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Empowering ELL Students to Excel in Mathematics,

Debby Culotta (principal) and Miranda Kus (consultant)

This story describes a three-year journey to improvements in mathematics in an urban K-8 elementary school. Most of the school's students were born in the Middle East, Nigeria and Ghana and many are refugees with limited schooling. The story illustrates how a principal enacted the leadership practices and drew on the personal leadership resources (PLRs) of the Ontario Leadership Framework (OLF) to foster staff collaboration, persistence, and a laser-like focus on a shared goal that resulted in significant improvements in Mathematics and in the collective efficacy of staff.

St. Andrew Catholic School is located in the North Rexdale section of Toronto. Approximately, 75% of our students come from the Middle East and speak Assyrian and/or Arabic. For many of these students, St. Andrew provides their first formal schooling experience. Approximately 20% of our students hail from Nigeria and Ghana and many of these students are also refugees with limited schooling. The final 5% of our students represent a smattering of various ethnicities and cultures. We are a vibrant and colourful community!

Over the past three years, the St. Andrew staff has been deeply involved in math study. During the first two years, we engaged in Math Study Groups comprised of grade 2-3 teachers, grade 4-6 teachers, grade 7-8 teachers and a Math for Young Children Group which included our Kindergarten and grade 1 teachers. In these groups, we engaged in deepening our own understanding of mathematical concepts in order to develop confidence among staff; we practiced teaching through problem-solving using the three-part lesson and board-writing to consolidate student learning in a collaborative and supportive environment.

Some of our teachers reached out to the greater educational community by opening their classrooms for public research lessons and leading and facilitating sessions at Toronto Educators Association for Mathematics (TEAMS) and Ontario Association for Mathematics Education (OAME) conferences. Finally, we engaged in co-planning and co-teaching as well as developing common assessment practices.

Cognitive Personal Leadership Resources (PLRs): problem-solving expertise, knowledge of effective school and classroom practices that directly affect student learning, & systems thinking

4.2 Providing instructional support.

3.2 Structuring the organization to facilitate collaboration

2.2 Stimulating growth in the professional capacities of staff

3.4 Connecting the school to its wider environment

4.3 Monitoring student learning and school improvement progress

During the two-year period of this focused study, improvement was noted in many aspects. We observed a renewed sense of energy and vision along with an increase in teacher dialogue around mathematics. Teachers were becoming more confident with the consolidation of mathematical solutions as they became more cognizant of the big ideas underpinning the mathematical concepts taught. Students were participating more readily in math lessons and were using mathematical terminology when explaining their thinking. They were no longer afraid to make mistakes.

Psychological Personal Leadership Resources (PLRs) – resilience, optimism, self-efficacy, proactivity

EQAO results indicated that our students were indeed making progress. EQAO scores (percentage of students achieving level 3 or more) increased in grade 3 by 12% from 39% to 51%. In grade 6, there was a 5% decline in the percentage of students achieving level 3 or more (37% to 32%) but we moved 23% of previous level 1 students to level 2.

1.2 Identifying specific, shared, short-term goals

4.2 Providing instructional support

Perhaps the most significant evidence was provided by our data integration platform (DIP) which shows that none of our students who continued with us from grade 2 to 6 experienced a decline in their progress but rather maintained status quo or demonstrated improved achievement.

Despite the fact that as a staff we felt we were making a significant difference in student achievement, we realized that there was a gap that existed with our students who were newly arrived, new to the language and new to formal education. In order to address this concern, during the next school year, we decided to engage our teachers of English Language Learners who had not previously taken part in our math study groups. Our goals were to understand student readiness for learning mathematics (e.g. math content, cultural learning background, learning skills) and to become familiar with and use ELL learning and teaching practices in mathematics. We also aimed to improve math content knowledge for teaching in terms of learning trajectories and to improve math instructional strategies.

With these goals in mind, we continued with our math study groups and included our ELL teachers in each of the primary, junior and intermediate sessions. We wanted to know how our ELL teachers could support the regular classroom teachers and their students through a cross-curricular approach, marrying language acquisition with mathematical concepts simultaneously.

We were fortunate to have the help of our Math Program Coordinator, Kathy Kubota-Zarivnij, as well as Dr. Richard Barwell, professor at University of Ottawa, who specializes in the ELL learner and Mathematics, to guide us through this journey. Dr. Barwell was able to join our sessions through Skype technology, as well as be present with us at St. Andrew's on some occasions. We began our inquiry by listening to and studying current research about the ELL learner and Mathematics as disseminated to us through Dr. Barwell.

3.6 Allocating resources in support of the school's vision and goals

The key research findings presented to us by Dr. Barwell were as follows:

4.3 Monitoring student learning and school improvement progress

- The “myth” that mathematics transcends language is detrimental to the interests of ELL students.
- While many ELL students quickly develop a basic level of “conversational” English, it takes several years to develop more specialized “academic” English.
- Encouraging students to use their home languages in the mathematics classroom appears to be beneficial.
- Low proficiency in all languages and mathematical underachievement is clearly linked and may explain some minority groups’ underperformance in mathematics.
- Children can learn and be successful in mathematics in a second or additional language.
- The language of mathematics (in any language) is complex and involves more than vocabulary.
- Participating in mathematical talk is important not just for learning mathematics, but also for learning the language of mathematics.
- Bilingual students draw on many different ‘resources’ to communicate their mathematical thinking.

Perhaps more than any other subject, teaching and learning mathematics depends on language. Mathematics is about relationships: relationships between numbers, between categories, between geometric forms, between variables and so on. In general, these relationships are abstract in nature and can only be brought into being through language. Even mathematical symbols must be interpreted linguistically. Thus, while mathematics is often seen as language free, in many ways learning mathematics fundamentally depends on language.

For students still developing their proficiency in the language of the classroom, the challenge is considerable. Indeed, research has shown that, while many ELL students are quickly able to develop a basic level of “conversational” English, it takes several years to develop more specialized “academic” English to the same level as a native speaker.

Learners’ home languages can play a crucial role in their learning of mathematics. Cummins suggests that students need a high degree of proficiency in at least one language in order to make satisfactory progress at school. He also proposes that students with strength in two or more languages will outperform their peers, while those without a high degree of proficiency in any language will underachieve.

Three Key Principles when Designing for Instruction

Given what we had learned through Dr. Barwell, our task was to determine a plan of action for our teachers. Collectively, we identified three guiding principles:

1.1 Building a shared vision

- As part of planning, include and address mathematical language learning goal alongside mathematics learning goals;
- Combine language learning and mathematics learning in the same activity;
- Ensure students have the opportunity to talk and write mathematical language.

Key Practices at St. Andrews

- Using classroom and local community contexts for lesson problems

- Using shared reading texts (story contexts, Math Readers)
- Dramatization and modeling (visual models, concrete models, websites)
- Vocabulary development (oral, visual, symbolic, summary)
- Peer support (peer translators, Google translate)
- Bansho (Board-Writing)
- Mathematics Content learning trajectory - (a) mental math across the grades and daily practice 2X per day; (b) multiplication across the grades and proportional reasoning and equivalency
- Re-voicing and listenership

3.2 Structuring the organization to facilitate collaboration

Staff met monthly, bringing forward student artefacts, sharing strategies which were successful and surfacing challenges experienced in the classroom. All of our data were collected and still reside on Google Drive accessible to all staff. Since Mental Math/equivalency activities were an area of focus, we conducted a school wide survey in November, February and May, for all students in grades 1-8, to assess whether our strategies were effective. All students were asked to solve the same problem: 8 + 4 = ☐+ 5

Although we used the same addends, we changed the order and the unknown in each of the surveys. By November 19% of our students were able to correctly answer the question. In February, the percentage increased to 46% and by May 60% of the student body were able to correctly answer the problem.

3.3 Building productive relationships with families and communities

While we showed improvement, clearly, we still have much work ahead of us. One of our greatest challenges is to encourage our parent community to engage in the academic “talk” around mathematics. Since the majority of our parents are unable to understand or speak English, we decided to initiate a student-led learning walk to coincide with parent/teacher interview night. As a staff we decided to focus on Data Management and Probability for our first student-led learning walk. Every staff member collected student artefacts which were posted in the gymnasium from kindergarten through grade 8. Each teacher posted their learning goal and curriculum expectation as well as their success criteria along with the student artefacts.

The trajectory of learning was made so explicitly clear in this format. Our students had the opportunity to walk through the gym with their teachers to talk about the math and see first-hand how each grade built onto the next. The students were then able to walk their parents through the gym on curriculum night and talk about their learning. A group of grade 6 students was selected to escort special visitors to our school who were interested in seeing the student-led learning in action. This built tremendous confidence in our student leaders and they demonstrated considerable pride in their accomplishments.

Conclusion

Psychological Personal Leadership Resources (PLRs) – resilience, optimism, self-efficacy, proactivity

As we move toward the next academic year, we plan to continue our Math Study Groups, inclusive of our ELL teachers and in a collaborative and supportive environment, plan and implement strategies which

work best in our ELL population. Our staff believes that all of our students can achieve success and we continue to work to ensure that they do.