



PRISM Ottawa Area (Pre-pilot) 2004- 2005 Executive Summary

The intent of the PRISM project was to use existing research-based programs with students experiencing difficulty in mathematics in order to provide learners with an opportunity to experience some degree of success. A professional development plan was instituted for teachers in order to help them re-think how math is learned and taught. Three relatively new resources designed to help educators approach the teaching of mathematics in a different way were used; **Prime**, researched by M. Small from the University of New Brunswick, Canada and published by Nelson Canada; **First Steps** researched and developed by S. Willis, W. Devlin and others under the auspices of the Department of Education in Western Australia and published in Canada by Pearson; and **Knowing Mathematics**, published by Houghton Mifflin; designed by Liping Ma and Cathy Kessel.

It is important to emphasize that the intent of this project **was not** to review the actual resources themselves, but rather to examine the effectiveness of building of a professional learning community using these resources as a catalyst for introducing a different approach to the teaching of mathematics. The premise of the project rested on the assumption that "...improvement of students' learning depends on skillful teaching, and that skillful teaching depends on capable teachers and what they know and can do" (Ball, Bass and Hill, 2004).

A total of 57, grade 7 and 8 teachers and 1,558 students from four boards of education participated fully in the PRISM project. Teachers were either part of a professional learning community, (*Prime*, *First Steps*, or *Knowing Mathematics* groups) or not (*Control* group). All teachers completed the Content Knowledge for Teaching Mathematics questionnaire (CKT-M) in December and then again in June. (Note: The CKT-M, developed by D. Ball and others, is designed to measure growth resulting from professional development). All students completed pre and post diagnostic assessments of Numbers and Operation skills in mathematics. Other measures of mathematical ability including report card marks were also collected.

A repeated measures analysis of variance (ANOVA) was conducted to determine whether CKT-M scores varied as a function of group membership and time. The analyses suggested that teachers who participated in either *Prime* or *First Steps* professional communities had statistically higher scores on the CKT-M as compared to either teachers in the *Knowing Mathematics* or *Control* group.

In order to assess how student learning changed as a function of the teachers' professional development, a multivariate analysis of variance (MANOVA) was conducted on students' diagnostic assessment scores. Group membership was the independent variable (i.e., *Prime*, *First Steps*, *Knowing Math*, and *Control*) and scores obtained from both pre and post administration of the Numbers and Operations diagnostic assessments were the repeated, dependent variables.

A significant group membership by time interaction was observed for students. Review of the subsequent univariate analyses revealed a significant interaction for Numbers and Operations. Post hoc analyses on Group Membership suggested a statistically significant difference in number scores for *Knowing Mathematics* and in operations scores for both *Prime* and the *Knowing Mathematics* groups. The identified groups increased scores over time as compared to the other groups.

Multivariate analyses of variance (MANOVA) were also conducted on gender, IEP status and grade as a function of group membership and time. It appears that females did better than males on the operations diagnostic assessment over time; students with an IEP did not do as well as students without an IEP regardless of time, program or the type of diagnostic assessment; and in general, the grade 8 students outperformed the grade 7 students on both the operations and the numbers diagnostics.



Correlations were also examined between several student variables. For example, the relationship between scores on the Number and Operations diagnostics and the report card marks were relatively weak. Similarly, the relationship between reading and the diagnostics scores was only moderate suggesting that the diagnostics are not overly influenced by a student's ability to read (c.f. EQAO scores). Absenteeism was not significantly correlated to any of the achievement measures.

The project was also evaluated using a mixed method case study design that allowed for a review of systems implementation and outcomes for school based principals, teachers - classroom and special education, and students (Yin, 1989). Critical questions focussed on how a professional learning community model was used to effect system change and examined system barriers and enablers, building teacher capacity as measured by transformations to teachers' professional learning experiences and practice, and student achievement.

The case study model gathered qualitative data by developing a Theoretical Scenario, supported by Theoretical Propositions based on the evidence found in the Professional Learning Community literature (DuFour & Eaker, 1999), Systems Change theory (Fullan, 2005), Professional Development Models (Joyce and Showers, 1986), and Emotional Intelligence (Golman, 1989). Data was gathered, displayed and analyzed using the analytic framework of Miles and Huberman (1994) and reported in terms of frequency of occurrences, significant themes and trends. Data was collected through the use of teacher self reflection logs, teacher-principal surveys, observational data for training workshops and regular working meetings, archival data including memos, minutes of meetings, training handouts, teleconferences, e-mail list serves, video tapes of teacher sessions, and focussed interviews with teachers and principals.

Findings and Results obtained for principals, teachers and students from the data of the case study design supported the findings of the quantitative measures and results. Results of Key Findings from the case study were reported using the following categories found in the professional learning community literature:

- a) Shared Values
- b) Goal Setting – Establishing Priorities
- c) Student Focus
- d) Collaboration
- e) Communication
- f) Action Research
- g) Focus on Student Results
- h) Teacher Capacity Building and Changes in Professional Practice
- i) Sustainability
- j) Parents – Community.

Some Key Findings emerged and were reported as Enablers and Barriers to project success.

Enablers reported included the value of using a school wide professional learning community team model, use of a variety of communication strategies both within and across school sites, need for support of staff by their school based principal, value of shared planning time both within and across school professional learning teams, need for effective and appropriate allocation of program resources, need for supportive regional office consultants, time for teacher reflection and networking, training for school based principals as instructional leaders in the content of the program change initiative.

Barriers to project success reported included the use of one shot whole group professional development workshops with no planned, ongoing staff support when they return to their home school, lack of school based principal support as an instructional leader, lack of special education



resource support and regularly scheduled shared planning time for classroom and special education school based teams, lack of appropriate resources to support program development and implementation, lack of appropriate school infrastructure in order to effect needed system changes, lack of whole school staff participation, too much time spent by staff at meetings away from their students.

Overall recommendations of the project included:

- a) Expansion of training of teachers in the use of developmental continuum and diagnostic tools in mathematics for students in the intermediate Grade 7 & 8 grades,
- b) Expansion of school participation in the pilot project to lower grade Primary-Junior level divisions,
- c) Expansion of the use of a collaborative professional learning community team model at the both within and across school schools and school systems,
- d) Organization of shared planning time for learning teams both within and across school sites,
- e) Provision of time for teacher reflection of professional practice,
- f) Asking additional research questions that address more in-depth school-classroom level teacher and student practices and achievement outcomes, a focus on parent involvement, and the role of system consultants.

The results from this pilot research project, although promising, are just preliminary. More information on the use and implementation of developmental continuums needs to be gathered. The impact of professional learning communities on student achievement is multifaceted and complex and needs to be studied in a variety of settings, with a variety of groups and in a variety of ways.