrooms for, as well as carry out, instruction, the schools in which the teachers work, and the districts in which teachers are employed are all factors which influence implementation. Districts may mandate that specific reading programs be used for specific grade levels, schools may require that reading take place at specific times during the day for specific periods of time, and teachers may believe that their professional judgment should be paramount in the decisions they make about which reading strategies to use and when they should be used regardless of what a reading program states. These are issues for anyone who designs professional development and in particular to trainers who provide training in instructional strategies. Introducing instructional strategies that can be used prior to, during, and after reading without training in how to make decisions about which specific strategies to use, how to adapt strategies to meet the needs of every student (the concept of differentiated instruction), how often to use the strategies, and how to assess the effectiveness of the strategies gives license to teachers and paraprofessionals to pick and choose what they like and when they see fit.

Training that takes place outside the school and district and that does not include classroom observations to help teachers and paraprofessionals implement reading lessons will carry the risk of even the best intentions running awry. Also, training that requires teachers and paraprofessionals to transport what they have learned in a general setting to a specific setting is a formidable task that requires interpretation and translation to the new context, particularly training that is expected to help students learn how to read.

Finally, when training brings together teachers and paraprofessionals representing different grade levels, content areas, schools, and districts, it is nearly impossible to meet the needs of all of the participants. With the exception of the EWU-P professional development, which took place on the Wellpinit Indian Reservation in one of the district's schools, the reading training for participants in the SMC and HC programs included participants from several districts who worked in more than a few different schools. Training had to assume that the needs of teachers and paraprofessionals were generally the same. None of the training stepped inside teachers' and paraprofessionals' classrooms to provide direct assistance with implementation.

Training that takes place over an academic year and that includes monthly meetings provides opportunity for participants to form professional communities of practice where implementation issues, instructional strategies, and information and ideas are shared.

Despite the moderate change in participants' self-reported ratings from pre to post training in the area of reading instructional strategies, along with a concern about the homogenization of the training in order to accommodate diverse groups of participants in each reading project, the topic of instructional strategies generated the most enthusiasm during focus group discussions. Both teachers and paraprofessionals alike talked about what they had learned during their training activities and how they were using what they had learned in their work with students.

In all three reading projects, participants attended a summer institute where they received intensive training in instructional strategies, and they attended monthly meetings with the primary trainer from the summer institute. The summer institute training typically introduced participants to the different reading instructional strategies while the monthly meetings usually focused on implementation issues, demonstrations by participants of how they carried out specific strategies, and discussions among participants about readings from the variety of materials they had received as part of their training. The HC and EWU-P projects also included intensive training in several other areas, so the 40-hour intensive summer institute training in instructional strategies in the SMC project was actually less for participants in the HC and EWU-P project.

While the intensive summer institute was appreciated, according to participants it was the monthly meetings that kept them "focused and accountable." This was particularly true in the SMC project where each month different groups of teachers and paraprofessionals were responsible for demonstrating and discussing a new practice from their readings. Each month the participants were expected to try a new practice, and one

of the groups was responsible for demonstrating the practice and describing its implementation in their classrooms. At the monthly meetings, teachers asked questions about implementation and shared ideas and exchanged materials. During the month at each of their schools, teachers would discuss among themselves the practices that had been successful with their students. As one participant shared:

> There are some things that it is just kind of a review of what you've learned before but they refreshed your mind and made you think, hey, this might work for me right now. So I tried a lot of the different things and some of them I tried again, but I really liked the fact that we were accountable and had to come with something every month. I liked that. (SMC)

Paraprofessionals in both the HC and EWU-P projects also described how the monthly professional development made a big difference in their ability to sustain what they had been learning. The monthly meetings for EWU-P participants was held from Friday after school through Saturday and included sharing a homemade dinner prepared by different groups on Friday night. The project director had an excellent relationship with participants, and the meetings were filled with learning and sharing first-hand classroom experiences.

Although length of time spent in professional development is no guarantee of substantial content, training that takes place over a school year creates opportunities for participants to engage in collective work together that would be less likely to occur if there were less time. By including regular monthly meetings in their professional development design, all three reading projects were able to provide support to teachers and paraprofessionals throughout the school year and to encourage teachers to work collaboratively in their schools with one another.

When several teachers and/or paraprofessionals from the same school participated in training, there was greater potential for discussion about the implementation of instructional strategies among participants during the school day and for sharing information with other staff members.

To learn is always to learn some particular thing in some situation, and the situation can influence what is learned. In the three reading projects, the opportunities to learn were situated outside teachers' and paraprofessionals' classrooms and occasionally away from teachers' and paraprofessionals' home districts. Transporting new learning from a general context into a specific context—one's classroom—is difficult, especially without the hands-on support of a trainer. The problems are compounded because teachers' and paraprofessionals' classrooms, schools, and districts can influence what is actually used from the professional development training. However, when teachers and paraprofessionals from the same schools attend professional development training together, they have opportunity to work collaboratively on instruction and share and resolve issues and concerns.

Similarly, teachers and paraprofessionals who work in schools whose principal participates in the training will be more likely to engage in what they have been learning because school administrators will likely support changes in school organization to accommodate a new learning environment. In all three reading projects, several participants from each school took part in the training. In the SMC project, the principal of each school also participated in the training. This made a big difference: Not only were participants able to discuss what they had learned, but also they were able to put into practice what they had learned with more confidence than if they had been the only person from their school attending the training. Moreover, as teachers and paraprofessionals shared what they had learned and were using with other staff members in their schools, the contagious effect of enthusiasm about new practices spread to others.

Indeed, teachers generally are more willing to change their practices when given testimonials from their trusted colleagues. In the HECB reading projects, when teachers shared what they had learned and what seemed to work best with their students or with particular students, other teachers from those same schools were more likely to try to the strategy with their students. When several teachers representing different grade levels attended professional development training together, there was a greater chance that many more teachers in their schools would try out what was reported as successful with students. This was particularly true in elementary schools where teachers worked more collaboratively and were not as isolated as their peers in middle and high schools. When school administrators took part in professional development training, they were in a better position to support their staffs during reading instruction.

Linking Washington's reading EALRs and GLEs to instructional strategies could have enhanced participants' understanding of the relationship between curriculum and instruction.

Although the relationship between their proposed training and specific EALRs was identified as important in many of the project proposals, none of the projects took the EALRs or associated GLEs inside their training and connected them to the strategies they were teaching. The EALRs and WASL are linked and would have provided a natural connection to make for participants, particularly in demonstrating the relationship between instructional strategies and specific EALRS and GLEs at different grade levels. Further information about how to adapt strategies to meet GLEs at different grade levels and with students exhibiting different types of reading problems would have made learning the instructional strategies more powerful. In addition, participants would have learned that specific tools have the potential for improving all students' performance on the WASL. To illustrate, reading EALR 1 states:

The student understands and uses different skills and strategies to read.

There are specific components to each EALR. For example, for EALR 1 at grade 2, there are four components:

1.1: Use word recognition skills and strategies to read and comprehend text.

1.2: Use vocabulary (word meaning) strategies to comprehend text.
1.3: Build vocabulary through wide reading.
1.4: Apply word recognition skills and strategies to read fluently.

Each component includes specific GLEs for each grade level. At grade 2, component 1.4 has three GLEs:

1.4.1: Know common sight words appropriate to grade level.
1.4.2: Apply fluency to enhance comprehension.
1.4.3: Apply different reading rates to match text.

If teachers and paraprofessionals had been taught specific strategies they could use with EALRs and GLEs at the grades they teach, they would have been able to see the relationships among the WASL, EALRs, GLEs, curriculum, and instruction for a whole grade level. Learning how to adapt instructional strategies to help students with particular reading problems meet the EALRs and GLEs would have provided a more powerful teaching tool than just learning which strategies could be used at different times during a reading lesson.

Performance-based assessment should play a more prominent role in teachers' decisions about which instructional strategies to use and when to use them.

In all three reading projects, teachers and paraprofessionals learned about and had opportunity to practice the instructional strategies introduced during their professional development training. However, one of the most powerful sources of information about student learning—analyzing students' oral reading samples—was not used as a tool for training teachers and paraprofessionals. The analysis of reading samples is a powerful analytic tool that can be used by groups of teachers to understand the reading problems of students. It goes beyond the identification of areas of difficulty, such as vocabulary and comprehension, identified on standardized tests. When teachers are able as a group to listen to tapes of students reading passages and then work together to understand the difficulties students are exhibiting, they are better equipped as professionals to identify problems and to determine appropriate remedies.

Even more powerful is the incorporation of student reading labs during training, where participants not only listen to audio tapes of students' reading and analyze the reading problems students are experiencing, but also then convert their analyses into strategies to remedy students' reading problems. Discussing students' reading difficulties as a group and making decisions about how to help students improve their learning is a very powerful learning experience for teachers and paraprofessionals; these activities center the assistance they provide to students directly on the problems students are experiencing.

Oral and written performance assessments of students should be part of training, so that participants have opportunities to discuss as a group the nature of the reading problems students are exhibiting and the strategies that would be most appropriate given

these difficulties. Equally important to discuss would be how to adapt specific strategies to meet the needs of students who exhibit certain types of reading problems, especially for ELL and special needs students.

Math

Figure 6
Instructional Strategies Taught in Math Projects

Instructional Strategies	**UW***	**WWU**	**WSU**	**EWU-P**	**EWU**
Implementing math across the curriculum (e.g., science)	X		X		
Designing curriculum replacement units	X				
Inquiry-based learning	X	X	X		
Methods to solve different types of math problems	X	X	X	X	
How to focus on depth versus breadth of learning	X		X		
Relating types of questioning strategies to math tasks	X	X	X		
Developing authentic math tasks	X			X	
Using manipulatives to examine and understand mathematical ideas		X	X		
Designing differentiated instruction to meet range of students' needs		X	X	X	X
Developing math projects			X		
Teaching math content using content-specific strategies			X		

Instructional Strategies	UW*	WWU	WSU	EWU-P	EWU
How to communicate math problem solving verbally and in writing			X		
Teaching student how to lead and engage in math discussions			X		
How to communicate math ideas			X		
Teaching a constructivist approach to learning math				X	
Using assessment tasks to design instruction					X

* UW: University of Washington, WWU: Western Washington University, WSU: Washington State University, EWU-P: Eastern Washington University-Paraprofessional, EWU: Eastern Washington University

Training in math instructional strategies introduced teachers and paraprofessionals to a variety of techniques they could use to increase their students' conceptual and skill-based understanding of math and to improve their students' performance on the WASL.

In four of the five math projects, training in instructional strategies was the main focus of the professional development. As Figure 6 illustrates, participants were taught a variety of techniques to help students learn math skills and concepts, design units of instruction that were rigorous and relevant and that employed a constructivist approach to learning, solve complex story problems using both reading and math comprehension strategies, and develop math projects and tasks. Although there was overlap in training activities, all of the math projects carved out a unique niche within math instructional strategies to focus on during training. The areas in which there was overlap in training across several projects included teaching participants methods to solve different types of math problems (e.g., fractions and story problems), to use inquiry-based learning in a constructivist approach, and to design instruction to meet the specific math needs of students.

As with the reading projects, many math teachers came into their training having familiarity and experience with math strategies. Indeed, nearly 50% of the survey respondents reported that prior to the training they were knowledgeable about and had skills in the specific math instructional strategies to be taught during training activities. One of the likely reasons that respondents rated their knowledge and skills so highly was that the majority of school districts in which participants worked had adopted new math curricula and materials. All of these were constructivist oriented and utilized best practices in mathematics. Math teachers reported that they were in their first, second, or third year of using the new materials and strategies and admitted that they had fought hard to retain old practices but were now completely sold on the new way of doing math.

However, despite the relatively high percentage of respondents who reported having knowledge and skills in teaching math, the majority of teachers and paraprofessionals taught in schools where WASL and ITBS math scores were low. Indeed, in many schools far less than 50% of the students had met the State math benchmarks at their grade levels, suggesting that teachers' and paraprofessionals' prior familiarity and experience with instructional strategies did not automatically translate into a uniform and universal change in classroom practices. Professional development in math pedagogical skills and knowledge thus held the promise of assisting, or at least redirecting, participants in the use of instructional strategies that could effectively increase their students' knowledge and skills in mathematics.

Teachers' and paraprofessionals' attitudes and ideas about mathematics teaching and learning influence their teaching methods.

Teachers' and paraprofessionals' attitudes and ideas about teaching mathematics shape how they teach. Teachers and paraprofessionals who see mathematics as a set of rules to be memorized, for example, will differ in their presentation of material from teachers who view math as a set of principles and concepts to be comprehended and used. Similarly, teachers and paraprofessionals who view students as passive recipients of knowledge will teach differently from those who see students as active problem solvers. In the same way that teachers' and paraprofessionals' attitudes about math and about students learning math influence both their choices of content and instructional strategies, so also their ideas about the best ways to help students learn affects their receptiveness to acquiring new ways to instruct students. Learning new methods often requires unlearning existing notions of mathematics, student learning, and instruction, as well as absorbing new knowledge and beliefs concerning each element.

Teachers and paraprofessionals attended professional development training in math for a variety of reasons. Some participants reported that they were selected by their school administrators to attend, some attended because they were told they would receive college credit for attending, and some chose to attend because they recognized the training as an opportunity to learn new ways of teaching. The draw of receiving college credit was a boon to many participants who needed the credits to satisfy the NCLB requirements for "highly quality teachers and paraprofessionals."

It is likely that the reason(s) participants attended the professional development training affected their receptivity to learning, as well as the likelihood of them changing their practices. For example, several teachers from two rural districts in eastern Washington commented that they were grateful to receive the college credit for the courses they took as part of the EWU professional development; their motivation for attending was the fact that they would receive college credit. Observations of their classes revealed that their students taught one another. In advanced classes, teachers said, that was how students were expected to learn the new material—by helping one another and using the teacher as a coach. The project focused on teaching participants how to develop WASL-like assessments. Observations showed that teachers who did not teach

grades that took the WASL seemed to feel no compulsion to apply in their classrooms what they had learned during training.

In addition to how the receptivity of participants toward new ways to teach math was affected by their motivation to attend training, their attitudes and ideas about math influenced how they understood what they were doing and how they taught. For example, teachers who said during focus group discussions that they were using the very same strategies, for example, leading a discussion or inviting students to frame conjectures about a problem, understood and carried out these practices quite differently when their ideas about mathematics differed. Observations of teachers who taught the same courses revealed more than subtle differences in the instructional strategies used to communicate concepts to students. Teachers provided different types of examples to illustrate the same concepts, they began their lessons differently, their emphases varied, their choices of and use of materials during class differed, and the nature and extent of their engagement with students, as well as opportunity for students' involvement in a class, differed.

The classroom observations showed, among other things, how differently both teachers and paraprofessionals implemented what they had learned by their choices of instructional techniques to use with students. For example, what they had learned during training about having students discuss different ways to solve math problems meant quite different things to different teachers. For some it meant engaging students in lengthy debates about particular elements of story problems, while for others it meant directing students to answer specific questions about the story problems.

As a case in point, in the WSU project, one geometry teacher used manipulatives to teach concepts and engaged students in hands-on activities throughout nearly the entire class period. The class was noisy with student-to-student discussion and interaction as students used materials to solve problems. Since there was no "right way" to solve a problem, each student group engaged with the materials differently. In contrast, another geometry teacher relied almost exclusively on an overhead projector to present information and teach the same concepts. The class was quiet and orderly and, although students were involved in learning, the nature of their involvement was predominantly in answering teacher-directed questions. Similar differences were observed among participants who had attended the EWU and UW projects, while teaching the same course.

The differences in teachers' and paraprofessionals' ideas about mathematics instruction were particularly acute between elementary and high school teachers. High school teachers who taught specific subjects, such as algebra, geometry, trigonometry, probability, and calculus, held very different beliefs about how the content in those courses should be taught than did elementary teachers who introduced students to concepts taught from these areas. Arguably, one would expect there to be differences in how geometry was taught between elementary and high school. For one thing, the scope and depth of the content to be covered is different. However, the methods used to teach geometric concepts also were observed to be very different.

Elementary teachers, particularly at the lower grade levels, were much more inclined to consistently use a constructivist approach in teaching math concepts. This was particularly evident in the WSU project. Elementary teachers were observed sitting on the floor or at tables with groups of students using manipulatives such as Cuisenaire rods, geoblocks, unifix cubes, pattern blocks, and base-ten blocks to teach math concepts. High school teachers, by comparison, tended to use a more conventional approach to teaching math. These teachers began their lessons by instructing students from the front of the classroom, using an overhead projector to present information, then directing students to work independently at their seats on assigned problems. There was some variation to this pattern depending on the course, with students in advanced math courses working on their own from the beginning of the class. Indeed, some teachers interpreted reform-based math at the higher levels as students teaching each other.

Differences observed among elementary teachers appeared to depend on the grade level taught and the teachers' math content knowledge. Teachers who had a solid background and understanding of the math they were teaching were more inclined to try new ways of teaching. Their receptivity to changing their pedagogical skills was linked to their knowledge of the subject matter. This was most evident in the EWU and the EWU-P projects. Teachers' and paraprofessionals' ideas about how to teach math in these projects were based on how they themselves had been taught as students and, in the case of EWU, how they had been taught in their teacher preparation math methods course(s). Whether or not they were at all successful appeared in classroom observations to be directly related to how well they knew the math content they were teaching.

Teachers and paraprofessionals made their own sense of the training they received based on their own ideas and attitudes about math, oftentimes constructing classroom practices from what they had learned during training and how they themselves had been taught initially. Teachers and paraprofessionals blended elements of new ideas and practices with older instructional traditions, resulting in a patchwork of instruction that made sense to them now.

Professional development training that was consistent with instructional strategies in math curricula and materials used in participants' schools increased the likelihood of the training being transported directly into teachers' and paraprofessionals' classrooms.

It is one thing for teachers and paraprofessionals to embrace new ideas and beliefs about instruction but quite a different matter to change their classroom practices. Learning new ways of teaching is often slow and attaches to inherited ideas, intellectual structures, and familiar practices. When professional development training was congruent with the curricula and materials used in project schools, there was a greater likelihood that teachers and paraprofessionals would adopt the new ways of teaching math.

Indeed, whether participants would adopt the instructional strategies and practices introduced during training was dependent, to some degree, on whether their districts had

adopted curricula and materials that employed similar strategies. As noted earlier, the majority of project school districts had adopted new sets of curricula and materials that were generally identifiable with the new movement in math reform. The math series known as *Math Their Way*, for example, is a primary-level text and manipulative materials package, developed on the assumption that if students use concrete objects in learning mathematical operations and ideas, they will deeply understand the underlying concepts. This program was widely used in districts of math project participants.

Similar curricula and materials for the upper grades into high school had been adopted in many of the project school districts. Even though teachers remarked during focus group discussions and during sidebar conversations in their classrooms that they had fought the new curricula and materials because they required a radically different way of thinking about math, teachers and paraprofessionals were observed using a mix of conventional and reform-based math instruction with their students. The welter of influences both personal and professional, as well as the omnipresent state, district, and school mandates for improved student performance in specific areas of math, resulted in a mixture of practices operating simultaneously in each observed math classroom.

Although most projects involved schools which had adopted new curricula and materials, WSU was the only project to teach specific instructional strategies consistent with the curricula and materials adopted by participating districts. This was evident in nearly all of the classrooms observed. The UW, WWU, and EWU-P projects also taught a constructivist approach to teaching math, but the strategies used were not always the same strategies participants were using in their district's math curriculum. This left teachers and paraprofessionals, like their colleagues in reading projects, to pick and choose among the strategies they felt would work with their students.

For teachers and paraprofessionals who lacked a conceptual understanding of math themselves, this was particularly problematic, because they were faced with having to make decisions about appropriate strategies to teach math concepts that they themselves may not have understood. This issue was clearly evident in the EWU project, where many teachers at different grade levels were observed struggling to teach concepts they did not show evidence of understanding themselves. One fourth-grade elementary teacher became so frustrated teaching fractions using a constructivist approach that she eventually gave up after trying one manipulative after another to teach students differences among types of fractions. She eventually tried mixing how she had been taught fractions with a constructivist approach, but by then her students were as confused as she was. Frustration evolved into a classroom management problem that ended only when the bell rang.

Thus, while training in new ways of teaching math offered teachers a chance to depart from conventional math instruction and to develop expertise in reform-based math instruction, their use of the training did not mean that there would be a fundamental classroom change. One reason is that conventional practice has enormous staying power; indeed, teachers tacked on reform-based teaching where it fit for them, rarely replacing how they had taught for years with an entirely new set of practices. Another reason was

the lack of consistency between professional development training and the math curricula and materials used in classrooms. Teachers and paraprofessionals who worked in schools where there was a close match between the strategies taught during professional development and those that were part of the school-adopted curricula and materials were more likely to use what they had learned and to slowly incorporate more of what they were learning into their daily math lessons.

Still another reason change did not occur automatically was that the instructional strategies and materials taught during training did not offer a coherent curriculum with which teachers and paraprofessionals could help students learn concepts associated with specific mathematics topics. Although most projects offered a mixture of hands-on or real-life activities that could be used as a single lesson or a bit more, the activities were not part of a systematic inquiry into mathematics. This unwittingly gave license for participants to pick and choose among strategies that they felt would work best for their students, usually resulting in fewer of the new strategies being used.

Training in specific instructional strategies that could be seamlessly integrated into math lessons and that resulted in recognizable improvement in students' math skills and knowledge promised a greater likelihood of sustainable changes in classroom practice.

All instructional strategies are not created equal. Strategies that do not require sweeping changes in how one teaches have a greater propensity for immediate implementation than do strategies that require dramatic changes in instruction. Teachers rarely make wholesale changes in their instructional methods unless there is a district mandate such as a district adoption of new curricula and materials. Even then teachers do not willingly give up one set of practices for another. According to teachers, when their districts mandated a new math series that required them to change their practices, they fought to retain the conventional practices that were comfortable from years of implementation. Change was slow but as teachers now vowed, they would not turn back; the new ways of "doing math" made a lot more sense, their students liked it, and most important, their students understood math at a conceptual level. Short of a district mandate, what chance did professional development training in math instructional strategies—ones provided outside the unique context of the districts and schools teachers and paraprofessionals taught in—have for resulting in fundamental classroom change?

It turns out that the answer is not all that abstruse nor is it even surprising: change depended on ease of incorporation. When teachers and paraprofessionals received training in strategies that could be easily transported into their classrooms and implemented seamlessly into their work with students *and* they could see improvement in students' knowledge and skills, the participants immediately wove these strategies into their math instruction. This was most evident in the WSU project when teachers were taught strategies for helping students solve story problems similar to the ones on the WASL, and in the EWU-P and WWU projects where the math instructors knitted together learning math content with math instruction so that participants learned how to solve math problems and how to use the strategies to help students understand math concepts.

In contrast, instruction in how to differentiate instruction to meet the needs of students (WWU, WSU, EWU-P, and EWU) was less likely to be implemented because training did not provide examples based on real classroom situations with students whose difficulties could be analyzed and with practice in designing instruction to remedy these specific student difficulties. (WWU did provide instruction in how to expand math problems to accommodate more advanced students.)

Similarly, the UW project introduced teachers in how to use real-life experiences in designing curriculum replacement units for existing ones. However, this activity was less likely to be integrated into a math course because it meant teachers themselves had to do all of the design work themselves. Even teachers who borrowed existing curriculum replacement units from other teachers found it hard to apply them because the fit was not seamless.

Replacement units, the curriculum modules designed around specific topics and meant to replace entire units of mathematical texts, have been around for over a decade. Workshops in replacement units typically are designed to enhance teachers' knowledge of mathematical thinking, instructional methods, and mathematical subject matter in a relatively more integrated fashion than training in discrete instructional strategies. Training in curriculum replacement units is most effective when it dovetails with the ongoing reform efforts in schools and districts so that the new unit can easily replace an existing unit. Taken out of context, a new unit is much more difficult for teachers to integrate into their math courses as evidenced by teachers' comments during a focus group with UW participants and from classroom observations of teachers.

Teaching is a very personal endeavor, which is one of the major reasons why math classrooms looked so different even when teachers were teaching the same course. When a strategy could not be easily implemented into a teacher's practices, it was far less likely to become part of an arsenal of teaching tools. This did not mean it would never be used but rather that teachers had to figure out how that strategy might be incorporated into their practice. Classroom assistance with implementation of strategies could have ameliorated this difficulty.

Classroom assistance with use of math instructional strategies could have increased the potential for greater and more uniform changes in classroom practices, as well as providing participants individualized help in implementation.

With the exception of the WSU math project, trainers did not visit the classrooms of participants to assist with the implementation of instructional strategies. Although participants in most of the projects developed professional communities of practice where they had opportunity during training to discuss math issues and concerns and figure out collectively how to resolve them, individual assistance with classroom implementation was not provided. In projects, such as EWU, WWU, and UW, where participants struggled with implementation, such assistance could have made a difference in how much and how well participants were able to take what they were learning into their

classrooms. Classroom assistance also would have increased the likelihood that teachers would create ways to implement their learning, especially with students struggling with math, since trainers could have assisted on the spot with any difficulties teachers and paraprofessionals experienced. There is probably no other profession whose members work directly with individuals as change agents where those same members are taught sets of practices and left on their own to implement them without any oversight.

This same observation was discussed with regard to instructional strategies for reading and points out a significant omission in the design of both types of projects. The math projects taught important strategies that could be used by teachers and paraprofessionals in their work with students. The migration of instructional methods from the training venues outside teachers' and paraprofessionals' districts and schools into classrooms was uneven at best and simply not implemented at worst. A host of influences persuade participants about their choices of instructional strategies. Teachers are faced with classrooms of students representing a range of mathematics ability. Decisions about particular strategies to use require ongoing assistance, particularly with the adaptation of strategies to meet the needs of students performing at different levels.

Linking Washington's math EALRs and GLEs to instructional strategies could have enhanced participants' understanding of the relationship between curriculum and instruction.

Although the relationship between their proposed training and specific EALRs was identified as important in many of the project proposals, none of the math projects took the EALRs or associated GLEs inside their training and connected them to the strategies they were teaching. The EALRs and WASL are linked and would have provided a natural connection to make for participants, particularly in demonstrating the relationship between instructional strategies and the specific EALRS and GLEs at different grade levels. Additional information about how to adapt strategies to meet GLEs at different grade levels, and with students exhibiting different types of math problems, would have made learning the instructional strategies more powerful. In addition, participants would have learned specific tools have the potential for improving all students' performance on the WASL. To illustrate, math EALR 2 states:

The student uses mathematics to define and solve problems.

There are specific components to each EALR. For example, for EALR 2 at grade 2, there are two components:

2.1: Understand problems.
2.2: Apply strategies to construct solutions.

Each component consists of specific GLEs for each grade level. At grade 2, component 2.1 has one GLE:

> 2.1.1: Understand how to define a problem in a familiar situation with teacher guidance.

Included with each GLE is an example of how to implement the GLE. For example, for GLE 2.1.1 the following information is provided:

- State information presented in a teacher-led discussion to determine if there is a problem (e.g., a classroom is having a play and each student invited two guests. Chairs are needed for the guests. There are some chairs available in the classroom).
- State the problem in own words (e.g., there aren't enough chairs for the guests. How many more chairs do we need?).
- Generate questions that would need to be answered in order to solve the problem (e.g., how many guests are attending? How many more chairs do we need?).
- Identify known and unknown information with teacher guidance (e.g., known ─ number of students, number of guests invited, number of chairs in classroom; unknown ─ number of guests attending, number of chairs needed). [1.1.5] (The 1.1.5 reference is GLE 1.1.5 (Computation) under component 1 for EALR 1.)

If teachers and paraprofessionals had been taught specific strategies they could use with EALRs and GLEs for the grade levels at which they teach, they would have been able to see the relationships among the WASL, EALRs, GLEs, curriculum, and instruction for a whole grade level. Learning how to adapt instructional strategies to help students with particular math problems meet the EALRs and GLEs would have provided a more powerful teaching tool than just learning strategies which could be used at different times during a math lesson.

Analyzing a variety of performance-based assessments, such as students' work samples, can inform teachers' decisions about appropriate instructional strategies. .

In all five math projects, teachers and paraprofessionals learned about and had opportunity to practice the instructional strategies introduced during their professional development training. However, one of the most powerful sources of information about student learning—analyzing students' work samples—was not used as a tool for training teachers and paraprofessionals. Analyzing student work is a powerful analytic tool that can be used by groups of teachers to understand the math problems of students. It goes beyond the identification of areas of difficulty, such as number sense, measurement, and probability and statistics, identified on standardized tests. When teachers and paraprofessionals are able as a group to analyze student work samples and then work together to understand the difficulties students are exhibiting, they are better equipped as professionals to determine appropriate instructional strategies. Discussing students' math

difficulties as a group and making decisions about how to help students improve their learning is a very powerful learning experience for teachers and paraprofessionals and centers the assistance they will provide to students directly on the problems students are actually experiencing.

This type of professional development training is not to be confused with introducing participants to strategies they can use to "teach to a test." Teaching to a test has had only a modest impact on changes in practices (Cohen and Hall, 2001) and is frowned upon in many educational circles. Instead, teaching participants how to analyze student work samples offers them important tools for understanding their students' thinking as they solve math problems.

Indeed, unraveling errors in students' thinking gives participants opportunities to discuss as a group the nature of the math problems students are exhibiting and to develop strategies that are appropriate given these specific difficulties. Equally important to discuss is how to adjust curriculum and adapt specific strategies to meet the needs of students with a range of difficulties. This is especially important for helping ELL and special needs students to become proficient in math.

Content Knowledge

Capable teachers must know many things, but knowledge of the subject matter is central.

Over 20 years ago Lee Shulman (1986) was the principal investigator in a large research project at Stanford University that focused on the role of subject matter knowledge in learning to teach. He and others found that without sufficient subject matter knowledge teachers could not plan for instruction nor could they develop a unit that included appropriate instruction for their students. In Pamela Grossman's seminal study about teacher knowledge and teacher education (1997), she concluded that without frameworks of understanding about the subject matter they were to teach, teachers' ability to teach was restricted, limiting not only what they could teach but how they taught.

Subject matter knowledge includes knowledge of the content of a subject area as well as knowledge of the substantive and syntactic structures of the discipline. It also includes knowledge of major facts and concepts within the field and the relationships among them. The substantive structures of the discipline refer to the various paradigms within the field that affect both how the field is organized and the questions that guide further inquiry. The degree to which teachers possess knowledge of substantive and syntactic structures of the subject(s) they teach may influence how they represent the subject to students. As Kerr (in Grossman, 1990, p. 7) suggests:

> So no matter how skillful one might be in getting students to learn things, the quality of one's teaching depends in important part upon one's understanding the subject well enough both to choose appropriate

learnings and to design plans that do not violate the nature of the subject matter.

Without knowledge of the structures of the subjects they teach, teachers may misrepresent both the content and the nature of the discipline itself. Teachers' knowledge of the content to be taught also influences what and how they teach, the nature and extent of classroom discourse, and how they critique and use textbooks and materials.

Content knowledge is thus the critical underpinning to teaching subject matter to students. Without a comprehensive knowledge of the subject content—its paradigmatic structure, concepts, facts, organization of knowledge, methods of inquiry, representations of knowledge and ideas and so forth—teachers do not have a foundation upon which to make important teaching decisions. Indeed, without content mastery, it is not possible to develop curriculum units, design instructional activities, develop classroom assessments, probe students' thinking and understanding of concepts, answer students' questions, help students acquire a deeper understanding of the subject, or anticipate individual student's prior knowledge in order to scaffold instruction.

Teachers' perceptions about their knowledge of the subjects they were teaching as expressed during focus groups differed from what was observed in many classrooms. Many teachers did not know what they did not know. When asked if they felt they had sufficient knowledge in the math areas they were teaching, all respondents replied in the affirmative. However, during classroom observations, particularly in elementary intermediate grades and in middle school grades, it was apparent that many participants did not have sufficient knowledge about the math content they taught and thus could not help students learn the content. Their newly learned instructional strategies were of little use because they could not be attached to a knowledgeable understanding of math concepts.

Being literate in the content areas of math and/or reading is a necessary precursor for helping students meet State standards.

Having knowledge of the subject content students need to learn is a prerequisite for teachers helping students learn concepts and skills that will be assessed on the WASL and ITBS/ITED. Four of the five math projects did not observe participants teaching math in order to determine their levels of math literacy nor did they formally assess teachers' knowledge and skills in math and use the information to build their professional development. Nevertheless, three math projects—WWU, WSU, and EWU-P—decided to teach participants math concepts associated with specific math topics (e.g., fractions; algebra; measurement; geometry, etc.). In the three projects, the math instructors believed strongly that for teachers to teach students to understand math, the teachers themselves must have a conceptual understanding of math.

The EWU-P project is an exemplary model of how to teach anxiety-ridden and math-phobic adults a conceptual understanding of math. The training in this area was so successful that paraprofessionals waxed confidence, joy, and excitement about what they

were learning. Participants reported that for the first time in their lives they understood math. They could now understand from a student's perspective the precise nature of the difficulty the student was experiencing in trying to learn math concepts and, moreover, how to intervene.

The math instructor used a constructivist approach to teaching math, and this hands-on experience concretized participants' understanding of concepts. For example, paraprofessionals described their new-found understanding of fractions by illustrating the kinesthetic approach the instructor used to teach the difference between vulgar and decimal fractions. The only unfortunate aspect of participants' increased understanding of math was that they worked under the auspices of teachers who sometimes were and sometimes were not willing to let them directly teach math in order to apply their learning. This concern emerged both in the fall and the spring focus group discussions.

Observations of teachers in other math projects highlighted the need for training in math content, especially for teachers who are using new reform-based curricula and materials. This is especially critical given how teachers select instructional strategies when teaching math. Without a solid understanding of math concepts themselves, teachers are unable to teach and modify curriculum units, let alone accommodate a range of student knowledge and skills.

Reading is a unique content area. At the elementary level in particular teachers tend to think of reading as an activity where students are taught specific skills *to read*. Professional development usually takes the form of introducing participants to instructional strategies that will aid students in learning how to read, as well as to increase students' understanding of what they are reading. The three reading projects focused their professional development attention on these areas. Observations of classrooms revealed that teachers were adept in using the strategies they had learned (even though the often used them on a trial and error basis).

However, what was missing was evidence that participants understood the content of reading. As a result, teachers struggled with teaching reading. The instructional strategies they had been taught and were using such as think-alouds, deducing meaning from text, making predictions, and drawing inferences were one-dimensional because teachers and paraprofessionals lacked a more comprehensive understanding of literature––literary concepts, criticism, analysis, and context (culture, language, people, period of time)—that motivate students to read, enrich students' ability to read, heighten their joy of what reading can provide, and increase their language capacity to discuss and write about what they have read. The *Open Court Reading* program utilizes literature as a foundation to teach students not only how to read but also how to learn though reading. Students read fiction, non-fiction, poetry, drama, and other forms of literature in order to gain a larger understanding of how literary works reflect the period of time when they were written, as well as how they influence how our thinking about the present and future. This requires that teachers and paraprofessionals think differently about what they are teaching when they teach reading in order to make reading more accessible to students.

Unfortunately, many teachers and paraprofessionals were observed either reading the assigned story to students, listening to students struggle while they read the story without providing assistance, listening to students read but not engaging them in a discussion about the story, discussing the story but asking only rhetorical questions, or asking open-ended questions and then not knowing what to do with students' answers. Not surprisingly, the usual result was student disinterest in reading, which then often manifested itself as a classroom management problem. Given the relatively low WASL reading scores in many of the districts and schools in which participants were teaching, it would have been propitious for teachers and paraprofessionals to learn the content of reading in addition to learning instructional strategies. Ensuring that teachers had a good grasp of the EALRs and GLEs in reading could have served as the foundation for teaching reading content.

Special Topics

In addition to the traditional topics covered in reading and math professional development training—subject content, instructional strategies, State policy, and assessment—several projects taught a variety of other topics, some of which were only tangentially related to math and reading. The special topics taught in different reading and math projects are illustrated in Figure 7.

Figure 7
Special Topics Taught in Different Reading and Math Projects

Content Area	Special Topics
Math	• Student participation • Building a professional learning community • American Indian education • Feelings about math
Reading	• Roles and responsibilities of paraeducators • Working with teachers • Ethical and professional standards • Communication with teachers and other adults • Behavior management • American Indian education

Interestingly, when the special topics taught in specific projects were combined under one umbrella category, the category often resulted in larger pre to post gains in professional growth than did training in other topics taught in the project. One likely reason is that this is the one area where trainers carefully aligned the expressed needs of participants with training. For example, the primary instructor in the WWU project felt strongly that she had to deal directly with participants' negative feelings about math

before she could teach math content, hence the topic called "feelings about math." Similarly, professional development training that brought together teachers from isolated rural districts (e.g., WSU) was able to meet the needs of these teachers by structuring professional learning communities or networks in which teachers could have time together to discuss what they were learning both during and outside of training. Ratings of this special topic were high, and participating teachers echoed one another about the power of the networks during the focus group discussion. Similarly, paraprofessionals in the HC reading project worked closely with teachers but felt they needed better methods for communicating with teachers. This topic was included in the training.

Summary and Recommendations

Unequivocally, the professional development activities improved the quality of K-12 teachers and paraprofessionals and increased the academic content knowledge and instructional skills of those teachers and paraprofessionals. Participants learned and practiced new instructional strategies, they learned about State policy related to reading and math, they learned different assessment strategies, they learned how to integrate curriculum and instructional strategies across content areas, and they overcame negative experiences they had had with certain subject matter. Their learning increased exponentially and solidified because they were able to meet together as a group during monthly meetings to discuss what they were learning, how this affected their students, what strategies were effective, and how to adapt what they had learned to make it more effective with the students they taught. Teachers and paraprofessionals teaching in isolated rural areas developed important networks wherein materials could be shared, issues discussed, and concerns resolved. Real-life experiences with the subject matter taught participants how to design units of instruction that would be meaningful to students.

However, there were some unfounded assumptions made about participants' knowledge of the subject matter that affected their potential to use everything they had learned. Because trainers did not observe the classrooms in which teachers taught, examine the texts and materials used in the schools teachers taught, or acquire information about the state, district, and school influences on participants' ability to use what they were to learn, the potential for participants to successfully apply what they had learned was attenuated. Many teachers, particularly in math, lacked conceptual knowledge about the subject matter they were teaching. Had participants been able to spend time during their monthly meetings analyzing student work samples, it would have been obvious to trainers that many participants simply lacked a coherent understanding of the concepts and skills they needed to know to help students learn. This was most evident in elementary and middle school math classes. The surveys and focus group discussions did not reveal this finding, but the classroom observations did, and these observations were powerful in clarifying a glaring omission in the professional development training.

In addition to including analyses of student work during training, trainers could have used the State's EALRs and GLEs to frame the professional development. The

State standards are linked to the State assessment, and participants could have learned how to link subject matter content at the grade levels they taught with specific instructional and assessment strategies. With the exception of the EWU-P project, there was no real professional development curriculum taught to participants. Although each trainer carefully prepared what she or he wanted participants to learn, the majority of the training simply introduced participants to instructional strategies, which resulted in participants selecting specific strategies or elements of strategies and weaving them into their existing teaching repertoire. Given how elements of the professional development in each project were selected for inclusion in teachers' and paraprofessionals' work, it was hard to discern a change in teaching practices and even more difficult to attribute any change in students' achievement directly to the professional development.

2. Did professional development provided to K-12 teachers and paraprofessionals result in improvement in students' academic achievement?

    a. Did students' academic achievement improve in the areas of math and/or reading?
    b. Did student achievement improve for all students?

    State assessment data were used to answer this evaluation question.

To answer the evaluation questions and sub-questions, the unit of analysis used was the school. Comparisons were made of the aggregate school scores of the State's two assessments—WASL and ITBS/ITED—in both math and reading from two points in time: the year preceding the training (2002-03) and the end of the year of the training (2003-04). In addition, two additional comparisons of assessment data were made. In both, the unit of analysis was the classrooms of participants and non-participants who taught the same grade in the same school. The first set of these analyses used State assessment data (comparisons of aggregate classroom scores of both the ITBS and WASL, as well as aggregate classroom strand scores of the WASL). The second set of classroom comparisons were of local district or school assessment data.

Unfortunately, there were incomplete data sets for all comparisons. This occurred for a variety of reasons: assessment data were not available at one of the two points in time in which comparisons were made, participating teachers did not teach at the grades the WASL or ITBS/ITED were administered, and/or there were no comparison teachers within a school (only one teacher at a grade level or subject area). Incomplete data sets complicate analyses because there is insufficient data from which to draw meaningful comparisons. Although several projects had multiple teachers from a school district who participated in the training, many schools had only one participating teacher per grade level or subject area. In this situation, adding schools to the data set would have made no difference in terms of resolving the analysis problems. Indeed, in the majority of cases, additional schools would have resulted in additional problems, since the schools were too small to have multiple teachers per grade level or subject. Appendix A includes the data from each of the projects..

The first set of Figures (8-16) show comparisons at the school level. Figures 8 through 12 illustrate changes in WASL math and reading scores from 2002-03 to 2003-04. Figures 13 through 17 illustrate changes in ITBS/ITED math and reading scores from 2002-03 to 2004-05. In the figures, a designated letter such as A or B identifies schools.

Nearly all schools show a positive change in WASL scores for both math and reading between the year preceding training and the end of the school year during which training took place, as Figures 8 through 12 illustrate. In most schools, the positive change in scores was small, but a few schools (EWU [S and T], SMC [N)] showed dramatic positive changes in school WASL scores from 2002-03 to 2003-04.

SMC [N] is one of the schools in the SMC project that had several teachers who participated in the training. The school had adopted the Open Court Reading program, everyone had received training in how to use the program, and the teachers were actively engaged in a variety of reading activities. Teachers shared what they had been learning with their colleagues and the climate in the school was positive and geared toward helping all students succeed in school. EWU [S and T] had adopted new math series, and middle school teachers were very involved with the new way of teaching; they were enthusiastic about the differences they observed in their students' conceptual understanding of math with the new instructional practice. The new math series used a constructivist approach to teaching and included the same types of problems that appeared on the WASL. In SMC [N] it is possible that the training provided a value-added component to what the school was already engaged in; however, in EWU [S and T], the greatest contributor to the changes in WASL scores was likely the adoption of a new math series.

Figure 8
Changes in Aggregate School WASL Math Scores From 2002-03 to 2003-04
by Project and School
Grade 4

Project (School)	Change†
WWU (A)	+2.8%
WSU (J)	+4.2%

† + = Positive change in aggregate score

Figure 9
Changes in Aggregate WASL Math Scores From 2002-03 to 2003-04
by Project and School
Grade 7

Project (School)	Change†
UW (D)	+13.9%
UW (E)	+3.1%
UW (F)	+11.7%
WWU (A)	+. 80%
WSU (K)	–8.3%
EWU (Q)	+14.2%
EWU (S)	+25.8%
EWU (T)	+24.2%

† + = Positive change in aggregate score
– = Negative change

Figure 10
Changes in Aggregate WASL Math Scores From 2002-03 to 2003-04
by Project and School
Grade 10

Project (School)	Change†
UW (B)	+4.8%
UW (C)	+6.4%
WSU (G)	+3.4%
EWU (Q)	– 12.9%
EWU (R)	+7.1%
EWU (S)	+ .8%
EWU (T)	+19.0%

† + = Positive change in aggregate score
– = Negative change

Figure 11
Changes in Aggregate WASL Reading Scores From 2002-03 to 2003-04
by Project and School
Grade 4

Project (School)	Change†
SMC (N)	+43.3%
SMC (O)	+5.2%

† + = Positive change in aggregate score

Figure 12
Changes in Aggregate WASL Reading Scores From 2002-03 to 2003-04
by Project and School
Grade 7

Project (School)	Change†
SMC (P)	+9.7%

† + = Positive change in aggregate score

In contrast to the mostly positive changes in school WASL math and reading scores from pre training to post training, changes in school ITBS math scores from 2002-03 to 2003-04 were negative at grades 3 and 7 and mixed at grade 9, while reading scores were positive at grades 3 and 6 (see Figures 13 through 17). It is difficult to know precisely what accounted for the decline in math scores (for many schools) on the ITBS at each of the grade levels (for many schools). However, since the focus has been on improving WASL scores, improvement on the WASL may have been at the expense of teaching students how to perform well on the ITBS. Each assessment requires students to exhibit their knowledge and skills about math differently, in particular how they will solve problems. The WASL focuses on students' ability to demonstrate their understanding of math problems, to deduce and define what the math problems are asking, and then to demonstrate in writing their solutions to the problems. The knowledge and skills students must exhibit to do well on the WASL types of problems are different from those they must demonstrate to perform well on the ITBS assessment.

Figure 13
Changes in Aggregate ITBS Math Scores From 2002-03 to 2003-04
by Project and School
Grade 3

Project (School)	Change†
WWU (A)	– 15
EWU (R)	– 12

† – = Negative change in aggregate score

Figure 14
Changes in Aggregate ITBS Math Scores From 2002-03 to 2003-04
By Project and School
Grade 6

Project (School)	Change†
WSU (H)	– 9
WSU (I)	– 17

† – = Negative change in aggregate score

Figure 15
Changes in Aggregate ITBS Math Scores From 2002-03 to 2003-04
by Project and School
Grade 9

Project (School)	Change†
UW (B)	+ 3
UW (C)	– 7
WSU (G)	– 1
WSU (H)	– 8
EWU (Q)	–17
EWU (R)	+ 18
EWU (S)	– 4
EWU (T)	– 8

† + = Positive change in aggregate score
– = Negative change

In contrast to the variability in ITBS school math scores from the pre-training to the post-training year, changes in ITBS reading scores were consistently positive. The positive changes in ITBS reading scores at grades 3 and 6 in two of the three reading projects—HC [L] and SMC [N]—are consistent with the emphases of reading at the elementary and middle school levels. As noted earlier, teachers in SMC [N] were actively engaged as a faculty in improving the reading levels of all students in the school. A combination of teachers and paraprofessionals, as well as other classroom assistants, worked with groups of students throughout each day. Middle school teachers at SMC [O] also taught reading across the curriculum, involving students in a variety of reading projects and activities.

Figure 16
Changes in Aggregate ITBS Reading Scores From 2002-03 to 2003-04
by Project and School
Grade 3

Project (School)	Change†
HC (L)	+12
SMC (N)	+2

† + = Positive change in aggregate score

Figure 17
Changes in Aggregate ITBS Reading Scores From 2002-03 to 2003-04
by Project and School
Grade 6

Project (School)	Change†
SMC (N)	+6
SMC (O)	+4

† + = Positive change in aggregate score

The second set of figures (18-29) illustrates differences between students of participating and non-participating teachers working in the same school, subject, and grade level in math and reading. Figures 18 through 22 illustrate differences in the State's WASL scores, and Figures 23 through 29 illustrate differences in the State's ITBS scores.

As Figures 18 through 20 show, there was a lot of variability in the WASL math scores for students of participating and non-participating teachers. Indeed, in some

projects, the students of participating teachers had higher scores than those of their non-participating colleagues, while in other projects the reverse was true. The variability occurred both within and across grades and within and across projects. For example, at grade 4, students of participants at WSU [J] had a lower aggregate score than did the students of non-participating teacher(s). However, the pattern was reversed at grade 10, albeit in a different school.

Nevertheless, there was a dramatic positive difference in WASL math scores between students of the participating and non-participating teacher(s) at WSU [G]. Similar differences within a project are present at UW schools and grade levels. At grade 7, the scores for students of participating and non-participating teacher(s) was the same, while at grade 10 students of participants at one school outscored students of non-participants at one UW school but not the other.

It would be easy to attribute the changes between scores from students of project participants and non-project participants to the actual teachers, but there are a host of other influences that may have contributed to the differences. The composition of students in a class, student tenure in the school, the length of time teachers had been teaching math, the amount of professional development activities teachers had participated in and in what areas, the elements of the HECB training which had found their way into the classrooms of participating teachers, and the number of ELL and special needs students in each classroom—all affect how well students perform on a math assessment.

Figure 18

Participants' and Non-Participants' Students' WASL Math Scores 2003-04
by Project and School
Grade 4

Project (School)	Participant	Non-Participant
WSU (J)	52.3% (N = 44)	64.7% (N = 34)
WWU (A)	75.0% (N = 7)	57.0% (N = 14)

Figure 19

Participants' and Non-Participants' Students' WASL Math Scores 2003-04
by Project and School
Grade 7

Project (School)	Participant	Non-Participant
UW (F)	64.4% (N = 73)	64.4% (N = 101)
EWU (Q)	53.3% (N = 15)	35.3% (N = 17)

Figure 20

Participants' and Non-Participants' WASL Students' Math Scores 2003-04
by Project and School
Grade 10

Project (School)	Participant	Non-Participant
UW (B)	76.1% * (N= 46)	50.7% (N = 67)
UW (C)	12.5% (N = 16)	51.2% (67)
WSU (G)	75.0% * (N = 59)	10.0% (N = 50)

* $p <= .10$

The same type of variability found in the comparisons of WASL math scores of students from classrooms of participating and non-participating teachers' was present in the comparisons of WASL reading scores. However, due to a limited sample, the comparisons are only of student scores from classrooms of participating and non-participating teachers in three schools in the SMC project (see Figures 21 and 22). Depending on the school and grade level, students in one setting outperformed students in the other setting. For example, at grade 4, students of participating teachers outperformed students of non-participating teachers, although the differences were not dramatic. In both elementary schools, faculty were actively engaged in reading across the curriculum; indeed, classroom life centered on reading. The principal at SMC [U] was involved in the training and took an active role in overseeing curriculum and instruction in that school. It is possible that the training added a motivational component, as well as reinforcing whatever teachers and paraprofessionals were already doing in their classrooms. In all three schools, teachers and paraprofessionals described workshops they had attended prior to the HECB grant and their constant efforts to integrate their learning into their instructional repertoire.

Figure 21
Participants' and Non-Participants' Student WASL Reading Scores 2003-04
by Project and School
Grade 4

Project (School)	Participant	Non-Participant
SMC (N)	88.0% (N = 25)	88.5% (N = 26)
SMC (U)	74.4% (N = 43)	63.6% (N = 33)

Figure 22
Participants' and Non-Participants' Student WASL Reading Scores 2003-04
by Project and School
Grade 7

Project (School)	Participant	Non-Participant
SMC (P)	53.0% (N = 150)	56.0% (N = 18)

Figures 23 through 27 compare the ITBS math scores for students of participating and non-participating teachers. A flip-flop pattern, similar to the pattern of math and reading WASL scores, emerged in these analyses. Across and within schools, as well as across and within grades and subjects, the patterns of students' ITBS scores are nearly identical, with students of some participants scoring higher than students of some non-participants and students of some non-participants scoring higher than students of their participating colleagues. For example, at grade 3, the students of participating teacher at WWU [A] outscored the students in the non-participating teacher's class. However, at grades 4 and 5 in the same school, the students in the non-participating teacher's classroom outperformed the students in the participating teacher's classroom. At grade 9 in the UW project, the differences in scores between the two student groups depended on, among other things, the school the participants' schools teachers and the particular non-participating teachers.

The host of influences on students' scores described earlier was likely present in these schools as well. This is especially so at both the WSU [G] and EWU [Q] schools, where the nature of the training was not aligned with the ITBS. In fact, the entire focus of the training in the EWU project was to help teachers design WASL-like assessments they could use to give their students practice before taking the exam in the spring. Notwithstanding the focus of training in both projects, it is possible that the training in math at a general level contributed to the dramatic differences in scores between students of participants and non-participants.

Figure 23
Participants' and Non-Participants' Student ITBS Math Scores 2003-04
by Project and School
Grade 3

Project (School)	Participant	Non-Participant
WWU (A)	61 (N = 12)	37 (N = 10)

Figure 24
Participants' and Non-Participants' Student ITBS Math Scores 2003-04
by Project and School
Grade 4

Project (School)	Participant	Non-Participant
WWU (A)	58 (N = 7)	64 (N = 14)

Figure 25
Participants' and Non-Participants' Student ITBS Math Scores 2003-04
by Project and School
Grade 5

Project (School)	Participant	Non-Participant
WWU (A)	86 (N = 7)	39 (N = 10)

Figure 26
Participants' and Non-Participants' Student ITBS Math Scores 2003-04
by Project and School
Grade 8

Project (School)	Participant	Non-Participant
UW (D)	43.6 (N = 22)	55.5* (N = 66)

* $p <= .10$

Figure 27
Participants' and Non-Participants' Student ITBS Math Scores 2003-04
by Project and School
Grade 9

Project (School)	Participant	Non-Participant
UW (B)	69.0* (N = 23)	54.0 (N = 84)
UW (C)	53.5 (N = 21)	64.9 (N = 34)
WSU (G)	83.0* (N = 33)	50.0 (N = 76)
EWU (Q)	70.4 (N = 11)	29.7 (N = 15)

* p < = .10

Figures 28 and 29 illustrate the differences in ITBS reading scores for students of participants and non-participants in two different schools in the SMC project schools.. The differences in student scores in both grade levels can be attributed to the many influences described earlier, including the training.

Figure 28
Participants' and Non-Participants' Student ITBS Reading Scores 2003-04
by Project and School
Grade 3

Project (School)	Participant	Non-Participant
SMC (N)	55 (N = 19)	71 (N = 18)

Figure 29
Participants' and Non-Participants' Student ITBS Reading Scores 2003-04
by Project and School
Grade 6

Project (School)	Participant	Non-Participant
SMC (O)	51.0 (N = 15)	48.7 (N = 93)

Interpreting aggregate data even at the participant level can mask the effects of training in specific areas within an assessment, especially when the aggregate score represents elements of a content area that are not covered during training. Given this possibility, project directors were asked to identify the specific WASL strands that were most closely aligned with the content of their training. The WASL data analyzed earlier

were disaggregated by strand (e.g., number sense, problem solving, and communication in math; literary analysis and composition in reading), and comparisons of the performance of students in each type of classroom (participant and non-participant) were made. The third data set (Figures 30-34) illustrates the differences between strand scores of students from classrooms of participating and non-participating math teachers.

As all five figures show, when the aggregate scores of individual strands are compared, there is even greater variability in the performance of students from classrooms of participating and non-participating teachers—within schools at the same grade level and across schools in the same project. Overall, students of both participating and non-participating teachers did better in some strands than in others. For example, as Figure 30 illustrates, in WWU [A] at grade 4, students of participating teachers scored better in problem solving and communication than they did in number sense. Since the project director identified all three strands as training foci, it is difficult to know why the students in non-participating teacher' classrooms outperformed students in the participating teacher' classrooms only in number sense. A similar distribution of scores is exhibited at EWU [Q] at grade 7. Conversely, students in the non-participating teachers' classroom outperformed the students in the participating teacher's classroom in all three strands at WSU [J]. Without observing the teaching in the non-participant teacher's classroom, it is difficult to provide an explanation for these differences.

Figure 31 is interesting because of the differences shown between two schools participating in the same project—UW. In UW [B] the students in the participating teacher's classroom outperformed the students in the non-participating teacher's classroom on all four strands. However, at UW [C] the reverse was true.

The performance of students in the participating teacher's classroom at WSU [G] is very impressive. In all three strand areas, students greatly outperformed their peers in a non-participating teacher's class. However, as rewarding and attractive as it would be to attribute the differences between the two groups of students to the teacher training, it is only possible to report that the training likely contributed to the dramatic differences in students' scores.

What all of these data point to is the difficulty of attributing changes or the lack of changes to professional development training in specific areas within math. Training in specific areas is only one factor that may affect students' performance in those areas. Another factor may be the way in which State assessments are designed, with only one or two questions per strand, giving students insufficient opportunities to demonstrate their knowledge and skills

Figure 30
Participants' and Non-Participants' Student Math WASL Strand Scores Related to Training Topics 2003-04
by Project and School
Grade 4

Project (School)	Participant	Non-Participant
WWU (A)	N = 8 (75%) Num Sense = 50.0% Prob Solv = 62.5% Commun = 75.0%	N = 14 (57%) Num Sense = 64.3% Prob Solv = 28.6% Commun = 42.9%
WSU (J)	N = 44 (52.3%) Prob Solv = 43.2% Commun = 65.9% Connect = 54.5%	N = 34 (64.7%) Prob Solv = 76.5% Commun = 79.4% Connect = 70.6%

Figure 31
Participants' and Non-Participants' Student Math WASL Strand Scores Related to Training Topics 2003-04
by Project and School
Grade 7

Project (School)	Participant	Non-Participant
EWU (Q)	N = 15 (53.3%) Num Sense = 40.0% Prob Solv = 46.7% Commun = 53.3%	N 17 (35/3%) Num Sense = 47.1% Prob Solv = 29.4% Commun = 35.3%

Figure 32
Participants' and Non-Participants' Student Math WASL Strand Scores Related to Training Topics 2003-04
by Project and School
Grade 10

Project (School)	Participant	Non-Participant
UW (B)	N = 46 (76%)* Num Sense = 58.7% Measure = 47.8%* Stats = 47.8%* Prob Solv = 54.3%*	N = 67 (50.7) Num Sense = 43.3% Measure = 26.9% Stats = 26.9% Prob Solv = 29.9%
UW (C)	N = 16 (12.5%) Num Sense = 31.3% Measure = 18.8% Stats =37.50% Prob Solv = 35.1%	N = 67 (50.7%) Num Sense = 46.3% Measure = 36.6% Stats = 46.3% Prob Solv = 41.5%
WSU (G)	N = 59 (75.0%)* Prob Solv = 76.7%* Commun = 76.7%* Connect = 51.7%*	N = 50 (10.0%) Prob Solv = 17.0% Commun = 26.4% Connect = 3.8%

* $p <= .10$

The previous set of figures (30-32) illustrates differences between the math WASL strand scores of students in classrooms of participating and non-participating teachers. Figures 33 and 34 display the differences in the reading strand scores for students in two different schools and grades, compared by their participating and non-participating teachers from the same reading project—SMC. The variability found among the scores in different math strands was also present among the scores in different reading strands. For example, In SMC [U] at grade 4, there was variability in students' scores depending on the particular strand, with students in the participating teacher's classroom outperforming their peers in the other classroom in literary analysis and information analysis. However, in SMC [P] at grade 7, students in the non-participating teacher's classroom outperformed the comparison students in all four strand areas.

Participating teachers in both schools were observed, and one possible explanation is that elementary teachers in SMC [U] were better prepared, at least in some areas, than the middle school participating teachers in SMC [P]. This might account for the differences. However, it is more likely that differences within classrooms—student and teacher variability—were greater in one classroom than the other classrooms and that this variability accounted for the differences shown in Figure 33. Reading activities in

grades 4 and 7 are very different. At grade 7, as well, there were several classrooms of participating teachers compared with only one classroom of a non-participating teacher, and at grade 4 only one classroom of a participating teacher was compared with one classroom of a non-participating teacher. All of these factors may have contributed to the differences shown in Figures 33 and 34.

Figure 33
Participants' and Non-Participants' Student Reading WASL Strand Scores Related to Training Topics 2003-04
by Project and School
Grade 4

Project (School)	Participant	Non-Participant
SMC (U)	N = 25 (88%) Lit Comp = 64.0% Lit Anal = 88.0% Info Comp = 84.0% Info Anal = 72.0%	N = 26 (88.5%) Lit Comp = 76.9% Lit Anal = 84.6% Info Comp = 88.4% Info Anal = 61.5%

Figure 34
Participants' and Non-Participants' Student Reading WASL Strand Scores Related to Training Topics 2003-04
by Project and School
Grade 7

Project (School)	Participant	Non-Participant
SMC (P)	N = 150 (53.0%) Lit Comp = 40.2% Lit Anal = 42.3% Info Comp = 45.0% Info Anal = 51.0%	N = 18 (56.0%) Lit Comp = 44.4% Lit Anal = 61.1% Info Comp = 50.0% Info Anal = 61.1%

Schools were also asked if they had administered any assessment tests in addition to the required WASL and ITBS. Schools in two projects—EWU and SMC—had used a test called a local assessment in grades 7 and 9, while school N in the SMC project had used two different assessments called the ORI and the STAR at grade 4. These data were also analyzed, and the fourth and final sets of data in Figures 35 through 37 illustrate the differences in scores for students of participating and non-participating teachers.

The local assessment administered in EWU project schools takes place at three different times during the school year. As Figures 35 and 36 illustrate, students in the participating teacher's classrooms outperformed the students in the non-participating teacher's classrooms at nearly all points in time for each of the two grades. Results from the two alternative assessments used in SMC [N] show that, on one test, students in the participating teacher's classroom outperformed students in the non-participating teacher's classroom, while the reverse was true for the other assessment. Again, it is difficult to know why the differences occurred, but it is likely that a host of student and teacher variables contributed to the observed pattern.

Figure 35
Participants' and Non-Participants' Student Math Scores:
Local Assessment
by Project and School
Grade 7

Project (School)	Participant	Non-Participant
EWU (Q)	N = 15 Time 1 Total=49.5% Time 2 Total=41.5% Time 3 Total=34.5%	N = 16 Time 1 Total=43.6% Time 2 Total=37.9% Time 3 Total=36.1%

Figure 36
Participants' and Non-Participants' Student Math Scores:
Local Assessment
by Project and School
Grade 9

Project (School)	Participant	Non-Participant
EWU (Q)	N = 11 Time 1 Total=34.3% Time 2 Total=23.9% Time 3 Total=37.5%	N = 15 Time 1 Total=24.1% Time 2 Total=13.7% Time 3 Total=22.2%

Figure 37
Participants' and Non-Participants' Student Reading Scores:
QRI and STAR
by Project and School
Grade 4

Project (School)	Participant	Non-Participant
SMC (QRI:N)	N = 39 3.67	N = 3 3.15
SMC (STAR:N)	N = 45 4.14	N = 37 4.23

Summary and Recommendations

Overall, the math and reading scores of students from classrooms of project participants increased from pre training to post training, with the most dramatic changes occurring on the WASL rather than the ITBS. The increase in students' scores on the WASL is important because, although training was not directed to its specifics, the nature of the training in both reading and math projects was geared more to helping the performance of students on the WASL than on the ITBS. Both tests place different response demands on students. The WASL is performance-based and the ITBS is not. Teachers and paraprofessionals dedicated a lot of their time during training to learning how to assist their students in responding to the types of questions on the WASL. At the school level there was improvement in students' scores from the year preceding the training to post training. Thus, at the school level, it is possible to conclude that the training contributed to the overall changes in school scores.

However, when data from both the WASL and ITBS were disaggregated and comparisons were made between only two sets of teachers—project participants and non-participants from within each school, for the current school year only—the otherwise dramatic differences observed between the pre and post training years were not nearly as evident. This suggests that the observed school level differences may have had more to do with wholesale changes within each school's curriculum and instructional practices and less to do with the professional development training of a few teachers and paraprofessionals in each school. Indeed, there was such variability within and across schools and within and across grades that it is impossible to determine if the training was or was not effective. A web of influences on teachers and students was more likely to have contributed to the observed differences in WASL and ITBS scores than the professional development itself.

The variability between test scores of students from classrooms of participating and non-participating teachers was further borne out when the scores of specific strands within the WASL were compared. Project directors were asked to identify the specific

WASL strands that most closely aligned with their training designs and foci. In some projects, in some grades, and in some strand areas, students of participating teachers scored better than their peers in non-participating teachers' classrooms. The reverse was also true in some projects; that is, the students of non-participating teachers outperformed student of participating teachers. Again, a host of teacher and student influences likely contributed to the observed differences. This was true for both math and reading projects.

Locally administered assessments revealed the same differences that emerged from the analyses of WASL and ITBS data.

In nearly all analyses, the data sets from projects were incomplete, with a lot of data missing from some projects more than from others. A complete data set may have revealed more profound differences between students of participants and non-participants. However, when small rural districts are involved in training, it is often difficult to find an in-school comparison group. Even when comparisons can be made between students of participating and non-participating teachers, the classroom composition among students and among teachers themselves introduces too many confounding variables. One teacher might be a veteran with 15 years of experience; another teacher might be a neophyte having just entered teaching. The new teacher might have a class of high-performing students, while the veteran teacher might have a class with many special needs students.

It is also difficult to compare the scores of students from classrooms in which participating paraprofessionals worked with the scores of students in which non-participating paraprofessionals worked. Paraprofessionals engage in a wide variety of activities when they are in classrooms, and their individual work with a student or a group of students varies considerably within a classroom and from one classroom to the next. The actual work of two comparison paraprofessionals may be so unlike that any differences found in their students' scores may have nothing to do with them specifically. That is, the nature of the assistance provided by both participating and non-participating paraprofessionals is often so different that any comparative interpretations of data may be meaningless.

All of these issues affect student performance on the State's assessment tests and the ability to make meaningful comparisons for evaluation purposes. Clearly, if training was focused on helping students improve their skills in performance-based activities, the students were then likely to show improvement on the WASL test. There is evidence to corroborate this. However, to ensure that all students can perform better on the State assessments, the recommendations identified in response to evaluation question #1 are important to consider for future improvement of the professional development models used in Washington.

3. What aspects of professional development had the greatest impact on changes in teaching practices and student achievement?

Two sources of data—focus group discussions and classroom observations—were used to answer this evaluation question.

Several features of different HECB projects had a strong impact on changes in the practices of participants. First, projects that included instruction *both* subject matter content and instructional strategies resulted in deliberate and purposeful changes in teachers' and paraprofessionals' classroom practices. This did not occur in reading projects but did occur in several of the math projects. As described earlier, the EWU-P project is an exemplary model of how math content and instructional strategies were combined to teach paraprofessionals what they needed to know in order to teach students math concepts. When the deliberate instruction in math content was paired with instruction in strategies and the combination demonstrated to participants, the effect was very powerful. Indeed, the process by which participants learned new information in that project was subsequently the same process by which they taught students when given the opportunity by the teachers with whom they worked.

Second, providing professional development during monthly meetings resulted in participants' sharing what they were learning, particularly about the implementation of what they had learned, then practicing what they had learned. For the effects of professional development to be enduring, training must take place over time, so that participants have many opportunities to practice and discuss what they are learning. The design of the HECB professional development project with a week-long summer institute involving all participants, followed by monthly meetings throughout the school year for additional training and practice, was quite effective. Two projects in particular—SMC reading and EWU-P math and reading—had very effective professional development designs. The SMC project required participants to read several books throughout the school year. Teams of teachers were required to select different practices, use them with their students, and report on them to the rest of the group at the following monthly meeting. Teacher testimony is very potent in shaping the practices of colleagues. Having participants share their experiences, including what worked and what did not, was very effective in encouraging teachers and paraprofessionals to use the new practices in their classrooms.

Third, having several teachers and/or paraprofessionals from the same school participate together in the professional development was very effective. Participants helped one another with the implementation of practices, brainstormed adjustments to strategies with one another, shared materials, and encouraged colleagues to try out new practices. When administrators from the schools in which teachers and paraprofessionals worked also attended the training, new practices were even more likely to be tried and implemented because of the support and encouragement administrators could render at their schools.. School principals recognized the value of what participants were learning, supported the new learning, and often found ways to make sure teachers and

paraprofessionals had the resources they needed to implement the new practices. The HC, SMC, EWU-P, WWU, WSU, and EWU projects all had two to three participants who attended the professional development from each school. The UW project's design also included having at least two participants from the same school or district, but several participants dropped out. In addition, participants sometimes taught different subjects or grade levels so that they were not always able to work together or assist one another with implementing new practices. The SMC project is the only project that included school administrators in the training.

The fourth and final feature of professional development that had a strong impact on changes in teachers' and paraprofessionals' practices was the inclusion of professional networks built into the training. Participants in two circumstances benefited particularly from the creation of a viable network—professional community of practice—where teachers could regularly get together and share ideas and practices, discuss issues, and solve problems. One circumstance was when more than one participant from each school attended training, and the other was when participants worked in small rural districts as the only particular subject content teacher in their school. The WSU project did a very effective job with this aspect of their professional development. Teachers remarked that implementing new practices was easier because they had built-in resources they could use to discuss implementation issues.

These four distinct but interrelated features of professional development did result in positive changes in teachers' and paraprofessionals classroom practices. While some projects appeared to have greater effects than others, all projects that included in their project design one or more of the four features in their training design had a greater impact on sustainable change in classroom practices than those that did not. However, given the knowledge of how teachers implement new practices and given the fact that many of the new practices in both the reading and math projects were already part of recent school-adopted curricula and materials, it is difficult at best to know whether what was taught during professional development was the *key* factor in any changes in students' academic achievement as measured on the WASL and ITBS/ITED.

Attributing changes in student achievement to specific features of professional development is nearly impossible unless an experimental design is used where both teachers/paraprofessionals and their students are randomly selected to participate in either an experimental or control group, with one group receiving training and one not. The problem is further compounded because of what teachers actually use from the professional development in their work with students. What is used and how it is used varies from teacher to teacher. Given that all projects included many school districts and often several schools from each district, an evaluation of this type would have had to be conducted quite differently. Even then it would have been difficult to state more than the strength of various factors on specific outcome variables such as changes in student achievement.

It is difficult to isolate effects of discrete elements of training on changes in student achievement when there are so many contributing factors that could account

either individually or collectively for the changes. This is especially true when training is nuanced, individualistic, and non-prescriptive, with teachers and paraprofessionals taking what they needed from each experience and incorporating pieces of what they learned during training into their classrooms. Teachers and paraprofessionals engage in all kinds of activities with their students, schools mandate that certain practices be implemented, districts mandate new curricula and materials, and the State puts pressure on schools to improve in very specific areas—all of which results in extra attention being placed on certain subjects more than on others. Isolating impact is thus messy and challenging. It is clear, however, that the four features identified did make a difference in the degree to which training did impact teachers' and paraprofessionals' classroom practices. Projects that included more of the features were more likely to result in sustainable changes in how teachers and paraprofessionals carried out their work with students.

4. Did professional development provided to K-12 teachers and paraprofessionals affect teaching and learning at the school organization level?

    a. Did the teaching/learning environment in schools change as a result of professional development?

Two sources of data—focus group discussions and classroom observations—were used to answer this evaluation question.

The nature of the training provided by each project precluded the possibility of observing any school-wide effects. Several factors affected the potential for school-wide changes in practice. First, the design of each professional development model targeted individual teachers and/or paraprofessionals, not an entire school's teaching staff. Individual participants from several districts and schools attended the training activities provided by project staff. Although some projects included several teachers and/or paraprofessionals from the same school, their numbers never represent the quorum needed to impact an entire school.

When several participants from a school shared what they had learned with their non-participating colleagues, there was a greater chance for more staff members to engage in the new practices. When school administrators participated in professional development training, as in the SMC project, there was even a greater likelihood that additional staff members would engage in the new practices owing to administrative support. However, because the professional development models did not provide training within schools to large groups, or to an entire staff, none of the schools from which participants came adopted the practices as part of a school-wide reform effort. Training provided to large groups of staff members, or to an entire staff, may succeed in producing change at the school organization level. Such teachers then become part of a large community of practice where they can share and discuss implementation issues, student issues, adaptation of curriculum, materials, instructional strategies, and the like.

Second, the professional development model employed by each project provided training in discrete topics, not in a reading or math curriculum that could be used school-

wide. Such training results in participants picking and choosing elements of training to use with their students, with different strategies selected at different times by different participating teachers, even teachers of the same subject at the same grade. Of course, teaching is a personal endeavor, and one would not expect or want all teachers doing the very same thing at the very same time. However, when training is in discrete topics, teachers then have license to use a decision model that is idiosyncratic and that cannot be generalized to the entire school. Training in a single curriculum that focused, for example, on math inquiry or literature-based instruction, would have had a more potent effect on teachers' ability to share their learning with an entire staff, thus empowering everyone in a school to use the curriculum.

Third, professional development training did not include school visits to assist teachers and paraprofessionals in their classrooms to implement what they were learning. Even though several teachers and paraprofessionals from different schools and districts participated in training activities provided by each project, the training process was not monitored and supported at the classroom level by the trainer staff in six of the seven projects. Only WSU conducted site visits to assist teachers and paraprofessionals. Indeed, participants in every project except WSU said trainers had not observed them teaching nor offered feedback on their progress with implementing what they had learned. When trainers make site visits, their presence can effect a school level response to training. Conversations with school administrators and staff can be arranged and discussions about practices can occur.

Fourth, professional development training did not take place at the school level. Although schools were used as training venues, they were used only to house all of the participants for meetings. For example, the EWU project involved 11 districts, and the UW project involved 16 districts. Monthly meetings in these projects were held at schools in central locations to minimize lengthy travel distances for participants. Participants had to take their learning from this general context back into their schools and classrooms where they had no support for implementing what they had learned. Because teachers tend to work in isolation from one another, there was limited opportunity for participants to get together to discuss what they had learned or to deal with implementation issues, let alone share what they had learned with other staff members. In projects where multiple districts, schools, and grade levels were involved, very few teachers/paraprofessionals attended from a single district, which added to the difficulty of participants being able to transport what they had learned to an entire school staff.

The fifth and final factor affecting changes in practice at the school organization level was the lack of an explicit connection between the training activities and the State's EALRs and GLEs. One of the stated goals of the HECB Title II training was to increase students' performance on the State's assessment tests. The EALRs and GLEs affect all school staff. That is, they provide, or should provide, the framework for decisions about curricula and materials and instructional strategies, as well as focus teachers' and paraprofesisonals' attention on what needs to be taught to students at specific grade levels. The type of professional development training provided by each HECB project

focused on discrete topics. Therefore, it was difficult to determine the effects of changes in practice on changes in students' performance, either on the WASL or ITBS/ITED, since different practices were selected by different participants to use with different students. Had the training provided by each project been linked to the EALRs and GLEs, which are tied to the State's assessments, there is a greater likelihood that the training could and would have been shared with all staff members at each school, thereby resulting in an impact at the school organization level.

Although project training was not designed to impact changes in practice at the school organization level, there would have been an increased likelihood for such change to occur if training had been designed differently. Had any of the projects incorporated several of these five factors, it is likely that changes in practice at the school organization level would have occurred.

References

Cohen, David K. & Hill, Heather C. (2000). *Learning policy: When state education reform works*. New Haven, CT: Yale University Press.

Endsley, Mark (personal communication, December 21, 2004).

Grossman, Pamela L. (1990). *The making of a teacher: Teacher knowledge & teacher education*. New York: Teachers College, Columbia University.

Guskey, Thomas R. (2000). *Evaluating professional development*. Thousand Oaks, CA: Corwin Press.

Shulman, L.S. Those who understand: knowledge growth in teaching. *Educational Researcher*, 15 (2), 4-14.

Tovani, Cris. (2004). *Do I really have to teach reading?: Content comprehension, grades 6-12*. Portland, Maine: Stenhouse Publishers.

Worthen, Blaine R., Sanders, James R., & Fitzpatrick, Jody L. (1997). *Program evaluation: Alternative approaches and practical guidelines*. New York: Addison Wesley Longman.

Appendix A

Achievement Data Tables

HECB Cycle I Data Tables: STANDARDIZED TEST SCORES BY PROJECT

University of Washington—MATH

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School D	7	WASL	23.8%	37.7%	18.4% N=38	NA
School E	7	WASL	27.7%	30.8%	31% N=91	NA
School F	7	WASL	52.2%	64.4%	64.4% N=73	64.4% N=101
School D	8	*ITBS*	NA	52.5%	43.6 N=22	55.5* N=66
School B	9	**ITBS**	55	58	69* N=23	54 N=84
School C	9	**ITBS**	68	61	53.5 N=21	64.6 N=34
School B	10	WASL	34.0%	38.8%	76.1%* N=46	50.7% N=67
School C	10	WASL	38.6%	40.4%	12.5% N=16	51.2% N=41

Western Washington University--MATH

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School A	3	*ITBS*	60	45	61 N=12	37 N=10
School A	4	**ITBS**	NA	62	58 N=7	64 N=14
School A	4	WASL	38.1%	40.9%	75% N=8	57% N=14
School A	5	*ITBS*	NA	58.4	86 N=7	39 N=10
School A	7	WASL	13.0%	13.8%	NA	NA

Washington State University-Vancouver--MATH

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School H	3	*ITBS*	NA	57	NA	NA
School H	4	WASL	NA	45.5%	NA	NA
School J	4	WASL	53.5%	57.7%	52.3% N=44	64.7% N=34
School H	6	*ITBS*	56	47	NA	NA
School I	6	**ITBS**	60	43	NA	NA
School H	7	WASL	NA	64.7%	NA	NA
School K	7	WASL	50.0%	41.7%	43.5% N=23	NA
School G	9	*ITBS*	57	56	83* N=33	50.0 N=76
School H	9	**ITBS**	70	62	NA	NA
School G	10	WASL	40.5%	43.9%	75.0%* N=59	10.0% N=50
School H	10	WASL	76.5%	76.9%	NA	NA

Heritage College--READING

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School L	3	*ITBS*	34	46	NA	NA

Eastern Washington University Wellpinit—MATH

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School M	3	*ITBS*	NA	78	NA	NA
School M	4	WASL	NA	74.2%	NA	NA
School M	6	*ITBS*	NA	54	NA	NA
School M	7	WASL	NA	29.0%	NA	NA

Eastern Washington University Wellpinit—READING

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School M	3	*ITBS*	NA	49	NA	NA
School M	4	WASL	NA	71.0%	NA	NA
School M	6	**ITBS**	NA	40	NA	NA
School M	7	WASL	NA	29.0%	NA	NA

St. Martin's--READING

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School N	3	*ITBS*	61	63	55 N=19	71 N=18
School N	4	WASL	44.9%	88.2%	88.0% N=25	88.5% N=26
School U	4	WASL	63.6%	68.8%	74.4% N=43	63.6% N=33
School N	6	*ITBS*	50	56	NA	NA
School O	6	**ITBS**	45	49	51 N=15	48.7 N=93
School P	7	WASL	43.3%	53.0%	53.0% N=150	56.0% N=18

Eastern Washington University--MATH

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School R	3	*ITBS*	67	55	NA	NA
School Q	7	WASL	29.6%	43.8%	53.3% N=15	35.3% N=17
School S	7	WASL	19.4%	45.2%	NA	NA
School T	7	WASL	15.8%	40.0%	NA	NA
School Q	9	*ITBS*	63	46	70.4 N=11	29.7 N=15
School R	9	**ITBS**	43	61	NA	NA
School S	9	**ITBS**	59	55	NA	NA
School T	9	**ITBS**	50	42	NA	NA
School Q	10	WASL	40.9%	28.0%	NA	NA
School R	10	WASL	14.3%	21.4%	NA	NA
School S	10	WASL	44.4%	45.2%	NA	NA
School T	10	WASL	14.3%	33.3%	NA	NA

HECB Cycle I Data Tables: STANDARDIZED TEST SCORES BY SUBJECT AREA

Math

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School A	3	*ITBS*	60	45	61 N=12	37 N=10
School H	3	**ITBS**	NA	57	NA	NA
School R	3	**ITBS**	67	55	NA	NA
School A	4	**ITBS**	NA	62	58 N=7	64 N=14
School A	4	WASL	38.1%	40.9%	75% N=8	57% N=14
School H	4	WASL	NA	45.5%	NA	NA
School J	4	WASL	53.5%	57.7%	52.3% N=44	64.7% N=34
School A	5	*ITBS*	NA	58.4	86 N=7	39 N=10
School H	6	**ITBS**	56	47	NA	NA
School I	6	**ITBS**	60	43	NA	NA
School A	7	WASL	13.0%	13.8%	NA	NA
School D	7	WASL	23.8%	37.7%	18.4% N=38	NA
School E	7	WASL	27.7%	30.8%	31% N=91	NA
School F	7	WASL	52.2%	64.4%	64.4% N=73	64.4% N=101
School H	7	WASL	NA	64.7%	NA	NA
School K	7	WASL	50.0%	41.7%	43.5% N=23	NA
School Q	7	WASL	29.6%	43.8%	53.3% N=15	35.3% N=17
School S	7	WASL	19.4%	45.2%	NA	NA
School T	7	WASL	15.8%	40.0%	NA	NA

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School D	8	*ITBS*	NA	52.5%	43.6 N=22	55.5* N=66
School B	9	**ITBS**	55	58	69* N=23	54 N=84
School C	9	**ITBS**	68	61	53.5 N=21	64.6 N=34
School G	9	**ITBS**	57	56	83* N=33	50.0 N=76
School H	9	**ITBS**	70	62	NA	NA
School Q	9	*ITBS*	63	46	70.4 N=11	29.7 N=15
School R	9	**ITBS**	43	61	NA	NA
School S	9	**ITBS**	59	55	NA	NA
School T	9	**ITBS**	50	42	NA	NA
School B	10	WASL	34.0%	38.8%	76.1%* N=46	50.7% N=67
School C	10	WASL	38.6%	40.4%	12.5% N=16	51.2% N=41
School G	10	WASL	40.5%	43.9%	75.0%* N=59	10.0% N=50
School H	10	WASL	76.5%	76.9%	NA	NA
School Q	10	WASL	40.9%	28.0%	NA	NA
School R	10	WASL	14.3%	21.4%	NA	NA
School S	10	WASL	44.4%	45.2%	NA	NA
School T	10	WASL	14.3%	33.3%	NA	NA

Reading

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School L	3	*ITBS*	34	46	NA	NA
School N	3	**ITBS**	61	63	55 N=19	71 N=18
School N	4	WASL	44.9%	88.2%	88.0% N=25	88.5% N=26
School U	4	WASL	63.6%	68.8%	74.4% N=43	63.6% N=33
School N	6	*ITBS*	50	56	NA	NA
School O	6	**ITBS**	45	49	51 N=15	48.7 N=93
School P	7	WASL	43.3%	53.0%	53.0% N=150	56.0% N=18

Reading AND Math

MATH Scores

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School M	3	*ITBS*	NA	78	NA	NA
School M	4	WASL	NA	74.2%	NA	NA
School M	6	*ITBS*	NA	54	NA	NA
School M	7	WASL	NA	29.0%	NA	NA

READING Scores

School	Grade	Test	2002-03 Aggregate Score	2003-04 Aggregate Score	2003-04 Participants Score	2003-04 Non-Participants Score
School M	3	*ITBS*	NA	49	NA	NA
School M	4	WASL	NA	71.0%	NA	NA
School M	6	*ITBS*	NA	40	NA	NA
School M	7	WASL	NA	29.0%	NA	NA

HECB Cycle I Data Tables: WASL STRAND SCORES PERTAINING TO TRAINING

Western Washington University

School	Grade	2003-04 Participants Score	2003-04 Non-Participants Score
School A	4	N=8, %=75 Num Sense = 50.0% Prob Solv = 62.5% Commun = 75.0%	N=14, %=57 Num Sense = 64.3% Prob Solv = 28.6% Commun = 42.9%
School A	7	N=29, %=14 Num Sense = 34.5% Prob Solv = 17.2% Commun = 13.8%	

University of Washington

School	Grade	2003-04 Participants Score	2003-04 Non-Participants Score
School D	7	N=38, %=18.4 Num Sense = 28.9% Measure = 26.3% Stats = 26.3% Prob Solv = 26.3%	
School E	7	N=91, %=31 Num Sense = 29.7% Measure = 17.6% Stats = 24.2% Prob Solv = 33.0%	
School B	10	N=46, %=76.1* Num Sense = 58.7% Measure = 47.8%* Stats = 47.8%* Prob Solv = 54.3%*	N=67, %=50.7 Num Sense = 43.3% Measure = 26.9% Stats = 26.9% Prob Solv = 29.9%
School C	10	N=16, %=12.5 Num Sense = 31.3% Measure = 18.8% Stats =37.50% Prob Solv = 35.1%	N=41, %=51.2 Num Sense = 46.3% Measure = 36.6% Stats = 46.3% Prob Solv = 41.5%

WSU-Vancouver

School	Grade	2003-04 Participants Score	2003-04 Non-Participants Score
School H	4	N=11, %=46 Prob Solv = 81.8% Commun = 63.6% Connect = 63.6%	
School J	4	N=44, %=52.3 Prob Solv = 43.2% Commun = 65.9% Connect = 54.5%	N=34, %=64.7 Prob Solv = 76.5%* Commun = 79.4% Connect = 70.6%
School H	7	N=17, %=65 Prob Solv = 58.8% Commun = 70.6% Connect = 52.9%	
School K	7	N=23, %=43.5 Prob Solv = 65.2% Commun = 56.5% Connect = 39.1%	
School G	10	N=59, %=75.0* Prob Solv = 76.7%* Commun = 76.7%* Connect = 51.7%*	N=50, %=10.0 Prob Solv = 17.0% Commun = 26.4% Connect = 3.8%
School H	10	N=13, %=77 Prob Solv = 69.2% Commun = 76.9% Connect = 76.9%	

EWU Wellpinit--MATH

School	Grade	2003-04 Participants Score	2003-04 Non-Participants Score
School M	4	N=31, %=74.2 Num Sense = 77.4% Measure = 58.1% Prob Solv = 83.9% Commun = 87.1% Connect = 80.7%	
School M	7	N=31, %=29.0 Num Sense = 32.1% Measure = 32.1% Prob Solv = 17.9% Commun = 28.6% Connect = 32.1%	

EWU Wellpinit--READING

School	Grade	2003-04 Participants Score	2003-04 Non-Participants Score
School M	4	N=31, %=71.0 Lit Comp = 41.9% Lit Anal = 67.7%	
School M	7	N=31, %=29.0 Lit Comp = 38.5% Lit Anal = 19.2%	

St. Martin's--READING

School	Grade	2003-04 Participants Score	2003-04 Non-Participants Score
School U	4	N=25, %=88.0 Lit Comp = 64% Lit Anal = 88% Info Comp = 84% Info Anal = 72%	N=26, %=88.5 Lit Comp = 76.9% Lit Anal = 84.6% Info Comp = 88.4% Info Anal = 61.5%
School P	7	N=150, %=53.0 Lit Comp = 40.2% Lit Anal = 42.3% Info Comp = 45.0% Info Anal = 51.0%	N=18, %=56.0 Lit Comp = 44.4% Lit Anal = 61.1% Info Comp = 50.0% Info Anal = 61.1%

Eastern Washington University--MATH

School	Grade	2003-04 Participants Score	2003-04 Non-Participants Score
School Q	7	N=15, %=53.3% Num Sense = 40.0% Prob Solv = 46.7% Commun = 53.3%	N=17, %=35.3% Num Sense = 47.1% Prob Solv = 29.4% Commun = 35.3%
School S	7	N=31, %=45.2 Num Sense = 61.3% Prob Solv = 38.7% Commun = 51.6%	
School T	7	N=22, %=40.0 Num Sense = 59.1% Prob Solv = 31.8% Commun = 50.0%	
School Q	10	N=23, %=28.0 Num Sense = 39.1% Prob Solv = 30.4% Commun = 26.1%	
School R	10	N=12, %=21.4 Num Sense = 16.7% Prob Solv = 33.3% Commun = 25.0%	
School S	10	N=46, %=46.8 Num Sense = 50.0% Prob Solv = 43.5% Commun = 32.6%	
School T	10	N=15, %=33.3 Num Sense = 46.7% Prob Solv = 40.0% Commun = 53.3%	

<u>HECB Cycle I Data Tables: LOCAL ASSESSMENT DATA</u>

St. Martin's: Local Reading Assessments

School	Grade	Test	2003-04 Participant Score	2003-04 Non-Participant Score
School N	4	QRI	3.67 N=39	3.15 N=33
School N	4	STAR	4.14 N=45	4.23 N=37

EWU—District Math Assessment

School	Grade	Test	2003-04 Participant Score	2003-04 Non-Participant Score
School Q	7	Local	Time 1 Total=49.5% Time 2 Total=41.5% Time 3 Total=34.5% N=15	Time 1 Total=43.6% Time 2 Total=37.9% Time 3 Total=36.1% N=16
School Q	9	Local	Time 1 Total=34.3% Time 2 Total=23.9% Time 3 Total=37.5% N=11	Time 1 Total=24.1% Time 2 Total=13.7% Time 3 Total=22.2% N=15