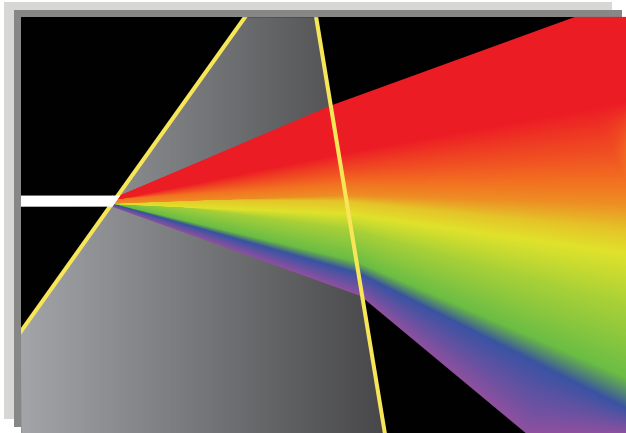


RESEARCH OVERVIEW AND QUALITATIVE RESULTS



Programming
Remediation and
Intervention for
Students in
Mathematics

Final Report
Carolyn A. Rees-Potter, Ph.D



Ottawa-Carleton
Catholic School Board



OTTAWA-CARLETON
DISTRICT SCHOOL BOARD



UPPER
CANADA
DISTRICT SCHOOL BOARD



Ministry of Education

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**PROGRAMMING, REMEDIATION AND INTERVENTION
FOR STUDENTS IN MATHEMATICS
(PRISM)**

FINAL REPORT

*"PROBABLY NOTHING HAS MORE IMPACT ON STUDENTS THAN THE PERSONAL,
PROFESSIONAL GROWTH OF THEIR TEACHER."*

(Barth, 1990)

INTRODUCTION

In education today, system leaders have a moral obligation to dedicate school board changes to implementing evidence based strategies that will make a difference in students' lives, specifically in closing the achievement gap between where they currently are performing and where they should be. It is imperative that whole school systems enter into change initiatives that will achieve lasting, sustained impacts in order to provide for student success for all.

The PRISM Pilot Project attempted to achieve this moral goal by moving teachers beyond what they currently know in math pedagogy and in their knowledge of use of a developmental continuum for students who are at risk for failure in mathematics. The aim of the project was building classroom and special education teacher capacity, to focus in a way that they would develop new skills and competencies in using a set of strategies and actions that will increase the collective efficacy of a group to improve student achievement (Fullan, 2005). The project consisted of providing new knowledge for teachers, combined with the opportunity to acquire new skills. Teachers were supported by the provision of new resources such as math diagnostic tool materials and planning time, as well as opportunities to collaborate with colleagues. The goal was to move teachers forward in the quality of their teaching, in the recognition that effective instruction is critical in order to improve the quality of instruction in the classroom to raise the bar and close the gap in student achievement in mathematics (Fullan, 2005).

Limitations apply to the qualitative research results contained in this report as a result of studying a pilot project that contained a small, delimited sample. The study presents information as well as raising questions that point us in the right direction, by providing a focus for what we believe are valuable lessons and experiences worthy of sharing with colleagues who wish to embark down a similar road of change to teacher practice and student achievement.

RATIONALE

The basis for the PRISM Pilot Project was grounded in best practices research (Ball & Hill, 2004; Dufour & Eaker, 1998; Fullan, 2005), as well as in the recommendations from key Ontario Ministry of Education reports, Pathways to Success (2003) and Leading Math Success (2004) that communicated expectations to support students at risk for failure in mathematics in Grades 7-12, with the implementation of evidence based best practices.

“The Expert Panel recommends that school boards work with the Ministry of Education and other education partners to develop, where necessary, and deliver research-based intervention programs for students at risk in mathematics.”

(Leading Math Success, 2004)

The PRISM project was developed as a result of an identified need to build teacher capacity, specifically to change professional practice in the area of mathematics in order to attempt to close the achievement gap of students who were identified as at risk for failure in mathematics in Grades 7 & 8.

For this project building teacher capacity was defined as:

“involving developing the collective ability-dispositions, skills knowledge, motivation, and resources-to act together to bring about positive change.”

(Fullan,2005)

Student needs were defined as being able to identify individual student gaps in conceptual knowledge in mathematics that left students at risk for failure in their grade appropriate math curriculum. Many of the students who participated in the project were 2, 3 and even 4 years below grade level in their mathematical achievement level.

Teachers’ professional learning needs in relation to this project may be exemplified by the following passage:

‘As a classroom teacher, I was frustrated. I didn’t always know specifically what my students were learning. And if, as a principal, I asked teachers: “How do you know your students are learning?”, they didn’t always have a solid answer. That’s why I really appreciate the data that are available to us now. If you can’t measure learning, you can’t manage it. Improvement is left to chance, and a child’s education is too important to leave to chance. If we can measure what an individual child knows and doesn’t know, then we can provide the instruction he/she needs. We can manage it. We can improve.’

(Cawelti and Protheroe, 2001)

QUALITATIVE RESEARCH FRAMEWORK

The aim of this component of the PRISM Project was to incorporate the use of a qualitative research design that would gather data to describe key findings in the implementation of the project, using a case study model (Yin, 1989). This type of design was best able to capture the focus of this project on contemporary phenomenon with a desire to understand and investigate real life events, within a real life context using multiple sources of evidence.

The case study framework captured the main features, strategies, experiences and lessons learned by participants (principals, teachers and central office staff) in their attempt to implement a math developmental continuum using a diagnostic assessment tool, and an intervention program to enhance teacher practice, and to close the gap for students at risk for failure in achievement in mathematics.

After data was collected, it was recorded, examined, combed, displayed and analysed using strategies found in the work of Miles and Huberman (1984).

Sources of Data

Information was collected from a variety of sources that included:

- participant observation
- focussed interviews with teachers and principals
- archival data, including copies of presentations, handouts, memos, minutes of meetings
- teacher reflective logs
- teacher and principal exit survey.

Information was collected from school-based principals, board office consultants, classroom teachers, and special education teachers within and across schools and three (3) school boards. The sample drew from approximately 53 teacher participants and 12 principal participants, board program and special education consultants.

Data was collected over the course of the implementation of the project from December 2004 to June 2005 in a variety of settings that included large, whole group training sessions and follow up meetings across school boards, regional team support meetings within one school board, in school teacher shared planning meetings, informal individual interviews with principals and teachers, board office planning meetings, meetings with superintendents.

Information used to discuss effects on teacher capacity and student achievement was gathered from data collected from teachers who worked at school sites, in all three of the participating school boards. Archival and board document data was gathered, reviewed, and coded using theoretical propositions as an organizing framework (Yin, 1989). Focused interview and survey data was coded, displayed and organized according to themes and trends, and also charted under headings system implementation Barriers and Enablers (Miles & Huberman, 1984).

Research Questions

How and what questions were posed in order to gather critical information that would inform practice on what boards do in order to build capacity in teachers that will make a difference in closing the gap in student achievement.

The study attempted to address the following questions:

- How was the PRISM Pilot Project being implemented in terms of the experiences of school leaders using a Professional Learning Community model within and across schools and school districts?
- How was the PRISM Pilot Project being implemented in terms of the experiences, understandings and impact on classroom and special education teachers using a Professional Learning Community model within and across schools and school districts?
- How was the PRISM Pilot Project being implemented in terms of the impact on students within and across schools and school districts who are at risk for failure in mathematics?

Refer to [Appendix One - Research Questions and Related Propositions](#)

Theoretical Propositions

To explore these questions and to gather relevant information the three participating PRISM pilot project school boards were studied using theoretical propositions (Yin, 1989) based upon best practices incorporated in a Professional Learning Community Model (Dufour & Eaker, 1999).

The following PLC elements were included in the development of the research propositions and used to define the roles & responsibilities, experiences and understandings of Principals-District Office Staff, Classroom and Special Education Teachers, and impact on Students:

- Shared Values
- Goal Setting-Establishing Priorities
- Student Focus
- Collaboration
- Communication
- Action Research
- Focus on Student Results
- Teacher Capacity Building & Changes In Professional Practice
- Sustainability

The Professional Learning Community Model propositions presented in the study were numbered

as P1, P2, ...P. The propositions were intended to represent significant elements of a Professional Learning Community Model as it is utilized to implement the PRISM Pilot Math Project within and across school and school district sites.

Propositions were based upon key elements found in the Professional Learning Community literature and upon the PRISM - PLC Implementation Scenario.

Refer to [Appendix Two - Study Propositions](#)

IMPLEMENTATION PROCESS
SCHOOL BOARD USE OF THE PROFESSIONAL LEARNING COMMUNITY MODEL

In December 2004, as teacher training was being offered in the PRISM Project, one of the three school boards decided to implement a Professional Learning Team model (Dufour & Eaker, 1998). The PLC framework was developed to support the implementation of strategies used to build teacher capacity in all of its pilot school sites over the next six (6) months of the project. As a result, the information gathered relating to the role of the school leader was primarily from the one board that implemented the learning community team model both within and across participating schools and the regional office. Information gathered from teachers was from school sites located in the board using the professional learning team model, as well as from the two (2) school boards who did not use a professional learning implementation model.

In the single school board that used The Professional Learning Community framework to implement its strategies, the following staff were invited to be part of the system school teams:

Superintendent of Schools and Superintendent of Program	
Principal of Program and Special Education	Student Success Leader
School Board Regional Consultants in Program and Special Education	
Individual School Sites with Teams of Principals, Classroom Teachers and Special Education Teachers	

Additional funding was required for the implementation of the professional learning model in the one school board and the funding was allocated from the board’s Student Success budget.

The Targeted funding supported costs associated with the acquisition of resources such as professional materials, books, meeting costs, student materials, occasional teacher costs for teachers and principals, and attendance at an annual mathematics conference for a six month time period.

A number of key planning meetings were held by the Principal of Program and the regional consultant team, in consultation with teams of school principals and teaching staff in order to develop the implementation framework that included defining roles and responsibilities of key team members, methods of communication and methods for ongoing teacher support and planning.

Strategies for Capacity Building - Support and Communication

- Development of a 6 month schedule (January-June) for teacher support strategies and communication strategies
- Once per week shared planning time for teachers of in school teams, with the regional consultant who had been assigned to their school team
- Once per month whole board lateral meeting for school based teams for one day to focus on further training and sharing of successes, challenges, barriers, resources, ideas, strategies, professional logs and next steps
- Alternate week across school team meetings, a teleconference for all project team members was held after school for 30 minutes
- Development of an e mail list serve of all project participants allowed for sharing ideas, challenges, updating information such as meeting dates, times
- The regular use of memos and newsletters from the principal of program and special education to school and regional office teams about resources, meetings, meeting minutes, next steps and supportive words of encouragement and validation
- Once per term whole day meeting of teachers and consultants from all three boards participating in the project to share ideas, strategies, successes, challenges & barriers, and next steps
- Development of a 6 month schedule (January-June) for teacher support strategies and communication strategies
- Once per week shared planning time for teachers of in school teams, with the regional consultant who had been assigned to their school team
- Once per month whole board lateral meeting for school based teams for one day to focus on further training and sharing of successes, challenges, barriers, resources, ideas, strategies, professional logs and next steps
- Alternate week across school team meetings, a teleconference for all project team members was held after school for 30 minutes
- Development of an e-mail list serve of all project participants allowed for sharing ideas, challenges, updating information such as meeting dates, times
- The regular use of memos and newsletters from the principal of program and special education to school and regional office teams about resources, meetings, meeting minutes, next steps and supportive words of encouragement and validation
- Once per term whole day meeting of teachers and consultants from all three boards participating in the project to share ideas, strategies, successes, challenges & barriers, and next steps

At all meetings the focus of teacher discussions were on individual student assessment information obtained from the use of the mathematics developmental continuum and diagnostic assessments in relation to identifying specific learning gaps for individual students in math. Results were then used by school teams to develop supporting differentiated instruction strategies and resources for their individual students at risk for failure in mathematics.

ACTION RESEARCH -TEACHER ENQUIRY MODEL

Strategies from the action research-teacher inquiry literature were used at school based shared planning sessions, and whole group meetings in an effort to allow teachers across all three school boards to talk about professional learning, student data. Strategies were also used to support the implementation of the professional learning team model framework utilized by one of the three boards (Dufour & Eaker, 1998; Sagor, 2005; Marzano, 2005).

Diagram 1 illustrates steps and strategies used.

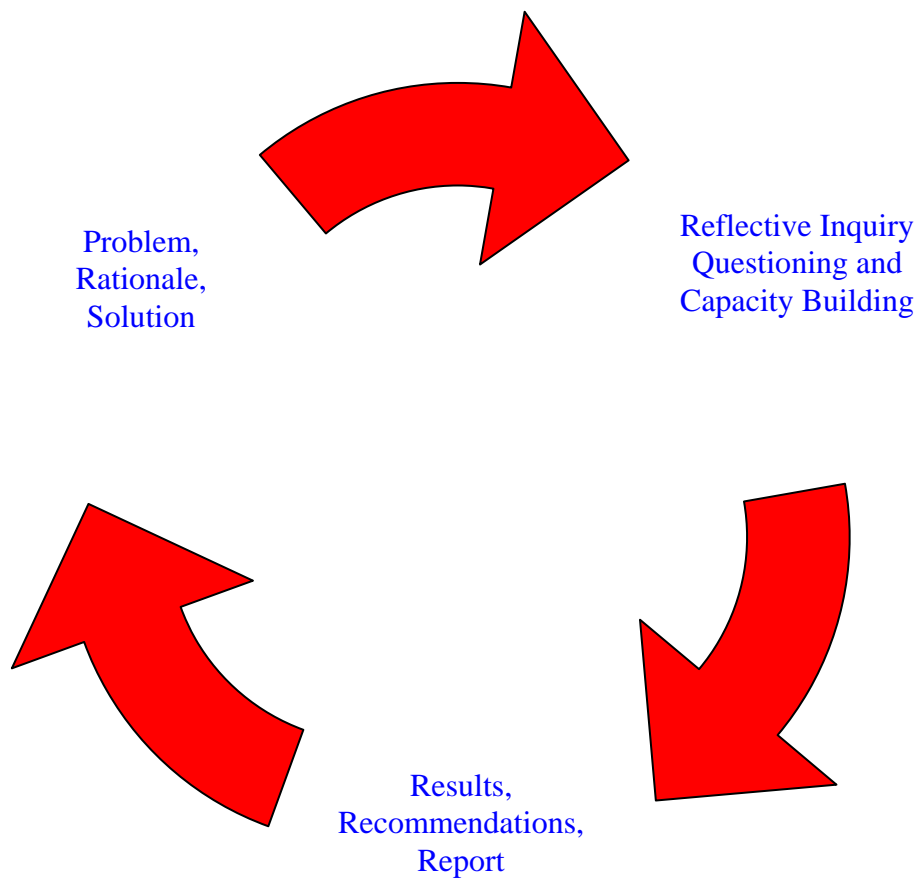


Diagram 1: Action Research-Teacher Inquiry Flowchart

PROJECT FINDINGS

Over a seven month implementation period, PRISM project members (classroom and special education teachers, school principals and regional office consultants) attended a variety of within and across school board training workshops, meetings, shared planning sessions, lateral capacity building activities, individual meetings with regional staff, teleconferences, reflective logs, focus interviews and exit surveys. Some training strategies were shared across boards, while other strategies were limited to the board that implemented the professional learning team model for school teams.

Several trends and patterns emerged over time from the review of information that was gathered from the variety of data sources both within and across the three participating school boards. Trends identified in teachers' experiences were more similar than dissimilar in theme.

Research findings from the pilot project were organized and presented using Propositions linked to evidence based practices found in the Professional Learning Community literature (Dufour & Eaker, 1998). The Professional Learning Team framework was used as a frame of reference to anchor the information gathered from the pilot about principal, and teacher experiences, changes in teacher capacity and professional practice, results and impact related to student achievement.

Research results for quantitative and qualitative data collected and analysed from all three of the participating school boards supported the following original goals of the PRISM Pilot Project:

- to build teacher capacity in professional practice in the use of a math developmental continuum, implementing teacher diagnostic tools in the classroom
- to close the gap in achievement for Gr. 7 & 8 students at risk for failure in mathematics by enabling them to be more successful in their mathematics program

Shared Values

The shared values of the participants in the project consisted of narrowing the focus to two key areas:

- teacher capacity building - meaning
- raising student achievement by narrowing the gap by enabling them to be more successful in their mathematics program.

Over the course of the project there was an emergent realization of an urgent need and belief that teacher training in the use of math diagnostics filled a void or gap in professional practice. For example staff commented that after the training and use of math diagnostics that they were using different language, viewing individual students math abilities in a new light and engaging in new types of dialogue with students and staff, as well as seeking to use new and different resources and materials.

Also evident in the project was a belief in the importance of using math diagnostic tools to pinpoint the needs of pupils in mathematics, in order to facilitate effective programming and enhanced academic achievement in math for these students. For example staff provided feedback that the use of diagnostics opened up new ways of viewing student math abilities, and allowed them to use alternate ways of questioning and seeking information that they could then use for developing effective individual programming needs. The use allowed them to diagnose problem areas for students at risk, to identify students who were really struggling as well as to see where individual students are in math to confirm teacher ideas that they already had.

A number of teachers spoke of the importance of developing a whole school team approach when implementing new change initiatives such as the change in teacher practice in using math diagnostic tools. Teachers who worked in the board using the Professional Learning Community Model spoke of first hand experiences working as a team that they found to be valuable in assisting them in undertaking the new learning, and teachers who were in schools that did not implement a team approach spoke of their frustrations and sense of isolation in trying to implement change on their own. A variety of themes that were recorded in relation to the role of the school principal support prior documentation contained in the instructional leadership literature (Fullan, 2005; Leithwood, 2000).

The key role that the principal played in supporting classroom and special education teachers was noted on numerous occasions by teachers. The importance of the school leader in attending all training session with the school team was reported by teachers and principals themselves. For instance when staff were asked to comment on what was working well in the implementation process a recurring theme was a supportive principal who had attended training and knew the content, knew what was going on....having them “on board.”

Teachers also reported that when principals in the learning community model attending shared planning sessions, that they were able to conduct supportive conversations that focussed on student needs. These principals were visible in the hallways and classrooms of their schools.

Teachers who were working in schools where there was no professional learning community model and where principals did not attend the training reported as feeling very alone, isolated and that their principal did not know what was going on and therefore was not able to support them in any sustained, meaningful manner. An additional theme was recorded was a “start small and go slowly” approach to implementation as the focus.

Key Findings - Shared Values

- 1) A whole school team approach is needed, with a critical role played by the school principal. Knowledgeable principal support was found to be critical to supporting teachers as they attempted to change their professional practice.
- 2) Importance was recognized by principals and teachers to focus efforts on raising student achievement and in closing the learning gap.

- 3) Importance was recognized by board, school leaders and teachers that if they were to
- 4) successfully build teacher capacity in professional knowledge in an effort to change professional practice then professional training in new skills are needed, accompanied by school based team supports to implement the new professional practice as a follow up to the initial training.

Goal Setting - Establishing Priorities

The overall primary goal of the three board pilot project was always focussed on teacher professional learning that would result in changes in professional teacher practice, which would in turn raise student knowledge and skills and achievement in mathematics

In the Professional Learning Team board model, an operational plan for implementation of the initiative was carefully developed by the system principal of program, and special education, in consultation with regional office consultants, the regional superintendent, school based principals, classroom teachers and special education teachers. After initial sharing, project members met to further develop and refine vision, and purpose with shared goals and outcomes. In the Professional Learning Team model there was an additional element of creating lateral clusters of schools that would participate in project implementation, work within schools, across grades and specialization areas, and across schools in collaboration with regional office staff. Strategies included the use of incentives of follow up professional training, as well as support in the form of additional planning time, additional resources, additional regional office consultation on a regular basis, and opportunities to meet and network with staff in other schools.

Key Findings - Goal Setting

- 1) The study highlighted the importance of setting shared, clear, simple and clearly articulated goals that are developed collaboratively by all levels of staff engaged in a change initiative maximize successful implementation by ensuring consistent support by staff.
- 2) It was reported that teaching staff valued a clear sense of direction, focus and support in order to engage in the specific tasks at a classroom level required to change professional practice.

Student Focus

A critical element in successful implementation is the use of a school based team approach with a student centred focus (Fullan, 2005). In one of the three participating boards, school based teams consisting of the principal, regular classroom teacher(s) and school special education resource teacher were formed in all of the participating schools. In turn a support team from the regional office (math-program consultants and special education consultants) was formed as part of a lateral, across schools team level of support for the schools. The focus of these school-based teams was to enhance teacher knowledge and practice and to focus on raising student achievement in mathematics.

In the professional learning community model the principal took on the role of a facilitator, by attending meetings, providing support in the form of shared planning time, supportive conversations that included encouraging the use of the new strategies being tried by staff to meet the needs of students. Having attended the initial training some of the principals were familiar with the content and able to know what the teachers were doing, and to recognize the gap that the new practices would fill. Principals would “touch base” and if staff were on the right track, would leave them to proceed.

In the two boards where principals did not become involved as part of a learning team, staff identified a void in support at the school leadership level, with reports that principals did not know or understand the new strategies that were to be implemented, and had made no provision for support, such as the provision of shared planning time. Staff reported that this created a barrier to implementing the new knowledge and skills and in turn impeded their ability to assist students who were experiencing difficulties in mathematics.

Regional staff provided ongoing support to all school based teams at both a school and regional meeting level on a regular schedule in an effort to support changes in teacher instructional practice in order to focus on student results throughout the duration of project implementation. Regional staff provided workshops, support during shared staff planning sessions, materials and resources such as math manipulative materials and letters to parents.

Further recommendations were made to expand the model to a whole school approach, where staff in all grade divisions were trained in the use of math diagnostic tools for all pupils.

Key Findings - Student Focus

- 1) Knowledgeable, supportive involved school principals were seen as making a difference to supporting teacher focus on using evidence based best practices that will ensure student achievement.
- 2) School based teams consisting of the principal, classroom and special education teachers were reported as key to being able to focus on student learning.

- 3) Support for teachers within and across schools from regional office consultants in math and special education, on a regularly scheduled basis for content knowledge, resources & materials was reported to be highly valuable.
- 4) Teacher focus was on the basics for students, with strict attention to mathematics and to the use of diagnostic tools-to improve professional practice and to take it to a more in depth level.
- 5) Teachers used both formative and combative assessment of student progress with math diagnostic tools to focus on improved achievement in mathematics.

Collaboration

Effective implementation of professional learning community teams involves the development of successful collaborative skills for all members. Effective collaboration within and across schools is critical to success (Fullan, 2005).

In the one board that implemented a professional learning model, staff and school leaders recognized that working in a collaborative model facilitated use of the newly acquired knowledge and skills and was especially supportive for staff who felt intimidated by the changes.

Collaboration between classroom and special education teachers provided for effective across school sharing, with the use of regular family of school meetings, shared within school planning sessions, teleconferences and regular e mail communications that resulted in staff feeling connected with others who shared the same experiences and were on the “same page.”

Staff assisted each other with shared marking, planning, teachings strategies and resource acquisition both within and across school sites. Use of a professional learning team model at school sites in the one school board was seen to provide for continuity and progression within and across school sites for involved staff.

There was also a recognition by participants in the study that no longer is the one shot, out of school individual professional development workshop appropriate for changing teacher knowledge and professional practice in an effort to effect growth in student achievement This is consistent with other emerging research in this area (Darling-Hammond, 1997; Joyce and Showers, 1987).

It was reported that team collaboration, combined with ongoing support throughout the implementation period provided a common focus for all staff involved, with all sharing successes and challenges, with a feeling of support being in place for them to do their job. Teachers in the two boards who were not part of the professional learning team model reported being envious of their counterparts who were receiving time to meet collaboratively and recognized the value of such collaboration in assisting in enhancing their professional practice.

Time and dollar resources were in put in place to assist in the professional learning team

collaborative process. The support for implementation became a credible tool to use and resulted in some staff feeling more ‘professional.’ In this model staff reported that they were able to talk without constraint, did not feel rushed and took comfort in not being alone in the change process, being able to see what others were doing and feeling.

It is of interest to note that teachers working in the other two boards reported opposite feelings and experiences. Teachers who were working in boards and schools that were not implementing a professional learning team model reported feeling isolated and alone.

They made comments that they experienced difficulty going back to a school after having been “energized” by the initial whole group training and then having no colleagues to collaborate with, or to share the enthusiasm and the next steps of program implementation. One teacher reported that after the initial training he became frustrated with being alone and having no support system at his school site and so “shelved” the material and did not attempt any further use.

Some specific examples of collaborative approaches used by professional learning teams of classroom and special education teachers within schools in one board included:

- shared planning time with lunch provided once per week
- 30 + 30 minutes before school and first part of the school day, with 2 teacher groups meeting, with a third group on student supervision duty, every third Wednesday of the month
- regular staff meeting item agenda
- regular book study topic.

Principals also reported that their roles were important in that they took on the task of being a ‘diplomat,’ of providing an umbrella, of having no judgmental piece to the collaboration process.

Some school leaders and their staff were building teacher use of math diagnostic tools into annual professional learning plans for accountability and using EQAO student data as a starting point for collaborative planning discussions to focus on student needs.

Teachers in schools in the two boards that did not implement a professional learning team model reported that in some cases their principals had no idea what they were doing, had no knowledge of the math developmental continuum and felt that the principal was not able to support the teacher with the project, in an instructional leadership capacity.

Key Findings - Successful Collaboration

- 1) Provision of shared planning time for teachers in the professional learning team model, was reported as effective in enabling regular opportunities for teacher teams to review, reflect and revise their professional practice and discuss individual student results.

- 2) Classroom and special education teachers reported a need to work together in a regular classroom setting to most effectively support at risk learners.

- 3) Opportunities provided teachers for sharing of ideas in the professional learning team model, allowed for teachers to engage in what they reported to be valuable opportunities for collective problem solving, for forming collective solutions, and for sharing of resources.
- 4) Lateral collaboration with professional learning teams of principals, school staff and regional office staff both within and across school sites and boards was reported by all three groups to be of benefit.
- 5) The need to ensure support for principals from the regional office staff and senior level administration in the change process was noted by teachers and principals.

Communication

A number of strategies were developed to build effective communication among and between school and school board staff, including regional office staff.

Communication strategies used across the three school boards included:

- periodic whole group meetings

Communication strategies used across the individual school board that used a professional learning team model included:

- regular whole group meetings
- regular shared planning with school based teams of classroom and special education teachers
- regular face to face consultation with board consultants
- regular teleconferences
- e-mail list serve and board
- regular minutes of meetings and information memos
- school staff meeting agenda items
- support in ongoing conversations with school principal

As a result of using a variety of communication strategies in schools in the board that employed a professional learning model, teachers were able to take advantage of a variety of opportunities to initiate conversations and dialogues that enabled them to ask questions about their professional practice, their use of the developmental continuum and diagnostic tools, programming ideas and resources, their content knowledge in mathematics, gaps in student knowledge, and student achievement in mathematics. Teachers were able to communicate questions, successes, challenges and frustrations as they worked their way through the change process over the project implementation. Teachers in the two boards that did not implement additional communication strategies reported feelings of isolation, lack of staff with whom to discuss the project, no opportunity for shared planning, and no time to reflect on their practice, unable to ask questions, discuss successes and barriers with peers.

Key Findings - Communication

Learning Community Team Model:

- 1) Shared planning within and across grade levels and schools was viewed as effective in supporting teacher learning.
- 2) Teleconferences linked sharing of experiences across school sites, and left staff feeling that they were not alone in their challenges.
- 3) Regularly scheduled system workshops and meetings with sharing sessions were viewed as supportive of teacher capacity building.
- 4) Effective sharing of the implementation of the project both within and across school sites included the use of project binders with regular handouts of strategic information, distribution of minutes of meetings, use of e-mail correspondence - updates, memos, distributing parent letters, informal conversations held among staff, including as a regular agenda item of staff meetings at the school and regional office level
- 5) Formal support by regional office staff - program and special education - school site visits was viewed as effective in building teacher capacity.
- 6) Teacher reflective logs acted as a source for teacher discussion, sharing, as well as useful information for project leaders.
- 7) Setting of strategic time lines and goals was viewed as beneficial.

Three Board Model:

- 1) Initial whole group training sessions were viewed as providing adequate initial information.
- 2) Follow up meetings that brought together staff from across school sites and boards were viewed as beneficial for sharing and networking for ideas, resources, challenges and successes.

Action Research - Teacher Inquiry

In the Learning Community Team model, staff and principals posed a number of questions as a result of informal conversations, shared planning, whole group meetings, and meetings with principals and regional office staff over the course of the seven month PRISM Project. Staff regularly met to engage in dialogue that focussed on student achievement and evidence based best practices that could be selected and implemented to raise math scores for at risk students and also to correct student specific math misconceptions that were identified through the use of the diagnostic assessment tools.

Staff from all three project boards also met in shared planning sessions at regularly scheduled meetings in an attempt to learn from one another and to answer questions that arose in relation to use of the diagnostic tools, and how it would influence their use in their professional practice and in the next steps of selecting individual student materials for program development and implementation.

Questions that arose centred around a number of themes that included:

- 1) How to link resources and materials needed to student results of administering the diagnostic tools?
- 2) How to develop questioning techniques to use with students?
- 3) How to use diagnostic tools and ‘maps’?
- 4) How to balance time to complete math diagnostics with all other professional responsibilities?
- 5) How to use the materials efficiently?
- 6) How to time tabling extra math assistance for students who were found to have large gaps and required additional math supports?
- 7) How to organize time within a school that uses a rotary system of class scheduling?
- 8) How to measure student outcomes and growth using the math developmental continuum and diagnostic assessment tools?
- 9) How to implement materials such as math manipulative material with students?
- 10) How to close the gaps in teacher conceptual understandings and practical knowledge in math that use of the diagnostic tools highlighted for some individuals?

Key Findings - Action Research-Teacher Inquiry

- 1) The use of lateral capacity building for teacher meetings both within and across schools and school boards was reported to be effective in supporting teacher capacity building in allowing teachers time to discuss successes, concerns, ideas for programming, barriers and next steps.
- 2) When teachers were provided with time to meet, critical key questions related to student achievement and their professional needs that affect their professional practice arose that were then used to assist in the development of new strategies and resources to support student achievement
- 3) Teachers and principals using the Professional Learning Team model reported opportunities for teachers to engage in shared planning time, to network, to engage in rich, deep discussions without feeling hurried that they believed supported professional learning and practice. Teachers reported the value of having a supportive principal as part of their school team.

Focus On Student Results

Overall teachers reported that to date, in the relatively short time frame for the project that preliminary positive student outcomes had occurred. A number of positive results in student achievement in mathematics were reported by teachers in all three boards participating in the pilot project, who began to implement in their professional practice, the use of a math developmental continuum, student diagnostic tools and student intervention programs in mathematics.

Teachers reported that they believed that information gained from the use of the diagnostic tools highlighted that many students were using memory to solve problems and did not possess a deep conceptual knowledge of the mathematics. After using the math diagnostic tools one staff member found that “for a few pupils....making a few errors....using an example of a student at Level 3...that they could still move them forward if they implemented some specific strategies!” Staff also believed that it was effective for assessing gaps in knowledge for students receiving special education and in developing appropriate individualized programs.

When intervention strategies were put into place using information obtained from the use of the developmental continuum, some teachers reported changes in students’ conceptual understanding of mathematics, for example “the light bulb went on!” Some teachers reported changes in students use of math language to ask questions and to express themselves, to communicate and to explain their thinking.

Reports were also made by some teachers that they believed that they observed beginning, preliminary indicators of changes to students in terms of enhanced self-confidence and in enjoyment in math activities during class. Other teachers tracked an increase in some students willingness and perceived comfort to ask questions in class. Lower levels of anxiety while working on mathematics assignments was also noted by some staff. One teacher commented that some of her students like it as now they can “see” it (the math). Some staff also observed a greater willingness to complete math homework by some students who they had used the individual results of the diagnostic tools in order to develop more individualized math intervention program and strategies.

Some teachers reported that they believed that impact depended on the type of student who was participating, for example that they (students) “need to be cooperative.” Teachers also communicated the importance and value of sharing their new-found professional practice with earlier grades and divisions such as primary and junior, so that teachers in these years could begin to implement what they viewed as valuable assessment tools.

Teachers also reported concern in the importance of sharing such resources and skills with colleagues in grade 9 and 10 so that the valuable information that they had acquired would be shared with these teachers in an effort to expand the educational opportunities of these students as they entered secondary school.

A caveat noted by some teachers and principals was the very short time frame for implementation of the diagnostic tools to show changes to teacher practice and related student achievement.

Key Findings - Focus on Student Results

- 1) Teachers reported that they believed the use of the developmental continuum and intervention strategies did have a positive impact on some students' conceptual understanding of math
- 2) Teachers reported that the Math diagnostic tools were effective to use with all students ie. Assessing gaps in Level 3 students, and also for students who were identified as exceptional
- 3) Intervention strategies were seen to positively impact students' attitudes to math, willingness to ask questions, to participate in math lessons and in some cases to enhance student completion of homework
- 4) Students also benefited as being seen by teachers to be more self confident in their use of mathematics
- 5) Teachers reported the need to share this professional practice with other grade divisions, both lower to primary and junior in order to begin the use of a math diagnostic continuum at an earlier age and grade for students, and also the importance of sharing this practice and student information about these at risk learners as they enter secondary school.
- 6) Teachers reported that they were cognizant of questioning the depth of impact on students in early stages due to short time frame that the project had been implemented.

Teacher Capacity Building and Change In Professional Practice

Over the duration of the implementation period for the PRISM pilot project several key trends or themes emerged in relation to changes in teacher conceptual knowledge and professional practice.

Teachers in all three boards reported that their professional learning was enhanced by the PRISM training, and effected changes to their professional practice and professional judgement. For example teachers spoke of making changes in some of their daily routines and schedule, in school practices such as how and where math lessons were offered, combining/splitting of classes to team teach, and in re-designing larger blocks of time for mathematics instruction.

Teachers reported changes in professional practice using examples such as changes in teacher-student interaction, in dialogue & conversations that they engaged in with students and with colleagues. Some reported using more open-ended questions in classroom practice, in their math lessons. A trend was noted that using the math diagnostic tools allowed for a teacher to find answers to 'why' a student comes to a particular solution. "As a teacher I stopped looking for patterns and started asking why for the understandings of pupils." Teachers reported that they "stepped back and reviewed student questioning models that they used".

Teachers reported feeling that the use of student diagnostic assessment tools were valuable in highlighting learning needs for at risk students and students who were also formally identified as having a learning exceptionality.

Some teachers reported that they began to engage in questioning current professional practice, why they did certain things in their teaching. For example some teachers posed professional practice reflective questions such as:

“How does this affect my regular program?”

“What materials and resources and strategies do I need to meet the needs that have been uncovered by using the math diagnostic tool?”

“How do I communicate this information with parents?”

Changes were reported by some staff in the way in which they viewed students and in the assumptions that they made in viewing the math skills of individual pupils. For example, some preconceived ideas about particular students level of achievement in a specific math strand were challenged with the use of the math diagnostic tool and in some cases highlighted gaps in conceptual knowledge that otherwise may have gone undetected. Teachers discovered that “for some students they get the right answer for the wrong reasons on math problems” after using the math diagnostic tools. For some it “changed how I involve all students now in the class, with individual diagnostics to track all pupils and results...use diagnostics to check....before kids who didn’t ask...slipped through the cracks.”

Impact was also noted in changes in some teachers’ personal understanding and knowledge of mathematics concepts, with comments that they now knew the actual math subject matter better than before being involved in the project. Some teachers reported that they had to unlearn and re learn math conceptual understandings, which they described as being “very hard!”

For example, “the way we talk about math, the language we use....it highlighted my gaps in mathematics! I followed only patterns...the why for students and the why for me!....Now I look deeper into the why of student needs....so difficult at the beginning.”

Some teachers shared that they previously had a “right or wrong view of math” and that the training in the use of math diagnostics “has opened up avenues of opportunities to help my students.”

In some cases the school special education teacher became a collaborator, a mentor for the regular classroom teacher, with reports that they “formed a learning partnership.”

Key Findings - Teacher Capacity Building & Changes in Professional Practice

- 1) Changes occurred in teacher questioning and in their use of language, in the way that they taught math in the classroom. For example more open-ended questions were reported as being used in math lessons with students.
- 2) Teacher change was noted in assumptions that teachers made in relation to student math abilities. Teachers reported that they no longer assumed student knowledge or motivation.
- 3) Changes were reported by teachers in how they worked with one another, they began to ask

questions among themselves and to work in collaboration with the special education teacher.

- 4) Some changes were noted in ways that teachers perceived their principal, who was now viewed as a supporter and as a knowledgeable partner in the initiative
- 5) Some teachers reported changes in their use of math materials, such as increased use of math manipulative materials with students in the classroom.

Sustainability

In order to sustain any long term, deep change both teacher and principal participants in this pilot recognized and shared their concerns for action beyond the 2004-2005 school year duration of the PRISM pilot.

Senior management staff, and some school principals sought ways to continue the pilot for the 2005-06 school year and to expand the use of math diagnostic tools to other grade-division levels within their school, including leveraging both fiscal and staff resources. There was an acknowledgement that senior management would need to seek sustainable funding that would include allocation over time from a board budget.

Many staff communicated the value of providing the strategy for teachers to learn on an ongoing basis in the context of their regular classroom and school with consultant support to mentor staff and wished for this to continue on a regular basis as part of their role and responsibilities.

This would also include the continuation of shared time in a teacher's schedule for reflection, planning, and collaboration both within and across school and school board settings.

The ongoing purchase of materials needed by classroom and special education teachers to sustain changes in professional practices was put forward as a critical element in an effort to sustain the new-found professional practice(s).

The use a Professional Learning Team model within and across schools to build professional networks, partnerships and lateral capacity building for learning, sharing of ideas, materials, strategies, and evidence based best professional practices was seen as a key piece to successful implementation and as a necessary component to include in a model for long term, deep change.

Teachers and principals also communicated the importance of making a commitment to continue to implement strategies for effective teacher communication, both within and across school and school board project sites.

Key Findings - Sustainability

- 1) To sustain long term change the following strategies were identified by participants in this

project are necessary factors:

- a. sustainable resource allocation - fiscal, staff and material
 - b. expansion of use of math diagnostic tools to a whole school approach, and to begin to assist students at an earlier grade and age level
 - c. continued use of a Professional Learning Team framework to effectively implement system change in a carefully planned fashion
 - d. use of a variety of communication methods to ensure ongoing lateral and multi level capacity building support
- 2) To provide ongoing opportunities for teachers to meet to network, to collaborate, to share successes, challenges and ideas about program planning both within their classroom and school, and also across schools and school boards with peers.

Enablers and Barriers

Information was collected from teaching staff across all three school boards and also from school based principals in the professional learning community model in an effort to answer questions about what they perceived to be factors that were enablers or barriers to the implementation of project strategies over a seven (7) month period.

Enablers

- use of a PLC model to support change after initial large group training, with lateral capacity building framework of cross school meetings, whole group workshops, sharing and networking
- use of a variety of meeting and communication methods to support teacher changes in professional practice
- regional office support
- student math diagnostic tools
- a committed staff focussed on a specific area for change
- regularly scheduled shared planning and meeting time where teachers can talk about what they have tried, what works, what does not work and what-where the challenges are
- provision of resources that support findings from the diagnostic tools in student gaps and programming needs
- training for principals in understanding of content knowledge of change initiative
- support of a school principal who is visible, has content knowledge of the changes in professional practice that teachers are being asked to implement in their classrooms and supports teachers in what he/she says and does

Challenges /Barriers

- one-shot initial whole group teacher training, and return to individual schools with no ‘big

picture' plan or school based learning team- 'alone in my school'

- lack of principal support, who were not trained in strategies, who did not attend meetings
- lack of special education resource teacher support
- no provision for release time for planning, lack of shared planning with colleagues or time to carry out necessary tasks connected to using student diagnostics, such as scoring the student assessments
- staff feelings of isolation in schools that lacked a PLC Model, that resulted in teacher lethargy, lack of action and failure to follow through with implementation of new strategies and as a result do not change existing professional practices
- timing of scheduling of initial training mid way through the school year
- lack of a global school-board wide strategic plan, as it would relate to enabling staff to narrow their focus to a specific change initiative
- lack of materials and resources for teachers and training in how to use materials, such as student math manipulative materials
- teachers assigned to two separate grades, or in two separate schools
- in school teacher and student timetables that lack flexibility, including schools with rotary systems
- lack of whole school staff involvement, and lack of communication to other staff members, parents, students
- too much time spent by teachers out of school and out of the classroom attending collaborative meetings
- teachers required a greater depth of conceptual knowledge in mathematics, and do not feel comfortable teaching math in the elementary school years
- physical format, lay out of commercial diagnostic tool materials

Parents

Teachers in all three boards reported communicating to parents about the PRISM Pilot Project. Some staff shared how they used information gained from the use of the math diagnostic tools as a communication strategy to parents to provide a reason to contact parents about student progress and achievement in mathematics, particularly in relation to difficulties being encountered by a particular student.

Teachers also reported using the information that they had acquired through the use of the math developmental continuum to help "get parents on board."

It was also reported that staff used the diagnostic tools and student data from the developmental continuum as a resource of information to share with parents in their effort to understand where the learning difficulties were with their child.

Teachers also believed that the use of the diagnostic tools helped to provide information on the next phases that a child needs to progress to in learning mathematics and information on how parents can help in this process.

Key Findings - Parents

Staff viewed the use of student diagnostic tools in mathematics as a beneficial additional strategy to use:

- a. to interact with parents
- b. to provide parents with useful information about how their child was progressing in mathematics
- c. to use as a source of information to parents on how they could assist their child
- d. to highlight the next phase of math development that a child would be progressing towards.

OVERALL RECOMMENDATIONS

A review of the overall project research data, results and findings highlighted key learning for school board superintendents, student success leaders, supervising principals of program and special education, regional consultants, school principals and teachers about the implementation of the PRISM project. Recommendations for future directions, policy and practices were developed from these key findings and learning for teacher professional capacity building, changes needed to school system structure, principal leadership and the mathematics developmental continuum and supported by evidence from the related literature.

OVERALL RECOMMENDATIONS

- 1) Expand the use of math developmental continuum and diagnostic tools in mathematics by teachers, classroom and special education, to a whole school approach, as a whole team approach was viewed as more effective for staff professional learning and project implementation (Fullan, 2005).
- 2) Begin the use of math developmental continuum and diagnostic tools in mathematics by teachers, classroom and special education, in earlier grades (late Primary into Junior years) to effect maximum yield to make a difference in assisting teachers to pinpoint gaps in student knowledge and achievement. This will assist teachers to implement early intervention strategies for students who are at risk for failure in mathematics at an earlier age, as one teacher commented “ before it is too late”.
- 3) Expand the use of a collaborative professional learning team model at the board, school and classroom level, both within and across schools and school boards to assist in the effective implementation of change strategies that enable teachers to engage in professional learning that results in effective changes to their professional practice. This would include a detailed plan for teacher support both within and across school sites, within and across school boards, when they return from initial whole group professional training sessions. It should also include the school principal as part of the professional learning team, and to include the principal in the initial training to further his/her capacity as an instructional leader (Dufour & Eaker, 1998).
- 4) Ensure that a board strategic planning team is developed before such a project is begun, in order to develop strategies such as key staff who will participate and their roles and responsibilities with a time line, a follow up support plan for teacher capacity building, an effective communication plan so that whole schools and school boards are aware of new change initiatives, and allocation of a budget to support all facets of the project (Dufour & Eaker,1998).

- 5) Ensure that sustainable change strategies are built into the original implementation plan for the system initiative in areas such as dollars to support teacher training, and for purchase of resources and materials, principal and regional office team support and for collaboration within and across individual schools and school districts so that the project, if found to be effective, may continue into subsequent school years. It is critical to apply teacher capacity building strategies that support the practice of embedded professional learning (Fullan, 2005).
- 6) Revise the commercial student diagnostic tools used by teachers in the pilot project to make them more “user friendly.” Add additional components such as programming ideas and materials that correspond to student level and to the Ontario literacy and numeracy curriculum documents.

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APPENDICES

Appendix 1: Research Questions and Related Propositions

Appendix 2: Study Propositions

Appendix 1

Research Questions and Related Propositions

CHART ONE -PRISM Project Research Questions and Related Propositions

RESEARCH QUESTION(S)	PROFESSIONAL LEARNING COMMUNITY ELEMENT(S)	PROPOSITION(S)	DATA SOURCE(S)
<p>1) How was the PRISM Pilot Project being implemented in terms of the experiences of school leaders using a Professional Learning Community model within and across schools and school districts?</p>	<p>a)Shared Values Setting Goals- b)Establishing Priorities c)Student Focus d)Collaboration-Regional Staff-Principals-Teachers e)Communication f)Action Research g)Focus on Student Results h) Teacher Capacity Building & Changes in Professional Practice i)Sustainability</p>	<p>P1. P2. P3. P4. P5. P6. P7. P8. P9. P10. P11. P12. P13. P14. P15.</p>	<p>Minutes of Meetings-staff, regional principal, shared planning, PD training, pilot schools lateral Tele conference-Notes PD Presentations Observational Notes Focussed Interview Exit Survey Archival Material Reflective Log</p>
<p>2) How was the PRISM Pilot Project being implemented in terms of the experiences, understandings and impact on classroom and special education teachers using a Professional Learning Community model within and across schools and school districts?</p>	<p>a)Shared Values Setting Goals- b)Establishing Priorities c)Student Focus d)Collaboration-Regional Staff-Principals-Teachers e)Communication f)Action Research g)Focus on Student Results h) Teacher Capacity Building & Changes in Professional Practice i)Sustainability</p>	<p>P1. P2. P3. P4. P5. P6. P7. P8. P9. P10. P11. P12. P13. P14. P15.</p>	<p>Minutes of Meetings-staff, regional principal, shared planning, PD training, pilot schools lateral Tele conference-Notes PD Presentations Observational Notes Focussed Interview Exit Survey Archival Material Reflective Log Student Data</p>

Primary and Secondary Research Questions and Related Propositions (Con'td)

RESEARCH QUESTION(S)	PROFESSIONAL LEARNING COMMUNITY ELEMENT(S)	PROPOSITION(S)	DATA SOURCE(S)
<p>3) How was the PRISM Pilot Project being implemented in terms of the impact on students within and across schools and school districts who are at risk for failure in mathematics?</p>	<p>a)Shared Values Setting Goals- b)Establishing Priorities c)Student Focus d)Collaboration-Regional Staff-Principals-Teachers e)Communication f)Action Research g)Focus on Student Results h) Teacher Capacity Building & Changes in Professional Practice i)Sustainability</p>	<p>P1. P2. P3. P4. P5. P6. P7. P8. P9. P10. P11. P12. P13. P14. P15.</p>	<p>Minutes of Meetings- staff, regional principal, shared planning, PD training, pilot schools lateral Tele conference- Notes PD Presentations Observational Notes Focussed Interview Exit Survey Archival Material Reflective Log Student</p>

Appendix 2

Study Propositions

CHART TWO: Propositions for the Use of a Professional Learning Community Model Framework to Implement the PRISM Pilot Math Project Propositions

Shared Values

- P1. Regional Office Support Team Members, Principals and Teachers develop a shared sense of mission, vision, values and commitment to closing the gap in achievement for students at risk for failure in mathematics within and across school and school district sites. Values influence daily decisions, and professional practice of teachers. Evidence of lateral capacity building begins to emerge.

Goal Setting-Establishing Priorities

- P2. Staff set and pursue measurable student goals, that are linked to the school improvement plan. Goal setting is part of staff routine responsibilities.

Student Focus

- P3. School teams focus on assessing student needs, and in designing appropriate programs in an effort to close the achievement gap for students at risk for failure in mathematics.

Collaboration

- P4. Regional Office Support Team, Principals and Teachers engage in the development and implementation of collaborative work teams.
- P5. Principals and teachers are fully involved in a collaborative decision making process.
- P6. Administrators pose questions, provide staff with time, resources and authority to make decisions and to meet the needs of students.
- P7. School-student improvement is viewed as a collective responsibility with shared ownership.
- P8. Teachers function as a team, characterized by common goals, planning time, and interdependent efforts to share information-resources-data to achieve student centred goals.

Communication

- P9. Regional office staff, principals and teachers engage in 2-way, multiple sources of honest, open and effective communication strategies in a collaborative effort to close the student achievement gap.

Action Research

- P10. Topics for action research arise from the shared vision of the PRISM Pilot Project.
- P11. Staff regard action research as an important part of their professional knowledge and skill set in becoming critical problem solvers.
- P12. Staff are engaged in regular, planned meetings & discussions regarding student findings and implications for professional sharing and practice. They attempt to learn from sharing & questioning the research, knowledge and experiences of colleagues. Findings generated from this practice are influencing teacher professional classroom practices.

Focus on Student Results

- P13. Staff are engaged in ongoing, regular assessment and collection of student abilities and achievement information. Student data gathered is analysed and used to identify discrepancies between actual and desired results, student areas of weakness & misconceptions in mathematics, with related goal setting developed in an effort to reduce discrepancies and to close the achievement gap.

Teacher Capacity Building & Changes In Professional Practice

- P14. Teachers engage in ongoing professional learning activities that result in new knowledge and skills that change professional practice at the classroom level, and result in enhanced student achievement.

Sustainability

- P15. School district and-or individual site decision making includes refocusing allocation of funds to include the continuation and-or expansion of change initiatives in teacher capacity building, such as the PRISM Math Pilot Project.