**Professional Learning Communities and Student Achievement:**

**More Than Standardized Test Scores**

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Public education is currently experiencing a major shift that fundamentally impacts both the structure and culture of schooling. While some government efforts continue to believe that the standards movement holds the promise for more effective schooling, others are focusing on a more systemic educational change. This change is based on a concept that is known variously as the learning community (Mitchell & Sackney, 2011; Voulalas & Sharpe, 2005), communities of practice (Wenger, 2000), professional community (Halverson, 2003), or professional learning community (Stoll, Bolam, McMahon, Wallace, & Thomas, 2006). This paper examines this reform initiative from the perspective of New Brunswick, a province that has shown great insight and persistence in transforming schools into *professional learning communities* (PLCs) (Williams, Brien, & LeBlanc, 2012). This paper also examines another equally important construct, one that is not being adequately researched in most jurisdictions. That construct is student achievement, the measure by which the success of all educational change must be gauged. As governments pursue the innovations associated with the learning community approach most continue to measure the success of their efforts by studying the effect they have on standardized test scores. We argue that, while standardized test scores provide a valuable reflection of student achievement, they are a narrow reflection that falls far short of the breadth of learning articulated in the mission statements of most schools and school districts. Nor do they measure in adequate depth the success of the PLC reform movement. Therefore, our current study builds on our expertise in defining PLCs, examines a more robust concept of student achievement, and seeks to determine how PLCs impact a broader notion of student achievement.

**Our Understandings of Professional Learning Communities and Student Achievement**

Any analysis of the relationship between PLCs and student achievement must begin with a clear understanding of what these terms mean. Our research defines the PLC in a comprehensive way that resonates with the changes that New Brunswick has been undertaking. We begin with the attributes outlined by Hord (1997): a) shared values and vision, b) supportive and shared leadership, c) collective creativity, later described as collective learning and application of learning (Morrissey, 2000), d) supportive conditions, and e) shared personal practice. We further incorporate: f) continuous inquiry focused on the improvement of student learning from Astuto, Clark, Read, McGree, and Fernandez (1993), g) teachers who share norms and values and engage in reflective dialogue that de-privatizes practice from Louis and Kruse (1995), h) professional collaboration and joint responsibility for student learning from Lambert (1998), and i) the identification of essential curriculum, j) use of common formative assessments, and k) systemic interventions from Stiggins and DuFour (2009) and DuFour and Mattos (2013). Using these components we created an instrument that measures the degree to which a school exhibits both a PLC structure and culture (Williams, Brien, Sprague, & Sullivan, 2008). This instrument examines four measures of a PLC: a) culture of the school, b) patterns of school leadership, c) beliefs and practices of teaching, and d) impact and potential of professional growth and development of the school staff.

Our definition of student achievement derives from Lambert’s (1998) construct, which posits three separate aspects of student performance:

* Authentic academic achievement
* Positive involvement
* Resiliency behaviours.

Authentic academic achievement is the combination of the summative assessments gathered over a lengthy period and in ways that reflect the full spectrum of assessment practices (e.g., pencil and paper tests, projects, and presentations) used by classroom teachers. Measures of positive involvement come from data associated with school attendance, student suspensions, dropout records, graduation rates, and student and parent satisfaction with the learning environment. Lambert’s (1998) description of positive involvement is similar to the concept of *student engagement,* described by Wang and Eccles (2011) to include three components: behavioural engagement, emotional engagement, and cognitive engagement. Resiliency is an often ignored but essential component of student achievement, a social learning that students achieve when they are active participants in a learning community. Lambert (1998) defines resiliency behaviour as self-direction, problem-solving, social competence, and having a sense of purpose and future. Lambert’s resilience behaviour factors align with those proposed by Ungar and Liebenberg (2011) and used in their Child and Youth Resiliency Measure. We intend to use a modified version of Ungar and Liebenberg’s instrument to gauge student resiliency in a later phase of our study.

Clearly, there is more to student learning than what is measured by standardized test scores. Indeed, there is evidence of growing fatigue among educators as a side effect of so-called data-driven teaching and learning dialogue and practices. For example, Baldasaro (2013), an experienced educational administrator in the United States, expressed concern about the current generation of teachers who emphasize the test scores of their students as evidence of the quality of their teaching:

The trend of more younger, test-touting teachers may signal a concerning shift toward a generation of teachers who equate high test scores with being a professional educator, teachers who measure their value by a change in test scores and not in the difference they make in the lives of children.

Hargreaves and Fink (2006) used harsh words to criticize the “rapid, relentless, and pervasive spread of standardization in recent educational reform” (p. 10). In particular, they cited such effects as a narrowed curriculum that has, in their opinion, destroyed the classroom creativity necessary for students in today’s knowledge-driven economy. Mulford (2011), writing in the Australian context, expresses similar concerns. Under the heading “What doesn’t work” on the basis of research, he includes “narrowing what counts for good schooling to a few areas that are relatively easy to measure” (p. 2) and “external authorities imposing change and reporting requirements on schools” (p. 2). He also points out, under the heading “What we don’t know,” that there is a lack of evaluation data to know “how to measure what we value, such as child and community social development” (p. 2).

The purpose of our study is to determine the effects of PLCs upon student achievement. Theory and practice claim that when schools operate as PLCs they are guided by shared vision and leadership, focus on student learning, build a collaborative school culture, encourage innovation, expect measureable results, and commit to continuous improvement; and in these schools students achieve higher academically, become more positive and involved in their education, and persist in their efforts even when faced with adversity. Our goal is to determine if these claims are supported by measurable data. If so, this research can be used to justify the resources required to sustain PLC reform and provide a framework to ensure that future changes work to enhance rather than diminish the positive effects of PLCs.

Earlier studies (Lee & Smith, 1996; Louis & Marks, 1998) indicated a positive relationship between higher student achievement and school professional community. Lee and Smith (1996) captured features of teachers’ professional community with four composites: collective responsibility for student learning, the variation among teachers’ beliefs about collective responsibility, cooperation and support among teachers and administrators, and teacher control. Louis and Marks (1998) examined: “(1) the impact of school professional community on the intellectual quality of student performance (authentic achievement) and (2) the relationship of professional community to the technical and social organization of the classroom” (p. 535). Lee and Smith (1996) measured student achievement as gains between eighth and tenth grade in mathematics, reading, history, and science. Louis and Marks (1998) studied 144 math and social studies classrooms at the elementary, middle, and high school levels and found that school professional communities correlated with higher student achievement. Unfortunately the vast majority of recent studies (Vescio, Ross, & Adams, 2008) use standardized test scores as a proxy for student achievement. Although very useful, standardized tests are curriculum-based assessments of cognitive learning in relatively few subjects and thus represent a limited measure of both student success and school effectiveness. While many of these studies do show that successful PLCs produce higher standardized test scores (Vescio et al., 2008),we believe that PLCs have the capacity to improve performance across all three aspects of student achievement. Therefore we are interested in the broader measure of student learning as provided by Lambert (1998) and outlined above.

**Research Background and Process**

The research we are reporting on today was designed as a stepping-stone to a larger, province-wide study. We began this project during the 2010-2011 school year by working with a cluster of 15 schools coordinated by a central office and located in a rural county of New Brunswick. Prior to a provincially mandated amalgamation of school districts that took effect in July 2012, this cluster of 15 schools formed an independent school district that operated as a PLC at the district level (Brien, Williams, & Briggs, 2009). In it, school principals were involved in district operations, shared leadership, and collaborated frequently with their educational partners in the central office. We chose this district and these schools because the effective operation of school PLCs is dependent upon an aligned PLC approach at the district level (Foster, Wright, & McRae, 2008; Fullan, 2005). Our study was built on the PLC philosophy and aligned with the PLC tenets outlined above. As in our earlier work (Williams et al., 2008), we have employed the principles of action research to guide our research. As described by Merriam and Simpson (2000), action research includes three components: (1) the researcher acts as a facilitator and catalyst in the research process, (2) the results are meant for immediate application, and (3) the design of the research is emergent in nature, developed as the research takes place rather than being completely predetermined from the beginning of the study. Our first step was to meet with the district leadership group and collaborate on both our vision for the study and the two variables we would study. The trust and collaboration resulting from this step led to the creation of a district/school based research team, termed *the* *guiding coalition* (Kotter, 1996), which informed and coordinated our planned two-year study. The first actions by the coalition focused on gathering information regarding best practices and the current reality within the schools. Coalition participants took it upon themselves to learn about PLCs and the instrument we used to gather PLC data, immerse themselves in the study of shared leadership, and analyze data on each of the 15 schools. Discussions within the coalition led to steps to improve PLC operations at the school level, which were acted upon and supported by the district superintendent.

With the support of the guiding coalition, we administered our school instrument in each of the 15 schools in May 2011. The PLC data collected from the teachers in these schools were used to create school reports that provided a picture of the culture, leadership, teaching, and professional growth and development within each school. Our instrument was designed to interpret teacher responses as leaning towards either a bureaucratic or a learning community perspective for each of the 62 instrument items. For the purpose of our analysis of the data, we considered items for which 20% or more of the teachers reported a bureaucratic response as *barriers* to the full implementation of PLC principles in a school (Williams et al., 2012). By contrast, items for which at least 50% of the teachers scored a PLC response were considered *strengths* upon which PLC implementation could be built in that school. Our reports to each school included the transformation of the school data into descriptions of strengths and barriers with respect to PLC implementation. Our intention was to identify schools that, going into the following year, had more barriers than strengths and to provide interventions for these schools. During the 2011-2012 school year, we worked with teams of teachers from each school to train them on how to analyze the school reports and to use them to develop school improvement goals for the following 2012-2013 school year. These goals, designed to improve school operations, were used by school leaders and supported by the original district.

Two years later, in the spring of 2013, we administered our instrument a second time and the data were used to generate a second school report. Our purpose was to determine if PLC operations had changed during the interim and to comprehensively analyze each of 62 indicators that defined the four measures within our independent variable – school-level PLC operations. The next step in our study is to gather measureable data for our dependent variable, student achievement as described above. While we expect eventually to analyze the relationships between the two data sets (school PLC operations and student achievement) for all 15 schools we have chosen for both theoretical and practical reasons to narrow our focus in this paper to the five schools that contain high school grades (Grades 9 to 12 in New Brunswick). Research suggests that organizational design and longstanding operational practices make high school the most challenging level to successfully implement the PLC reform (Clark, 2008; Louis, Marks, & Kruse, 1996). On the practical side, the technology being used to report student performance in high schools is the easiest for gathering the data we require for our measures of student achievement.

In the next two sections of the paper, we present two sets of data. The first set represents the data collected from the administration of our school PLC instrument in the five high schools in 2011 and in 2013. The second set of data comes from selected student achievement measures in these schools during the school years from 2009 to 2012.

**School PLC Instrument Data and Analysis**

The five schools that we are examining in this paper, labeled as Schools **C**, **D**, **H**, **I**,and **K**, represent the typical divisions occurring in New Brunswick schools that contain high school grades. School **C** is a high school that consists of only grades 9 to 12, Schools **D** and **I** are grade 7-12 schools that contain both middle and high school grades, and Schools **H** and **K** are community schools located in rural areas and consist of grades K-12. The analyses of PLC operations for the five schools are broken down into the four measures used in our school instrument: culture, leadership, teaching, and professional growth and development. For each measure we have focused on: a) the numbers of strengths and barriers within schools, b) changes in these numbers between the results in 2011 and 2013, and c) identifying the statements that represent barriers to PLC operations. Appendix A provides a summary of the descriptive statements in our school instrument.

The combined metrics for the five schools shown in Table 1 indicate that in 2011 there were 98 barriers identified within the 310 items used to measure the 20 statements, thus 32% of these items required some analysis to determine how high schools could improve PLC operations. At the same time there were 154 strengths, indicating that 50% of school instrument items suggested support for PLC principles at these schools. The remaining 58 items fell between the barrier and strength thresholds. This 19% represented neither significant challenges nor supports for PLC operations. The metrics for 2013 show a decrease in the number of barriers to 59 representing 19% of the instrument items, an increase in strengths to 171, representing 55% of the items, and an increase in the ‘neither’ category to 80 or 26% of the items. These metrics indicate a reduction in the proportion of barriers of 13% and an increase in the proportion of strengths of 5%. We interpret this as a positive change in PLC operations that occurred because of the interventions made by the schools. The disaggregation of these changes into school changes shows a more interesting picture.

**Analysis for Each School**

In the tables below, we present summaries of the strengths and barriers at each school as reported by the teachers during the 2011 and 2013 administrations of the instrument. Each row of the table shows the number of items that were barriers, strengths, or neither in comparison to the number of instrument items for each section of the instrument. Fractional entries occurred in cases when more than 50% of responding teachers reported the item as a strength and 20% or more of the teachers reported the same item as a barrier. For each school, a chi-square test was also applied to these results using a 3 x 2 matrix (3 rows representing strengths, barriers, and neither, and 2 columns for 2011 and 2013). For the chi-square test, instrument items that were reported as both strengths and barriers were treated as strength, barrier, or neither according the relative proportion of teacher responses.

School **C** decreased in both its barriers (8%) and strengths (5%) making the overall change positive but not significant. The chi-square test applied to these results similarly found no statistically significant difference between the two years.

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| **Figure 1 - School C** | | | | | | |
|  | Barriers | | Strengths | | Neither | |
|  | **2011** | **2013** | **2011** | **2013** | **2011** | **2013** |
| Culture | 2/15 | 2/15 | 11/15 | 7/15 | 2/15 | 6/15 |
| Leadership | 7.5/16 | 4/16 | 6.5/16 | 6/16 | 2/16 | 6/16 |
| Teaching | 2/16 | 2/16 | 13/16 | 12/16 | 1/16 | 2/16 |
| Professional Growth & Development | 2.5/15 | 1/15 | 7.5/15 | 10/15 | 5/15 | 4/15 |
| Totals for all Instrument Items | 14/62 | 9/62 | 38/62 | 35/62 | 10/62 | 18/62 |
| Percentage of Change | 8% Decrease | | 5% Decrease | | 13% Increase | |

School **D** decreased its barriers (42%) and increased its strengths (56%) making its overall change positive and significant. The chi-square test similarly found a statistically significant difference (*p* < .001).

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| **Figure 2 - School D** | | | | | | |
|  | Barriers | | Strengths | | Neither | |
|  | **2011** | **2013** | **2011** | **2013** | **2011** | **2013** |
| Culture | 8/15 | 1.5/15 | 6/15 | 12.5/15 | 1/15 | 1/15 |
| Leadership | 6/16 | 1/16 | 6/16 | 15/16 | 4/16 | 0/16 |
| Teaching | 5/16 | 0/16 | 6/16 | 15/16 | 5/16 | 1/16 |
| Professional Growth & Development | 9.5/15 | 0/15 | 3.5/15 | 14/15 | 2/15 | 1/15 |
| Totals for all Instrument Items | 28.5/62 | 2.5/62 | 21.5/62 | 56.5/62 | 12/62 | 3/62 |
| Percentage of Change | 42% Decrease | | 56% Increase | | 14% Decrease | |

School **H** increased its barriers (24%) and decreased its strengths (10%) making its overall change negative and significant. The chi-square test found a statistically significant difference (*p* < .01).

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| **Figure 3 -** **School H** | | | | | | |
|  | Barriers | | Strengths | | Neither | |
|  | **2011** | **2013** | **2011** | **2013** | **2011** | **2013** |
| Culture | 2/15 | 7/15 | 9/15 | 6/15 | 4/15 | 2/15 |
| Leadership | 4/16 | 7.5/16 | 5/16 | 2.5/16 | 7/16 | 6/16 |
| Teaching | 2/16 | 5/16 | 9/16 | 10/16 | 5/16 | 1/16 |
| Professional Growth & Development | 3/15 | 6.5/15 | 9/15 | 7.5/15 | 3/15 | 1/15 |
| Totals for all Instrument Items | 11/62 | 26/62 | 32/62 | 26/62 | 19/62 | 10/62 |
| Percentage of Change | ~24% Increase | | 10% Decrease | | 15% Decrease | |

School **I** decreased its barriers (44%) and increased its strengths (22%) making its overall change positive and significant. The chi-square test found a statistically significant difference (*p* < .001).

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| **Figure 4 - School I** | | | | | | |
|  | Barriers | | Strengths | | Neither | |
|  | **2011** | **2013** | **2011** | **2013** | **2011** | **2013** |
| Culture | 11/15 | 2/15 | 3/15 | 6/15 | 1/15 | 7/15 |
| Leadership | 13/16 | 4/16 | 0/16 | 4/16 | 3/16 | 8/16 |
| Teaching | 6/16 | 2/16 | /316 | 6/16 | 7/16 | 8/16 |
| Professional Growth & Development | 8.5/15 | 3/15 | /4.515 | 8/15 | 2/15 | 4/15 |
| Totals for all Instrument Items | 38.5/62 | 11/62 | 10.5/62 | 24/62 | 13/62 | 27/62 |
| Percentage of Change | 44% Decrease | | 22% Increase | | ~22% Increase | |

School **K** increased its barriers (8%) and decreased its strengths (35%) making its overall change negative and significant. The chi-square test found a statistically significant difference

(*p* < .001).

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| **Figure 5 - School K** | | | | | | |
|  | Barriers | | Strengths | | Neither | |
|  | **2011** | **2013** | **2011** | **2013** | **2011** | **2013** |
| Culture | 1/15 | 3/15 | 14/15 | 7/15 | 0/15 | 5/15 |
| Leadership | 3.5/16 | 5/16 | 10.5/16 | 4/16 | /216 | 7/16 |
| Teaching | 2.5/16 | 2/16 | 12.5/16 | 7/16 | 1/16 | 7/16 |
| Professional Growth & Development | 0/15 | 2/15 | 15/15 | 12/15 | 0/15 | 1/15 |
| Totals for all Instrument Items | 7/62 | 12/62 | 52/62 | 30/62 | 3/62 | 20/62 |
| Percentage of Change | 8% Increase | | 35% Decrease | | 27% Increase | |

From these results it appears that two schools, **D** and **I** were successful with the steps that were taken to improve PLC operations. Two schools, **H** and **K** were unsuccessful and need to examine their interventions (or lack thereof). The remaining school, **C**, had mixed results with some interventions leading to reduced barriers. One reason given by teachers in School **C** for the loss of strengths was their perception that the amalgamation had reduced the leadership capacity and support for innovative practices that they had enjoyed previously. If true, this should have been reflected in all five of the schools in our study.

In order to determine how schools **D** and **I** had achieved significant improvement, the principals were asked to consult with their respective staffs and determine what new actions had been taken that might have increased strengths and decreased barriers for PLCs in their schools. We collated the responses and organized them by the four sections of the school instrument: Culture, Leadership, Teaching and Professional Growth and Development. There were no changes in Culture that were common to both schools. In Leadership, both schools revised the mission statement that directed the school vision, values and goals. Both developed a shared leadership approach that involved teachers as members of a guided coalition. Both developed formal practices of collecting data and then used that data to inform school decision making. In Teaching, both schools created teacher teams that focused on instructional practices and develop communication systems whereby teachers regularly discussed teaching and assessment practices. With respect to Professional Growth and Development, both schools increased their focus and on professional development. Leaders at School **D** also undertook several strategies that School **I** did not. They worked to enhance staff collaboration and empowered the staff to take responsibility for monitoring goal achievement identified by the school improvement plan. Teachers were invited to collaborate in building the school’s teaching schedule and help identify teaching assignments. The school also made efforts to track struggling students and develop action plans to provide them with assistance. Teacher meetings to complete these tasks were scheduled after hours for 2011-2012 but were to be built into the school day for 2013-2014. Teachers were encouraged to commence action research and were provided with professional development to help them identify documents on ‘best practices’. Teachers at School **I** worked with the new principal to recreate the school mission statement, a task they reported as an ‘uplifting process’. One major result was the establishment of common assessments within the school.

**Analysis by Theme**

We turn now to an examination of the school patterns for each of the four measures of the school instrument: culture, leadership, teaching, and professional growth and development. The tables below present detailed response data for each theme. Chi-square tests were also performed on the data and the results are reported for each theme. The first chi-square test was conducted using a 2 x 5 matrix with 2 rows (the number of strengths and the total number of barriers and neither) and 5 columns (representing each of the five schools). This test was applied twice, once for the 2011 data and again for the 2013 data for each theme. This test was used to determine if there were any differences among the schools with respect to instrument responses for each theme in each year. The second chi-square test used a 3 x 2 matrix with 3 rows (representing the number of strengths, barriers, and neither) and 2 columns (2011 and 2013). This test was applied for each theme to determine whether there were any changes across the five schools between 2011 and 2013 with respect to each theme.

**Culture**. In 2011 the culture in Schools **C**, **H**, and **K** have several strengths with few barriers. Each appears to have had a high degree of collegiality, trust and commitment and a culture that supported professional collaboration. This support was reinforced in School **K** where teachers were provided with instructional time to collaborate on student learning. In Schools **C** and **K** the structural and physical characteristics of the school lent themselves to teacher collaboration. There were formal systems in Schools **C**, **H**, and **K** that reinforced effective communication among teachers. The patterns in Schools **D** and **I** were very different. The number of barriers outweighed the strengths in these schools. Structural and physical characteristics and the lack of time available prevented teacher collaboration. The lack of an effective communication system in School **I** further exacerbated collaborative efforts among teachers.

The first chi-square test was applied to the 2011 PLC culture data to determine if there were any significant differences among the five schools with respect to the number of strengths and barriers. The result showed a statistically significant difference (*p* < .001) among the schools with respect to culture in 2011.

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| Figure 6a - PLC Culture - 2011 | | | | | | | | | | | | | | | |
| School | Collegiality, Trust, Commitment | | | Support for Professional Collaboration | | | Time to Collaborate on Student Learning | | | Impact of Structural Factors on Collaboration | | | Importance of Effective Communication | | |
|  | 1a | 1b | 1c | 2a | 2b | 2c | 3a | 3b | 3c | 4a | 4b | 4c | 5a | 5b | 5c |
| **C** | S-74 | S-69 | S-72 | S-72 | S-74 | S-74 | B-49 | S-51 | - | S-67 | S-68 | B-26 | S-59 | S-79 | - |
| **D** | S-71 | B-21 | S-57 | S-71 | - | S-79 | B-71 | B-36 | B-21 | B-43 | B-38 | B-36 | S-54 | S-77 | B-38 |
| **H** | S-74 | S-83 | S-61 | S-70 | S-83 | S-87 | B-35 | S-65 | - | B-45 | - | - | S-70 | - | S-57 |
| **I** | S-78 | S-64 | S-61 | B-22 | - | B-39 | B-61 | B-42 | B-31 | B-42 | B-19 | B-50 | B-36 | B-22 | B-33 |
| **K** | S-85 | S-77 | S-92 | S-77 | S-85 | S-92 | S-77 | S-85 | S-69 | B-31 | S-69 | S-75 | S-61 | S-77 | S-61 |

In 2013 the culture in School **C** showed some minor changes, and the numbers we see for Schools **D, H, I**, and **K** were significantly changed. Schools **D** and **I** had overcome the barriers in trust and support for collaboration. School **I** had removed several of the barriers that prevented collaboration and effective communication and School **D** had turned these into strengths.

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| Figure 6b - PLC Culture - 2013 | | | | | | | | | | | | | | | |
| School | Collegiality, Trust, Commitment | | | Support for Professional Collaboration | | | Time to Collaborate on Student Learning | | | Impact of Structural Factors on Collaboration | | | Importance of Effective Communication | | |
|  | 1a | 1b | 1c | 2a | 2b | 2c | 3a | 3b | 3c | 4a | 4b | 4c | 5a | 5b | 5c |
| C | S-77 | S-72 | S-67 | S-64 | S-84 | S-78 | B-61 | - | - | S-64 | - | B-31 | - | - | - |
| D | S-100 | S-100 | S-100 | S-92 | S-100 | S-100 | B- 46 | S-77 | S-85 | S-55  B-23 | S-85 | - | S-100 | S-100 | S-85 |
| H | S-65 | S-55 | S-55 | - | S-70 | - | B-35 | S-60 | B-25 | B-40 | B-25 | B-45 | B-35 | S-55 | B-20 |
| I | S-72 | S-69 | S-53 | - | S-64 | S-69 | B-33 | - | - | - | - | B-33 | - | S-61 | - |
| K | S-100 | S-100 | S-100 | S-88 | S-94 | S-82 | B-62 | S-69 | - | B-81 | - | B-44 | - | - | - |

The patterns in School **H** and **K** show deterioration in the factors that enhance professional collaboration and effective communication.

The same chi-square test applied in 2011 was repeated for the 2013 data. There was no statistically significant difference found among the schools in 2013. This suggests an overall narrowing of the differences among the schools with respect to PLC culture over the two years.

The second chi-square test was also applied to PLC culture data for 2011 and 2013. This test yielded a statistically significant difference between the two years (p< 0.5). This suggests that there was a change in the distribution among strengths, barriers, and neither between the two years.

**Leadership**. Upon first examination, we see that in both years there were more barriers with regard to leadership than with culture.

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| Figure 7a - PLC Leadership - 2011 | | | | | | | | | | | | | | | | |
| School | School Grounded in Effective Organizational Practices | | | Building Leadership Capacity Reinforces Learning | | | Shared Leadership Strengthens Leadership Capacity | | | Decisions Made on Careful Analysis of School Based Student Performance Data | | | | Resource Allocation Decisions Made by Those Most Involve in their Use | | |
|  | 1a | 1b | 1c | 2a | 2b | 2c | 3a | 3b | 3c | 4a | 4b | 4c | 4d | 5a | 5b | 5c |
| C | S-82 | S-61 | - | - | B-28 | B-61 | S-77 | S-74 | S-60 | B-26 | B-21 | S-55  B-29 | B-24 | S-58 | B-41 | B-27 |
| D | S-64 | - | - | S-64 | - | B-58 | S-71 | S-64 | S-64 | B-23 | S-54 | - | B-23 | B-21 | B-21 | B-36 |
| H | S-70 | - | - | - | - | B-87 | - | S-56 | S-61 | - | - | B-48 | S-56 | S-74 | B-35 | B-24 |
| I | - | B-25 | - | B-31 | B-22 | B-82 | B-39 | B-33 | - | B-26 | B-26 | B-39 | B-34 | B-24 | B-42 | B-47 |
| K | S-85 | S-75 | S-83 | S-69  B-23 | S-61 | B-64 | S-54 | B-23 | S-69 | S-61 | S-77 | S-61 | S-75 | B-38 | - | - |

In 2011, School **I** had the greatest number of barriers and School **K** had the greatest number of strengths. In School **I,** teachers did not report that leadership was grounded on effective organizational practices. There was a pattern across all five schools that indicated a problem with building leadership capacity that reinforced learning. There appeared to be a serious lack of shared leadership in School **I**. While School **K** had a slight problem with sharing leadership, it was the place where decisions were most often based on careful analysis of student performance data. Resource allocation in all five schools seemed to be a concern to teachers.

The chi-square test applied to the 2011 PLC leadership data found a statistically significant difference (*p* < .01) among the schools.

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| Figure 7b - PLC Leadership – 2013 | | | | | | | | | | | | | | | | |
| School | School Grounded in Effective Organizational Practices | | | Building Leadership Capacity Reinforces Learning | | | Shared Leadership Strengthens Leadership Capacity | | | Decisions Made on Careful Analysis of School Based Student Performance Data | | | | Resource Allocation Decisions Made by Those Most Involve in their Use | | |
|  | 1a | 1b | 1c | 2a | 2b | 2c | 3a | 3b | 3c | 4a | 4b | 4c | 4d | 5a | 5b | 5c |
| C | S-71 | S-58 | - | - | - | B-53 | S-53 | S-75 | - | S-60 | - | B-29 | - | S-56 | B-38 | B-27 |
| D | S-100 | S-85 | S 92 | S-92 | S-85 | B-46 | S-92 | S-92 | S-85 | S- 77 | S-85 | S-92 | S-69 | S-85 | S-85 | S-69 |
| H | S-55  B-30 | B-25 | - | - | B-21 | B-61 | B-20 | B-25 | - | S-50  B-20 | S-55 | S-55  B-25 | - | - | B-45 | - |
| I | B-25 | - | - | - | - | B-67 | S-58 | S-78 | S-58 | - | - | B-31 | - | S-53 | B-44 | - |
| K | S-56 | - | - | S-56 | S-56 | B-100 | B-38 | B-38 | - | S-62 | - | B-75 | - | B-69 | - | - |

By 2013 the number of leadership barriers had reduced from 35 to 23 and strengths had risen slightly from 28 to 33. The most improvement occurred in Schools **D** and **I**. School **D** strengthened its leadership practice effectiveness, focused the building of leadership capacity on reinforcing learning, increased its decision making focus on student performance data analysis, and shared more decisions on resource allocations. School **I** reduced barriers: a) between building leadership capacity and reinforcing learning, b) in decision-making based on student performance data and c) increased teacher input into resource allocation. School **C** ‘s only significant leadership change was an increase in the use of student performance data in decision-making. School **H** shows marked decrease in shared leadership. School **K** decreased its: a) effectiveness in leadership based on grounded organizational practices, b) connection between building leadership capacity and learning, use of shared leadership to build leadership capacity, and c) lessened its use of school-based student performance data on decision making.

The chi-square test applied the 2013 PLC leadership data again found a statistically significant difference among the schools (*p* < .001), suggesting that the overall differences among the schools with respect to PLC leadership principles actually increased.

The second chi-square test, comparing 2011 and 2013 PLC leadership data, yielded no statistically significant difference. This suggests that the overall distribution of strengths, barriers, and neither did not change greatly over the two-year period.

**Teaching**. Overall the schools showed an increase in teaching strengths and a decrease in the barriers that prevent collaborative practices. Teaching practices had become slightly more collaborative in Schools **D** and **I**. There were no major changes in School **C**. Teachers in Schools **H** and **K** reported less collaboration.

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| Figure 8a - PLC Teaching - 2011 | | | | | | | | | | | | | | | | |
| School | Teacher Collaboration on Instructional Practices Encouraged | | | Instructional Practices Meet All Student Ability Levels | | | Lesson Planning is Vital for Improving Student Achievement | | | Interventions Provided to Students When Required | | | Assessment is a Key Component of Instructional Practice | | | |
|  | 1a | 1b | 1c | 2a | 2b | 2c | 3a | 3b | 3c | 4a | 4b | 4c | 5a | 5b | 5c | 5d |
| C | S-72 | S-82 | S-58 | S-54 | B-47 | B-31 | - | S-60 | S-76 | S-77 | S-64 | S-85 | S-77 | S-72 | S-72 | S-67 |
| D | S-57 | S-71 | - | - | B-36 | B-33 | B-50 | - | - | S-57 | B-29 | - | S-57 | S-54 | B-43 | S-64 |
| H | S-77 | S-91 | - | S-54 | B-82 | B-38 | - | S-52 | S-61 | S-52 | - | - | S-70 | S-61 | - | S-70 |
| I | S-53 | S-81 | - | - | B-72 | B-37 | B-53 | - | - | B-25 | - | B-28 | - | S-54 | B-36 | - |
| K | S-61 | S-92 | S-100 | S-92 | B-46 | S-54  B-23 | - | S-85 | S-100 | S-85 | S-54 | S-54 | S-77 | S-85 | B-23 | S-92 |

In 2011 there was a consistent issue regarding the lack of training of paraprofessionals and with the lack of training for teachers to maximize the teacher-paraprofessional instructional dynamic. This impacted schools’ ability to meet the needs of students of all ability levels. The other issue identified in item 5c highlighted the barriers that prevented teacher collaboration on student assessment matters. This was a strength only in School **C**. School **I** reported a lack of interventions provided to students who need additional support.

The first chi-square test applied to the 2011 PLC teaching data found a statistically significant difference (*p* < .001). This suggests that some noticeable variations existed in the number of strengths among the five schools with respect to teaching.

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| Figure 8b - PLC Teaching - 2013 | | | | | | | | | | | | | | | | |
| School | Teacher Collaboration on Instructional Practices Encouraged | | | Instructional Practices Meet All Student Ability Levels | | | Lesson Planning is Vital for Improving Student Achievement | | | Interventions Provided to Students When Required | | | Assessment is a Key Component of Instructional Practice | | | |
|  | 1a | 1b | 1c | 2a | 2b | 2c | 3a | 3b | 3c | 4a | 4b | 4c | 5a | 5b | 5c | 5d |
| C | S-83 | S-92 | S-69 | S-57 | B-40 | B-26 | - | S-63 | S-86 | S-75 | - | S-81 | S-75 | S-62 | S-59 | S-78 |
| D | S-92 | S-92 | S-92 | S-77 | S-62 | S-54 | S-69 | S-77 | S-69 | S-100 | S-100 | S-92 | S-100 | S-92 | - | S-92 |
| H | S-55 | S-95 | B-20 | S-65 | B-60 | B-33 | B-25 | S-65 | S-50 | S-70 | - | S-53 | S-80 | S-75 | B-40 | S-70 |
| I | - | S-89 | - | - | B-58 | - | - | - | S-64 | - | - | S-58 | S-58 | S-72 | B-31 | S-56 |
| K | S-81 | S-94 | S-62 | S-81 | B-62 | - | B-56 | - | - | - | - | - | S-75 | S-62 | - | S-62 |

In 2013 there was a decline in professional collaboration to improve teaching in School **H**. School **D** improved in all three areas describing collaborative lesson planning and in interventions provided to student in need of extra help. School **H** reported deterioration in these same areas. Schools **D** and **K** overcame the barriers to collaborative assessment performed by teams while this became a barrier in School **H**.

The chi-square test for 2013 PLC teaching data also found statistically significant differences

(*p* < .01), although at a lower probability level than in 2011. Again, this result suggests the persistence of differences among the schools with respect to the perception of PLC principles in teaching. It also suggests the potential benefit of having some schools work with other schools to promote PLC principles in teaching.

The second chi-square test comparing the 2011 and 2013 results for all five schools found no significant difference. This suggests that the overall distribution of strengths, barriers, and neither did not change greatly among the five schools over the two years.

**Professional Growth & Development (PGD)**. This measure of PLC operation improved across the five schools with a decrease from 27 to 13 barriers and an increase from 43 to 52 strengths between 2011 and 2013. School **D** reported most of the improvement, followed by half as much in School **I**. Once again School **C** reported a slight improvement while Schools **H** and **K** reported a slight deterioration.

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| Figure 9a - PLC Professional Growth & Development - 2011 | | | | | | | | | | | | | | | |
| School | PD is Multifaceted,  System-Wide and On-Going | | | PD is Supported in This School | | | Teachers Have the Knowledge, Skills, Dispositions to Collaborate | | | PD Based on Comprehensive School Plan and Vision | | | Mentorship Provides for Professional Growth | | |
|  | 1a | 1b | 1c | 2a | 2b | 2c | 3a | 3b | 3c | 4a | 4b | 4c | 5a | 5b | 5c |
| C | - | S-67 | B-42 | S-85 | S-74 | - | S-85 | S-69 | S-72 | S-64 | - | - | S-51  B-23 | B-28 | - |
| D | - | S-57 | B-46 | S-71 | B-29 | B-36 | S-64  B-21 | S-64  B-21 | B-29 | - | B-43 | B-23 | B-21 | B-21 | S-57  B-29 |
| H | S-61 | S-70 | - | S-73 | S-61 | S-56  B-26 | S-100 | S-74 | S-56 | S-56 | B-22 | - | S-65  B-22 | B-27 | - |
| I | - | S-53 | B-33 | S-67 | S-56  B-28 | B-47 | S-67 | S-53 | B-22 | - | B-31 | B-39 | B-50 | B-50 | B-33 |
| K | S-77 | S-100 | S-69 | S-92 | S-77 | S-92 | S-100 | S-85 | S-85 | S-61 | S-69 | S-77 | S-92 | S-85 | S-69 |

In 2011 the only school that scored all five statements as strengths was School **K**. Although every school reported that PGD was an on-going collaborative learning process that extended beyond formally scheduled professional development sessions, only school **H** reported that most teachers were involved with some form of professional development (PD). In School **C** professional growth is fostered but teachers did not report a formal plan as a strength. Schools **D**, **H**, and **I** reported the lack of a formal plan as a barrier. Teachers in School **D** noted a lack of knowledge about professional collaboration and a corresponding lack of skills or disposition to work with colleagues. In School **I** teachers believed they had the knowledge and skills, but often chose not to use them. In Schools **D** and **I**, and to some extent School **H,** there was a disconnect between PD and both the school improvement plan and the school vision. All schools, except **H**, reported a lack of planned effective programs to help orient new teachers to the school. Some teachers in Schools **D** and **I** expressed concern over the lack of administrative mentorship provided to the staff.

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| Figure 9b - PLC Professional Growth & Development - 2013 | | | | | | | | | | | | | | | |
| School | PD is Multifaceted,  System-Wide and On-Going | | | PD is Supported in This School | | | Teachers Have the Knowledge, Skills, Dispositions to Collaborate | | | PD Based on Comprehensive School Plan and Vision | | | Mentorship Provides for Professional Growth | | |
|  | 1a | 1b | 1c | 2a | 2b | 2c | 3a | 3b | 3c | 4a | 4b | 4c | 5a | 5b | 5c |
| C | - | S-67 | B-26 | S-71 | S-75 | S-63 | S-86 | S-83 | S-64 | S-66 | - | - | S-52 | - | S-56 |
| D | S-92 | S-92 | S-62 | S-92 | S-100 | S-100 | S-92 | S-100 | S-85 | S-85 | - | S-77 | S-85 | S-85 | S-92 |
| H | S-70 | S-70 | B-20 | S-61 | S-63 | S-79 | S-90 | S-70 | B-25 | B-20 | B-20 | - | S-60  B-20 | B-30 | B-25 |
| I | S-58 | S-67 | B-39 | S-75 | S-58 | S-58 | S-75 | S-56 | - | - | - | - | B-33 | B-31 | S-64 |
| K | S-81 | S-75 | S-63 | S-75 | S-75 | S-81 | S-88 | S-94 | S-69 | B-31 | B-31 | - | S-88 | S-62 | S-62 |

In 2013 increased support for PD was evident in all five schools. In Schools **D** and **I** professional development was perceived as important to all staff, even the non-teaching members, and there were formal programs in place to monitor staff growth. Collaboration was a strength in every school with only School **H** reporting teachers who were reluctant to collaborate with their colleagues. PD focused on the school improvement plan, which had been a slight barrier in School **H** had deteriorated and it had become a barrier in School **K**. Schools **C** and **D** had improved their mentorship efforts for new staff members but this continued to be a barrier in Schools **H** and **I**.

The chi-square test applied to the 2011 PGD data yielded a statistically significant difference

(*p* < .001) among the schools. When applied to the 2013 PGD data, the test continued to show a significant difference, but at a lower probability level (*p* < .05). This suggests some narrowing of the differences among the schools over the two years.

The second chi-square test, comparing 2011 and 2013 data, produced no statistically significant difference. This suggests that the overall distribution of strengths, barriers, and neither in the area of PGD did not change greatly over the two years.

**Student Achievement Data and Analysis**

The second data set that we have compiled from the five schools is based on student achievement. Consistent with Lambert’s (1998) definition of student achievement, one element is authentic academic achievement. For this paper, we have gathered student marks in four key curricular areas: English, Mathematics, Science, and Social Studies. In each school, we wanted to see if there were any changes in overall student academic performance in these four subjects over a two-year period. Since we were interested in finding out the extent to the implementation of PLC principles had an effect on student learning, we have compared student marks before and after the PLC interventions described earlier in the paper.

The student achievement data used for this paper were divided into two sets. The first set came from students enrolled in Grade 9 in the 2009 – 2010 school year. We collected student marks in the four school subjects (English, Mathematics, Science, and Social Studies) in each of the five schools. For purposes of comparison, we then collected student marks in these same subjects for students in Grade 11 two years later (2011 – 2012). The second data set came from students enrolled in Grade 10 in the 2009 – 2010 school using the same school subjects. For comparison purposes, we also collected student marks for students in Grade 12 in the 2011 – 2012 school year. Then, for each grade and subject at each school, we calculated the average mark achieved by the students in that group. While students in Grades 9 and 10 generally take only one course in each of these four subject areas in a given school year, students in Grades 11 and 12 can take more than one course in these subject areas. If a student took more than one course in a subject area, then the mark for that subject for the purpose of this paper would be the average mark for the courses in that subject. For example, New Brunswick students in Grade 11 and Grade 12 can take several courses in Science, such as Chemistry, Physics, and Biology. If a student took two or more Science courses in a given year, then the student’s Science mark for the would be the average mark obtained in all Science courses taken in that school year.

In general, we expected that the students enrolled in each school in Grade 9 in 2009 – 2010 would be the same students enrolled in the same school in Grade 11 in 2011 – 2012. Similarly, we expected the same for students enrolled in Grade 10 in 2009 – 2010 and in Grade 12 in 2011 – 2012. We intend to do a more detailed investigation of the student data to learn the extent to which this expectation was met. We also intend to collect student marks for the 2012 – 2013 school year once those results are available to us.

In the graphs that follow, we have used the terms pre and post PLC interventions to refer to the 2009 – 2010 and 2011 – 2012 school years respectively. As described earlier, we began working with the guiding coalition during the 2010 - 2011 school year. We administered the school PLC instrument in May 2011, which provided a measure of the level of PLC implementation in each school at that time. As we have learned throughout our research into PLCs since 2006, teachers and administrators with whom we have worked often begin making changes to their thinking and to their practice even as we discuss the PLC instrument items with them. For these schools, once we shared the results of the May 2011 data collection with the teaching staff, they were able to engage in interventions at the school level. During the following school year (2011 – 2012), as described earlier, we worked with teams of teachers to show them how to interpret their school data, to report it to their colleagues, and to create action plans for school improvement. These efforts would have had an effect on student learning during the 2011 – 2012 school year and beyond. Once we have the student marks data for the 2012 – 2013 school year, we will be making further comparisons.

The graphs below show the student marks for the five schools.

**School C**

In School C, the Grade 9 group had 147 students, compared to 178 students in Grade 11 two years later. In the Grade 10 group, there were 147 students compared to 166 students in Grade 12 two years later. If we accept that an increase or decrease of 3 points could be explained by changes in the sample size and focus on changes that are larger we see that academic achievement increased slightly in English for the 2009-2011 sample and slightly in Math for the 2010-2012 sample. There were no significant decreases in any of the four subject areas.

**School D**

In School D, there were 20 students in the Grade 9 group, compared to 29 students in Grade 11 two years later. The Grade 10 group had 26 students, compared to 27 students in Grade 12 two years later. In this school there were four increases; a significant increase in English in the 2009-2011 sample and significant increases in Math, English and Social Studies in the 2010-2012 sample.

**School H**

In School H, there were 43 students in Grade 9 in 2009 – 2010, compared with 42 students in Grade 11 two years later. The group of 24 students in Grade 10 was compared to a group of 24 students two years later in Grade 12. In this school there were four increases and two decreases. The increases were in Science, English and Social Studies in the 2009-2010 sample and in Social Studies in the 2010-2012 sample. The decreases were in Science and English in the 2010-2012 sample.

**School I**

In School I, there were 119 students in Grade 9 compared to 103 students in Grade 11 two years later. The Grade 10 group had 121 students in 2009 – 2010, compared with 98 students in Grade 12 two years later. In this school there was one increase and one decrease, both of which were in the 2010-2012 sample. The increase was in Social Studies and the decrease in Math.

**School K**

In School K, there were 12 students in Grade 9 in 2009 – 2010, compared with 10 students in Grade 11 two years later. There were 13 students in Grade 10 in 2009 – 2010, compared with 12 students two years later. In this school there was one increase and one decrease. The increase was in English in the 2009-2011 sample and the decrease was in Social Studies in the 2010-2012 sample.

**Summary and Next Steps**

The pattern of grade changes in two sample sets across the five schools indicates 12 increases and 5 decreases in student achievement. Of the 12 increases 8 occurred in two schools, School **D** and School **H**. The previous pattern of PLC strengths and barriers indicates that over the same two year period there was an increase in PLC operations in two of the five schools. These were school **D** and School **I**. It appears that changes in PLC operations in School **D** may have had a positive effect on student achievement. The answer to why PLC changes in School **I** did not produce a positive effect on student achievement is puzzling. Equally puzzling is why School **H** could both increase its PLC barriers and decrease its PLC strengths and still increase its student achievement.

The second level analysis that we plan to conduct soon will use a factor analysis to determine how each statement from the PLC instrument impacts student achievement. We will also add the third sample of student achievement when we gather student achievement data for 2012-2013. This analysis should help us understand the puzzling results we are currently reporting.

The next step will be the collection and analysis of the student achievement data on positive involvement and resiliency. Our final step will be to expand the study to include the remaining 10 schools, which are elementary and middle level schools. Once this is completed we will pursue resources to expand our pilot study and examine one of the large amalgamated districts.

**Appendix A**

**School Instrument Statements Used to Represent Four Measures**

|  |  |
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| **A. CULTURE** | |
| 1. | This school has a culture of collegiality, trust, and commitment. |
| 2. | The culture in this school supports professional collaboration. |
| 3. | Teachers in this school have the time to collaborate with their colleagues regarding student learning. |
| 4. | The impact that structural factors have on professional collaboration are addressed in this school. |
| 5. | In this school we recognize the importance of effective communication. |
| **B. LEADERSHIP** | |
| 1. | School leadership in this school is grounded in effective organizational practices. |
| 2. | Building of leadership capacity among both teachers and support staff reinforces learning for both teachers and students in this school. |
| 3. | The sharing of leadership strengthens the leadership capacity of this school. |
| 4. | Decisions in this school are based on careful analysis of school based data on student performance. |
| 5. | Decisions regarding resource allocation are made by those most involved in their use. |
| **C. TEACHING** | |
| 1. | Teachers in this school are encouraged to use professional collaboration to learn effective instructional and assessment practices. |
| 2. | Instructional practices in this school meet the needs of students of all ability levels. |
| 3. | Effective lesson planning is vital for improving student achievement in our school. |
| 4. | In this school, interventions are provided to students who require additional support. |
| 5. | In this school, assessment is a key component of instructional practices and contributes to student learning. |
| **D. PROFESSIONAL GROWTH & DEVELOPMENT** | |
| 1. | In this school professional growth is a multi-faceted, systemic, and on-going component of school improvement efforts. |
| 2. | Professional growth is supported in this school. |
| 3. | Our teachers have the knowledge, skills and dispositions to engage in professional collaboration. |
| 4. | Professional development for teachers is organized using a comprehensive plan focused on the school’s vision. |
| 5. | In this school, mentorship provides for professional growth. |

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