

CRITICAL TRANSITIONS IN STUDENT MATHEMATICAL DEVELOPMENT, ELEMENTARY TO SECONDARY SCHOOL: LITERATURE REVIEW AND RESEARCH STUDY FINDINGS

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Overview: For the purposes of this Community of Practice, the third transition of focus is the one *between elementary and high school*. The transition from Grade 8 to 9 is a challenging and, at times, overwhelming experience for many students. This transition has been recognized as a stumbling point for many students, and particularly for those who are at risk of leaving school early. For example, the movement is commonly associated with a dip in academic achievement and an experience of increased social anxiety. For students at risk, the experience of transition can be even more problematic. Research-informed recommendations may facilitate the transition: for example, students state that they need more accessible information in the final years of elementary school about high school courses, programs, and expectations. To this end, we will work to demystify the course pathways that are available in mathematics throughout secondary school and emphasize the *importance of choosing a path that includes sufficient and appropriate levels of mathematics* in terms of course selections and student career planning. We will share information from *recent studies* that highlight the high cost of dropping mathematics in the senior years of high school, and will provide a synthesis of *effective strategies for supporting students* in their transition from Grade 8 to Grade 9 mathematics study.

1. Literature Review

1.1 Related Ontario Resources and Research

Targeted Implementation and Planning Supports for Revised Mathematics (OME, 2005)

In 2003-05, a large group of educators and researchers were brought together in Ontario to create a support resource for Intermediate Division mathematics teachers known as *Targeted Implementation and Planning Supports*. Originally focused on Applied 9 Mathematics, the resource went through several expansions/revisions based on provincial feedback, and eventually encompassed support resources for Grades 7-12 mathematics which were made available online via the EduGAINS website (see Figure 1; OME, n.d.). The primary goal of this resource was to provide Intermediate Division teachers with an approach to curriculum planning that would focus on reform-oriented strategies such as problem-based learning, hands-on manipulatives, the use of technology, collaborative groupwork, and balanced assessment. It also promoted a planning framework that sought to emphasize connections between the mathematics curriculum strands, connections with real-world applications, and connections to other disciplines. As part of the extensive preamble eventually labeled *Developing Mathematical Literacy*, a series of brief research synopses were developed for use in schools as part of professional development activities. One of these research synopses dealt specifically with the adolescent learner:

¹ This literature review and interview research was conducted as part of the Critical Transitions Community of Practice.

The adolescent mathematics learner (Grades 7–9) is experiencing great changes and challenges in several domains simultaneously. Intellectually, adolescents are refining their ability to form abstract thought, think symbolically, render objective judgments, hypothesize, and combine multiple reactions to a problem to achieve resolution. . . . Physically, adolescents tend to mature at varying rates; are often concerned about their physical appearance; and may experience fluctuations in metabolism causing extreme restlessness and/or lethargy. Emotionally, many adolescents are sensitive to criticism; exhibit erratic emotions and behaviour; feel self-conscious; often lack self-esteem; search for adult identity and acceptance; and strive for a sense of individual uniqueness. Socially, adolescents may be eager to challenge authority figures and test limits; can be confused and frightened by new school settings that are large and impersonal; are fiercely loyal to peer group values; and are sometimes cruel and insensitive to those outside the peer group. . . . Teachers of Grades 7–10 adolescent mathematics learners should consider the following questions: Do students have a role in determining classroom rules and procedures? Do students feel safe to take risks and participate during mathematics learning? Do students have opportunities to move around and engage in situations kinesthetically? Are a variety of groupings used, for particular purposes? Do students have opportunities to discuss and investigate different ways of thinking about and doing mathematics? and, Do tasks have multiple entry points to accommodate a range of thinkers in the concrete-abstract continuum? (OME, n.d.-c, p. 19)

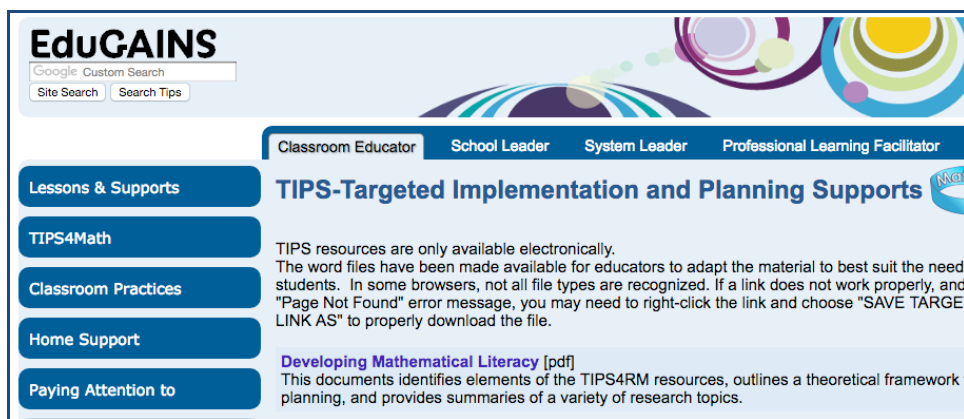


Figure 1. Targeted Implementation and Planning Supports for Revised Math (TIPS4RM) website (OME, n.d.-c).

While it has been over ten years since the release of this support document, many Intermediate Division teachers in Ontario are still using this online resource for planning and for implementing the curriculum.

Curriculum Implementation in Intermediate Mathematics (Suurtamm & Graves, 2007)

The last major research study that was conducted in Ontario around the area of Intermediate Division (Grades 7-10) mathematics was the *Curriculum Implementation in Intermediate Mathematics* (CIIM) project that was funded by the Ministry of Education and was directed by Dr. Christine Suurtamm and Dr. Barbara Graves from the University of Ottawa. Directly following the newly released *Ontario Curriculum: Mathematics* (Revised) documents (OME, 2005a, 2005b), this comprehensive study set out to examine how the inquiry-oriented mathematics curriculum for Grades 7-10 in Ontario was being implemented and understood by the multiple stakeholders involved in the province (e.g., teachers, researchers, policymakers). The multi-faceted research design addressed the following aspects of the curriculum implementation: how the Intermediate mathematics curriculum was understood and taught; how teachers had been supported in the implementation of this curriculum; and how certain learning environments reflected the enactment of the new curriculum. The study involved focus group interviews with leaders in math education, a web-based questionnaire for math teachers in grades 7-10, case studies

in classrooms that were identified as implementing the curriculum, focus group interviews with teachers of mathematics, and classroom site video data collection. Results of their study were presented to the public by way of both a Full Report and an Executive Summary (Suurtamm & Graves, 2007a, 2007b). Pertinent to the current MKN work is the CIIM reporting on the transition from Grade 8 to Grade 9 mathematics. What follows are a series of relevant excerpts from the CIIM Executive Summary:

The research literature on students who are making the transition from elementary to secondary school directs our attention to the complexity involved in transition and cautions that the inability to adjust can have an adverse effect on success in completing high school. The Ontario mathematics curriculum documents recognize that there should be a smooth transition from elementary to secondary school. “The Grade 9 courses in the Ontario mathematics curriculum build on the knowledge of concepts and skills that students are expected to have by the end of Grade 8. . . . a feature that is essential in facilitating transition” (OME, 2005a, p. 4). Our data suggest that many teachers may not be fully aware of the content and expectations of the mathematics curriculum of the other panel and may benefit from opportunities to explore the curricula of other grades. . . . While 75% of the teachers of Grades 7 and 8 are very familiar with the curriculum expectations for Grade 8 mathematics, only 8% report being very familiar with the curriculum expectations for Grade 9 mathematics. The situation is reversed when we look at the Grade 9 and 10 teachers’ familiarity with the curriculum expectations for those two courses. In that case, 76% of the Grade 9 and 10 teachers report being very familiar with the curriculum expectations for Grade 9 mathematics, while only 8% report being very familiar with the Grade 8 curriculum expectations. In addition, our findings reveal that there are several differences between the teaching and learning cultures in Grades 7 and 8 and in Grades 9 and 10. . . . This then underscores the need for increased dialogue in order to address these issues, and to develop an awareness and understanding of both the curriculum and the cultures of schooling as experienced in the different panels. In fact, with respect to transition, both the research literature and many of the results from this study point to the importance of establishing the practice of collaborative communication among teachers from both panels. . . . The question we posed is as follows: “Teachers of mathematics in Grades 7, 8, 9, and 10 may meet together to help ease the transition of their students from Grade 8 to Grade 9 mathematics. During the current school year, how often will you have met with your colleagues in the other panel?” In response to this question, 46% of the teachers reported that they had not met with their colleagues at all. . . . The data would suggest that more opportunities for discussions across the panels are needed. There are many possible topics of conversation that would be of value for teachers including specific classroom practices, as well as engaging with each others’ perceptions of what is required to be a good mathematics student and how that appears different depending on the grade level and specific course focus. (Suurtamm & Graves, 2007b, pp. 14-17).

Clearly, this research indicated the need for, and benefits associated with, an increased awareness of the “other” curriculum, and regular opportunities for cross-panel dialogue and professional development.

Cross-Panel Professional Development Study and RE4MUL8 Project (Jarvis, 2012)

In 2012, Jarvis conducted a research study that tracked a Grade 7-10 “family of schools” model initiative for cross-panel professional development (PD) within a northeastern Ontario District School Board. Interviews were conducted with five participants including the original coordinator who had set in motion the first “family of schools” groupings, the existing coordinator who was responsible for scaling up the initiative within the board in subsequent years, and three teacher leaders in the project (two elementary teachers and one secondary school mathematics teacher). The researcher also attended the closing event for the year-long series of “family of schools” meetings, a day in which the various groups

shared their progress, analyzed elementary/secondary student work samples together, and debriefed on the entire experience in their cross-panel groups. This PD model involved the selection of a “lead teacher” for each teacher team, a shared problem solving focus, lesson planning/analysis, and, perhaps most importantly, cross-panel observation. Further, the model involved seven “families” composed of secondary mathematics teachers (Grades 9 and 10) and “feeder school” elementary teachers of mathematics (Grades 7 and 8; most of whom taught mathematics along with the other core subjects, but some of whom were strictly specialist “math teachers” within a rotary style elementary school context). There were approximately 75 teachers involved altogether in the initiative. Wanting to incorporate a shared leadership approach, the coordinator invited seven “lead teachers” (some elementary, some secondary teachers) to act as organizers and key contacts for their respective teacher teams. Two half-days of “family of schools” meetings were planned throughout the school year, during which teachers were encouraged to discuss curriculum, pedagogical strategies, streaming, specific students, and were also given the opportunity to observe each others’ classrooms (i.e., lesson study) and debrief together on what they had noticed regarding teacher practice and student learning. A final half-day was planned as a district-wide closing event meeting of all seven “family of schools” teams.

Jarvis (2013) found that one of the unintended, yet beneficial, consequences of this PD model was an increased and shared understanding of Grade 9 student placement issues. In fact, teachers would often discuss their students’ past performance and/or real, or forecasted, achievement with teachers from the opposite panel. These informal discussions happened spontaneously, and they often led to meaningful communication between teachers, with the actual students providing the linking element. Part of following up on a past student, or helping a current student prepare for future mathematics education, was found in discussing the difficult issue of Grade 9 student placement in terms of the levels and options available in the Ontario school system (i.e., Academic, Applied, or Locally Developed “Essential” level Grade 9 courses available in most secondary schools). The cross-panel meetings allowed teachers to become familiar with one another—to open up vital lines of communication for many issues, including the complex topic of Grade 9 placement. In his study conclusions, the researcher noted the following:

Professional development models that allow for teacher *choice* (selection from among various options), *voice* (active participation in PD design and implementation), and *ongoing support* (meetings spread out over the school year, and perhaps even available in summer months) hold much promise in terms of teacher engagement and overall effectiveness. . . . The cross-panel teacher team approach, organized by family of schools (secondary school teachers grouped with local feeder school teachers), focusing on problem-based learning (self-selected), and which involved a form of lesson study with classroom observations featured all three of the above-mentioned elements. . . . Perhaps one of the most significant aspects of a PD approach that encourages direct communication between teachers from different school panels is that of a consistent teaching and assessment program within an educational jurisdiction or region. A lack of clear communication and informed classroom practice can not only lead to an inferior delivery of the curriculum, but it can also ultimately affect student achievement. If classroom activities, teacher expectations, and related assessment do not coincide—sometimes not even vaguely—with the experiences of other mathematics classrooms within the same school, let alone with those from the school(s) from the opposite panel located down the street or across town, one would not be surprised to find that student achievement would suffer as a result of mixed messages, varying definitions of success, and widely different classroom activities. (pp. 314-317)

In a separate project entitled *RE4MUL8* (see Figure 2), Jarvis (2012) asked six different District School Boards to nominate an Intermediate Division teacher who, in their opinion, exemplified excellence in teaching in terms of the Ontario Curriculum (OME, 2005a, 2005b) expectations and reform-based strategies. Video-taped documentation of classroom teaching sessions (using the TIPS4RM major topics)

along with subsequent post-lesson interviews with the teacher(s), and often also the board coordinator, were completed in the six locations and the video footage edited for the RE4MUL8 Project website.

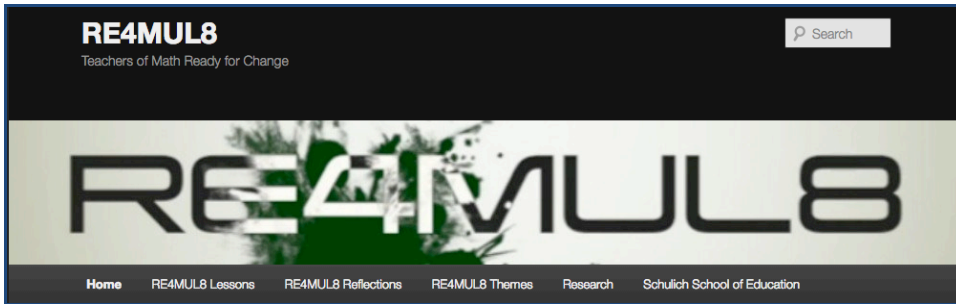


Figure 2. RE4MUL8 Project website (<http://re4mul8.ca/>).

The video data was further analyzed and a third series of thematic videos were also created for the site (e.g., Problem-Based Learning, Messy Time Teacher Transition, Co-Teaching Strategies, Math Coaches, and the OME CLIPS Resource), as were two sets of video-based teacher PD discussion questions.

Creating Pathways to Success (OME, 2013)

In 2013, the Ontario Ministry of Education released a document entitled *Creating Pathways to Success: An Education and Career/Life Planning Program for Ontario Schools* (OME, 2013). This resource outlined an inquiry-based conceptual framework and supporting policies and processes to guide schools in developing a comprehensive Kindergarten to Grade 12 education and career/life planning program. The four-step inquiry process (see Figure 3) built on four questions linked to the four areas of learning in education and career/life planning: Knowing Yourself; Exploring Opportunities; Making Decisions and Setting Goals; and Achieving Goals and Making Transitions. (OME, 2013, p. 12)

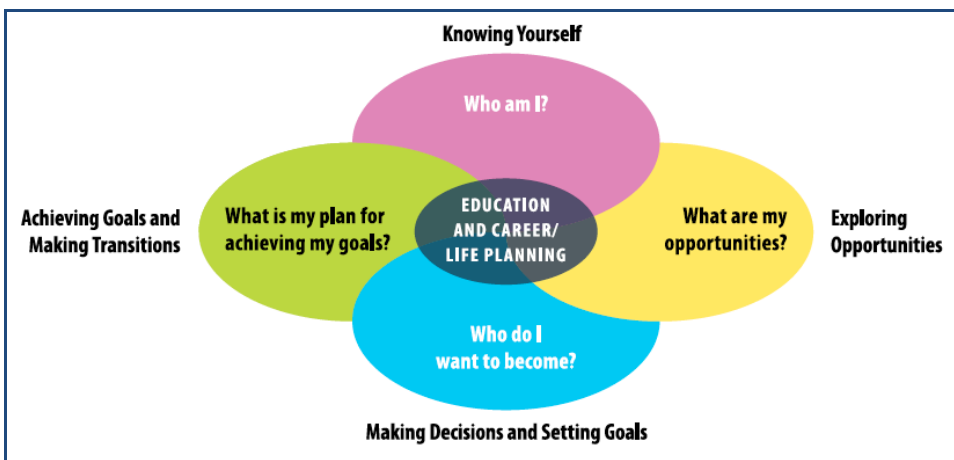


Figure 3. Education and Career/Life Planning Framework: A Four-Step Inquiry Process (OME, 2013, p. 13).

The *Creating Pathways* document featured a section regarding “Elementary to Secondary Transition Planning” in which the authors underscored how the transition from elementary to secondary school is among the most challenging and personally complex periods for the individual adolescent learner.

At this stage of their lives, students are struggling to establish their identities every day, through interactions with friends, at school, at home, and in the community. Immersed in uncertainty on several fronts, they need to feel safe and to experience a sense of belonging. They also need to

take courses that align with their strengths, interests, and aspirations. . . . Effective transition planning to secondary school begins for all students in Grade 7 and continues into and sometimes beyond Grade 9. A smooth transition contributes to a strong foundation for success in secondary school and beyond. The IPP [Individual Pathways Plan] supports students in Grade 8 in the planning they need to do in order to make a successful transition from elementary to secondary school. They record evidence of their investigations and reflection, in the four areas of learning, to support them in: selecting secondary school courses; setting goals for community involvement (which can begin during the summer before Grade 9); and identifying areas of interest for extracurricular activities and leadership opportunities. . . . Elementary and secondary schools should work collaboratively to develop strategies that support student planning for successful transitions from elementary to secondary school. All students need information about: the Ontario Secondary School Diploma (OSSD) requirements; types of courses offered, and how best to design their personal secondary school program based on their interests, strength, needs, and aspirations; specialized programs and board-wide programs, extracurricular activities, and additional support programs; strategies for completing the community involvement requirement; the full range of postsecondary opportunities (apprenticeship training, college, community living, university, and the workplace); and the education and career/life planning process and strategies for the effective use of education and career/life planning resources. All secondary schools are required to provide orientation programs for students and their parents to help students make a smooth transition from Grade 8 to Grade 9. Orientation programs should be tailored to meet the needs of the student and parent population. (OME, 2013, pp. 21-22)

The Creating Pathways to Success resource highlights the need for administrative planning and for open and clear communication with students and parents/guardians around transition/graduation issues. It also speaks directly to the complex decision of course selection and streaming (see Turner, 2007).

Education Quality and Accountability Office (EQAQ) School Stories (EQAQ, n.d.)

The Education Quality and Accountability Office (EQAQ) in Ontario is responsible for the annual assessment of Grade 3, 6, and 9 students in the areas of literacy (reading/writing) and mathematics, as well as for the Grade 10 assessment of literacy proficiency (OSSLT). EQAQ also coordinates student participation in national and international assessments on behalf of the Government of Ontario, and conducts and reports on research regarding student assessment and attitudes. The EQAQ website also features positive examples of school success stories (see Figure 4) where student achievement has been significantly improved over time owing to certain strategies being implemented within the school.

The screenshot shows the EQAQ website interface. At the top, there is a search bar and a navigation menu with links for 'About EQAQ', 'The Assessments', 'Research', and 'Our Data in Action'. Below the navigation, there is a breadcrumb trail: 'Home \ Our Data in Action \ School Stories \ St. Stephen Catholic Secondary School'. The main content area is titled 'St. Stephen Catholic Secondary School' and features a video library section. The video is titled 'Recognition of Achievement' and is presented by Dr. Bette M. Stephenson. The video description includes the following information: 'PETERBOROUGH VICTORIA NORTHUMBERLAND CLARINGTON CATHOLIC DISTRICT SCHOOL BOARD 2014-2015', 'Student population: 940; Grades: 9-12; Principal: Mark Joly', and a list of bullet points: 'St. Stephen has a 30-year tradition in the community; however, the current building was finished in 1998.', 'In 2010, a 20-classroom addition with a state-of-the-art technology building opened to accommodate growth in the area.', 'The school serves a large geographic region including both rural and suburban areas.', and 'The school offers a full academic program from Grade 9 to 12, including a full French Immersion program.'

Figure 4. EQAQ School Stories: St. Stephen Catholic Secondary School (EQAQ, n.d.).

One such success story highlights the strategies being implemented at St. Stephen Catholic Secondary School (SSCSS) where “all learning pathways are highly valued. The staff works very hard to ensure that all students are on pathways appropriate to their learning needs. Students are assessed early, and the school and home discuss placement to ensure that it is effective” (EQAO, n.d.).

Various video-taped segments of interviews with the school administrator and teachers are accessible on the site, and one such documentary is entitled “Grade 8 to Grade 9 Transitional Strategies at Work.” The SSCSS Principal, Mark Joly, provides the following commentary on his school’s transition strategies:

So the transition from Grade 8 to Grade 9 is a critical piece. It’s an important time in kids’ lives. I think an overarching principle that really covers all the work we do is at St. Stephen all pathways are valued. So when we talk about a pathway, we’re talking about Locally Developed, Academic, Applied, and Life Skills. So we refer to those as pathways, and they’re all valued, right? And so part of the transition in our view, part of what makes the transition successful, is to ensure kids are in the right pathway—they’re in a pathway that meets—that suits their learning style, that will allow them to thrive. And so we work really hard with our elementary feeder schools to ensure that the transition is informed—that it’s well informed. So we have transition meetings with our feeder schools; Grade 8 teachers share with us information about their students, about their learning styles, about, you know, areas for improvement and so on, and all of that informs their movement into our school. Once that process is, I mean, it’s never really complete—it’s ongoing, it’s a continuous process right into the start of the school year. And then at the very start of the school year—frankly the start of each semester is important—the first two weeks are when we do some work to verify that our students, we think, are in the right pathway. Sometimes despite the best effort to make recommendations, you know, students don’t end up in the pathway that suits them, and so we undertake a process of doing some diagnostic testing.

Jennifer Clark, the Curriculum Chair of Mathematics, then describes a 1.5 week diagnostic strategy:

So we begin each semester with a week-and-a-half-long diagnostic review period, where we go through topics that were covered in the Grade 8 classes, give them a little bit of a refresh on it and then have daily quizzes, so they can show us where they’re at and what they know, how comfortable they are with the various topics. What we do with this information is use it to just double-check that the students are in the correct pathway, that the recommendations that were made and the choices that perhaps flowed from that are going to set the students up for success in Grade 9 math. The other thing it does is informs us as to the skill set that our students have coming in, so it really informs our planning and what background work we will need to do to cover the topics that are coming up in the Grade 9 curriculum. At the end of our diagnostic period, where we have a collection of three or four small quizzes and a bigger test on the skills that we’ve been practicing, if we identify that there are students who are really struggling and who are not likely to be successful in the pathway that they have chosen, we call home and have a discussion with the parents as well as with the students to touch base as to whether we feel the pathway is appropriate for them or whether we need to take a look at some of the other options that are available and some of the other pathways as a better fit. Those conversations aren’t always easy conversations to have, and we do meet with some resistance on some fronts with parents deciding that the choice that was made is the choice that they’re going to stick with, and it’s interesting to watch those students throughout the semester get frustrated with the work that’s coming at them . . . those are typically the students that we find in for extra help on a very regular basis and whose anxiety levels are a lot higher, because they’re struggling to meet with success in the pathway.

The School Story of SSCSS also features a special focus on their full-year Applied Math/Science courses which are taught by the same teacher for both subjects, and which, after five years, is producing notable success with these students. Principal Joly remarks on the specific details of this particular strategy:

So those students do math and science on an alternating basis all year. And they do that with the same teacher all year. . . . Now an important point from my past experience is that it's critical—I've tried it the other way, with two different teachers—excellent teachers—but that's not where the disconnect is—the continuity just isn't there for those students. You know, there could be confusion about when work is due, you know, what are we doing in math tomorrow, or science, but when it's the same teacher, you're always working with the same person. There's flexibility in how you deliver the program, so, for example, I know that our teacher right now delivers by unit, so they may do a full unit of science and then do a full unit of math. There's no confusion around what books am I bringing, what are we studying, etc. And so we've found that program to be very successful for students. The students, when they're entering the program, are below provincial standard, usually significantly below provincial standard. We've been using the EQAO data to check on our progress and the success of that program. It is verified—our work and the results given are showing us that students are achieving by and large at provincial standard, and we've even had some remarkable success stories, like students who may have scored Level 1. . . scoring a Level 4. So there's something good happening there.

Surely there are many strategies such as the diagnostic week and full-year Math/Science courses being used throughout Ontario to help students and parents/guardians make better, more informed pathway decisions in mathematics, and to better support students once these important decisions are made. It therefore really becomes a matter of collecting, organizing, and sharing these stories within the province.

CLIPS and Mathies Websites (OME, 2017)

Two other remarkable Ontario math resource websites that have been developed by the Ontario Ministry of Education over the past few years, and which serve to support Intermediate Division teachers of mathematics are the *Critical Learning Instructional Paths Supports (CLIPS)* (OME, n.d.-a) resource, and the *MATH Interactive Electronic Supports (mathies)* (OME, n.d.-b) resource.

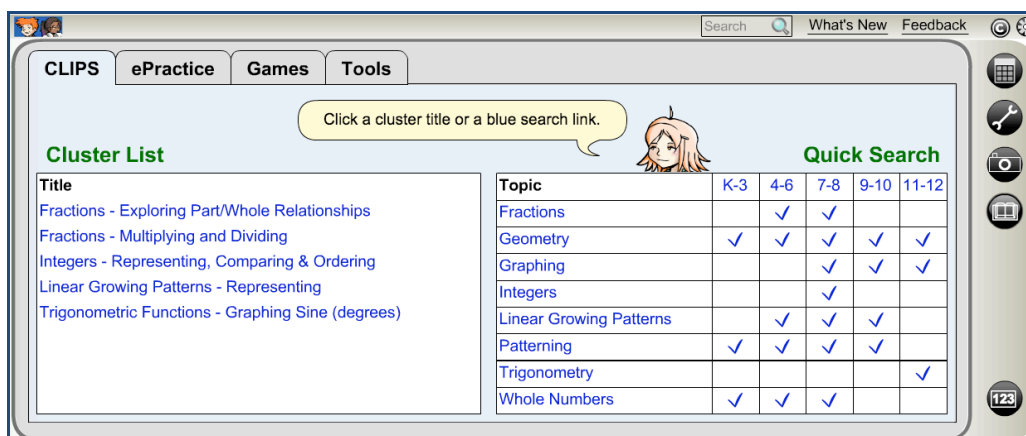


Figure 5. Critical Learning Instructional Paths Supports (CLIPS) website (OME, n.d.-a).

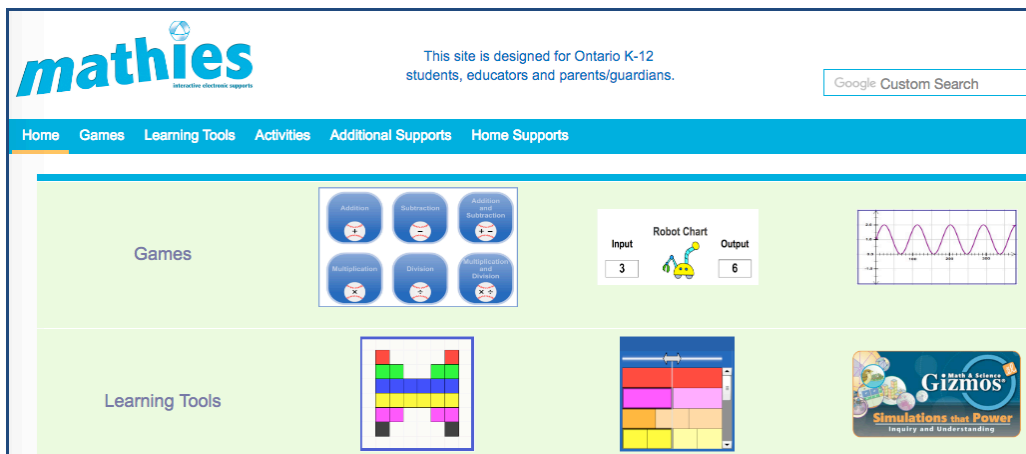


Figure 6. EQAO School Stories: St. Stephen Catholic Secondary School (EQAO, n.d.).

The CLIPS resource (see Figure 5) provides teachers with detailed, interactive math content explanations and activities that can be used in classrooms or computer labs for student remediation, review, or extended learning. The *mathies* resource (see Figure 6), as noted on its Index page banner, has been designed for Ontario K-12 students, educators, and parents/guardians and provides many useful electronic tools, games, activities, and links to other existing resources for mathematics learning.

Choices: Secondary Schools Course Selection & Planning Guide, 2017-18 (TDSB, 2017)

There are 76 public school boards in Ontario including 38 public secular boards (34 English boards, 4 French boards) and 38 public separate boards (29 English Catholic boards, 8 French Catholic boards, 1 English Protestant board). There are also seven public school authorities that operate in children's treatment centres. Each of these boards and school authorities provide their students with various forms of supports and resources regarding the critical transition between elementary and secondary school. One such example of a well-developed transition resource is the Toronto District School Board's *Choices: Secondary Schools Course Selection and Planning Guide, 2017-2018* (see Figure 7). *Choices* clearly draws upon the *Creating Pathways to Success* framework mentioned above (pp. 6-7), as well as guiding students on how to use the board's selected online career/course selection software, *myBlueprint* (pp. 8, F-H).

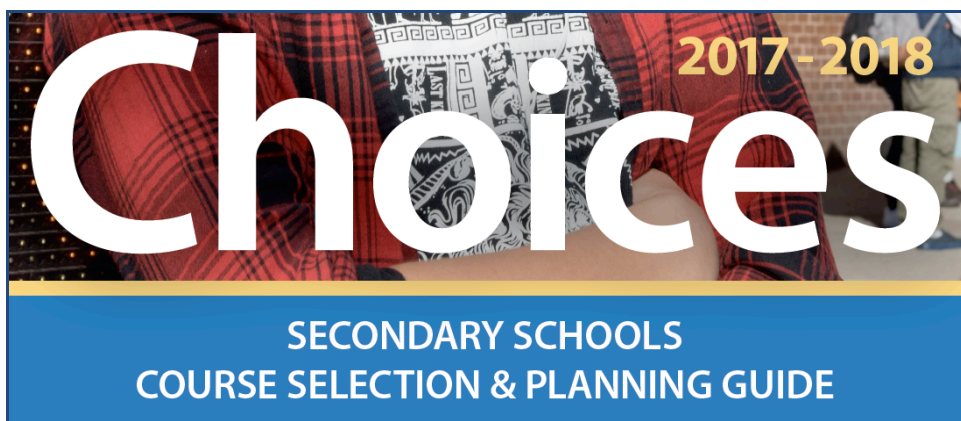


Figure 7. Choices: Secondary Schools Course Selection and Planning Guide (TDSB, 2017).

Under the section entitled "Career/Life Development," the guide provides the following advice:

A career is your path through life. It includes education, learning, different jobs, work (paid and unpaid), family life, friendships, community activities and leisure activities. Career development requires students to understand themselves and opportunities in both the world and workplace so that when presented with opportunities they are prepared to make decisions about their future. Career development requires students to learn how to make informed choices to ensure their successful transition from elementary to secondary school and from secondary school to further education, training, and work. It involves understanding self, goal setting, decision making and opportunity awareness. The workplace is rapidly changing. As existing jobs become more complex and new jobs demand increased levels of education, career development is more critical than ever before. (p. 10)

The remainder of the 60-page *Choices* document includes sections dealing with important topics such as: building character, policies and practice, special education, assessment and evaluation, reporting, alternative learning opportunities, re-engagement opportunities, specialized programs, apprenticeships, diploma requirements, course (required, elective, and alternative non-credit) codes and descriptors, and course pathway charts for various disciplines such as English, Math, and Science (p. E). Such guides, coupled with local information sessions, no doubt serve as meaningful tools for transition planning.

Homework Help Resource (OME/TVO, n.d.)

The Homework Help resource (see Figure 8) is freely accessible to all Grade 7-10 Ontario students at publicly funded schools, who register with their Ontario Education Number (OEN). Homework Help is offered in English and is run by TVO's Independent Learning Centre with support from the Ontario government. Students can log in between 5:30 p.m. to 9:30 p.m. ET, from Sunday to Thursday for one-on-one tutoring support in mathematics. They can also join their grade level tutor's room to see questions that other students are asking, and to watch teachers walk through problems on a group whiteboard.

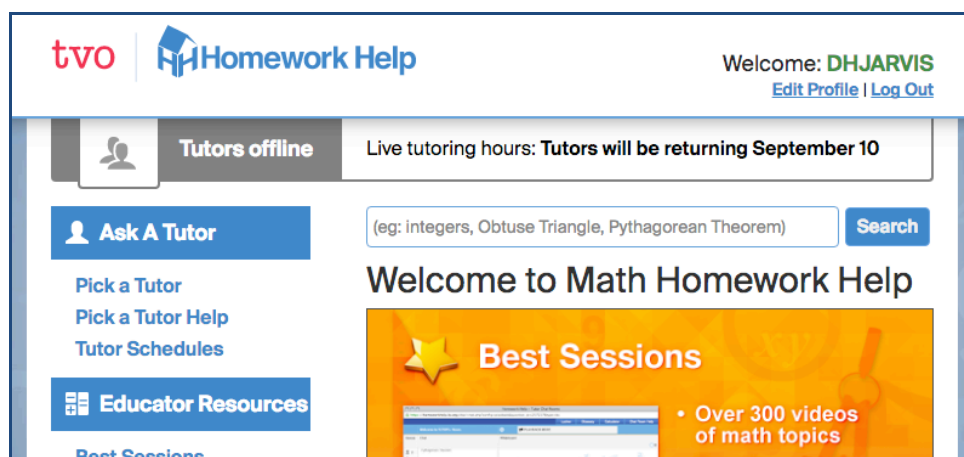


Figure 8. Homework Help online tutoring resource (OME/TVO, n.d.).

Video archives of popular questions and teacher explanations are stored on the site, and can be searched by title, or by teacher pseudonym. At the beginning of the two secondary school semesters, TVO offers one special week of online training and virtual tours for students and their teachers. This resource has become a commonplace support for thousands of students across Ontario. In some schools, teachers insist that their classes register for this resource and will provide ample time to facilitate the registration process either within classroom with tablets or desktop machines, or in school computer labs.

Choose a Path That Includes Math (CAPTIM) (2016-17)

Most recently in Ontario, Colgan (2017), with financial support from the Ontario Ministry of Education (OME) and the Council of Ontario Directors of Education (CODE), has created a new online resource entitled *Choose a Path That Includes Math* (CAPTIM). This resource is designed to specifically support Grade 7-12 students and their parents/guardians in terms of highlighting the importance of mathematics for many occupations, and by encouraging students to hence select a math pathway that involves at least four appropriate mathematics courses at the high school level.

The CAPTIM website comprises many short videos with current students, high school graduates working in a wide variety of fields, random pedestrians (comical “streeter” type videos), and mathematics teachers. It also provides an interactive course pathway chart (based on the OC documents) with related career opportunities, math course descriptions with examples of math content items, and links to related research and student/teacher resources. In explaining the rationale for, and potential significance of, this new resource, Colgan (2016) cites recent Canadian research studies:

Less than 50%, [this is] the average annual percentage of secondary school graduates, across a selection of provinces, completing Grade 11- and 12-level mathematics and science courses. . . . In 2013, Let’s Talk Science, a national STEM Outreach organization . . . in partnership with Amgen Canada, published a startling research report: *Spotlight on Science Learning 2013: The High Cost of Dropping Science and Math*. . . . To prepare the report, researchers at Let’s Talk Science and Impakt, a research-based global consultancy, carried out an environmental scan of peer-reviewed literature, reports, media articles, and institutional and government websites to investigate the financial, opportunity, and social costs of student disengagement from science, technology, and mathematics courses at the secondary school level. To supplement the environmental scan, interviews were conducted with stakeholders in Canadian business, innovation, media, public policy, economics, governance, and skills development. . . . The report included many disquieting findings. For example, did you know that the average annual expenditure per student in publically funded schools (from Kindergarten to Grade 12) in Canada from 2011 to 2012 . . . was \$12 557.00? Imagine the cost knowing that at least 20 000 Ontario students return each year for a fifth year of secondary school, *after* meeting graduation requirements. Did you know that the average cost of one semester of undergraduate university tuition, or two semesters of college courses is \$2790? Or that the institutional cost for each first year Canadian college or university student who fails to progress to the second year is between \$6111 and \$10 800? . . . in general, students without Grade 12 math can expect to be excluded from 40 to 75% of program areas, and those without Grade 12 science can expect to be excluded from 30 to 65% of programs at Canadian universities. Students without Grade 11 or 12 math can also expect to be excluded from half of community college programs. Did you know that 70% of Canada’s jobs require a science, technology, engineering, and mathematics (STEM) education? . . . ALL of Canada’s top jobs require a STEM background: Oil and Gas Drilling Supervisor, Head Nurse, Health Care Manager, Electrical and Telecommunications Contractor, Chemical Engineer, and Petroleum Engineer. The report underscores the fact that by the time students apply for skilled-trades training, college, or university, it’s too late. They find out that they are unprepared in prerequisite courses or lack the experience required to pursue a number of career options. The report underscored the fact that students, their parents, teachers, and guidance counsellors need to be aware of the options and opportunities lost when they say goodbye to STEM learning in secondary school, and the financial and time costs involved of later re-engaging in STEM learning. (p. 11)

Clearly, there exists an urgent need in Ontario to make these facts more widely accessible to parents and guardians, to Grade 7-12 students and their teachers, to Guidance counselors, to school administrators,

and to policymakers. Let's Talk Science published a related research report entitled *Exploring Parental Influence: Shaping Teen Decisions Regarding Science Education* (2015). According to Colgan (2016), the content of this report was equally as shocking in terms of common parental attitudes and school realities.

The results for this study emerged from the data obtained from an online survey of 805 randomly selected Canadian parents, whose children (aged 13–17) were entering Grades 7–12. The sample was balanced on a 50/50 gender split and to regional data for the parents in proportion to the census. The good news is that the majority of parents polled (57%) reported that they discussed education goals or pathways with their children often. . . . Yet while a whopping 75% of parents agree that STEM education is very important for today's youth, and two-thirds of parents (67%) agree that it's important for all children to participate in STEM education until the end of high school, only 28% of parents discuss the value of these courses. Why? At least one-third believe that there are enough careers for their children that do not require STEM, or that STEM courses are too difficult for their child. The research report also highlighted this finding: Almost nine in ten parents (88%) believe they have a lot or some influence on their children's education—and their children agree. In fact, teens said that parents, by far, have the greatest influence on their educational direction, with teachers a distant second (76% versus 24%). . . . Given the enormous influence of parents, it is important to recognize that it is largely their encouragement that will help children pursue the grounding they need to open up academic and career choices, avoid the need to make up courses after high school (due to dropped science and math), and prevent lost opportunities. . . . These concerned parents expressed enormous confusion about how to support their children's math course selections for Grade 9 and beyond. Most often, they reported overwhelming frustration because they had such limited access to resources to help them in this critically important endeavour. Perhaps of greatest concern to me was the knowledge that students and parents have a limited menu of available experts at the school level to support them in decision making. Why? In Ontario, secondary schools report an average of 381 students for every guidance counsellor (with some secondary schools reporting a ratio as high as 595 students per guidance counsellor. Moreover, only 17% of elementary schools report that they have guidance counsellors . . . This means that the burden of support falls squarely on the shoulders of mathematics teachers, many of whom are not well positioned to offer extensive, comprehensive, and targeted advice because of other duties, responsibilities and limiting factors. (pp. 11-12)

The CAPTIM website resource is set to be released to the public in the fall of 2017, and the degree to which it will be used as a positive catalyst for change in the Ontario system of course remains to be seen.

1.2 Understanding the Critical Transition from Grade 8 to Grade 9

As noted earlier, students in Grade 8 and Grade 9 are experiencing multiple and significant changes in their lives, all at the same time, during the elementary to secondary school transition years. Their bodies are changing as they reach puberty; their social connections and structures (even within an era of social media usage/dependency) are radically shifting as they prepare for a geographically new learning space with related transportation changes and new social hierarchies; and their learning is actually being stretched in new directions as their brains further develop, and as a series of new teachers may adopt entirely different teaching strategies, classroom management techniques, and assessment expectations. As Cushman (2006) notes, entering secondary school can be a terrifying prospect for some students:

High school will be huge and confusing. Unless they are headed for a small high school, kids imagine an overwhelming scene. In a crowded school short on human and financial resources, the prospect grows even scarier: "All my buddies told me that high school was going to be a zoo,

people running around, nobody going to class. . . . people just standing there like lightposts, with no worry about getting an education. It's so big here, there's like 2,000 kids." (p. 48)

It is important to note that the transition to more reform-based mathematics instructional strategies can be equally as discomfoting for the Intermediate Division teacher as it is for the students moving through the grade transition. This apprehension can sometimes be conveyed to students subconsciously, particularly when the "messy time" teacher transition is in its infancy. However, as teachers of mathematics (non-specialists) or math teachers (subject specialists) become increasingly comfortable with the use of manipulatives, technology, collaborative groupwork, problem-based learning, and varied assessment strategies, student (and teacher) engagement often sees a noticeable increase over time as these strategies are implemented (Breide, 2016; Jarvis, 2008, 2016; Jarvis & Franks, 2011).

Butts and Cruzeiro (2005) surveyed all ninth grade students entering a large Midwest comprehensive highschool to better understand student perceptions surrounding transition issues and effective practices. Based on their 30-question survey findings, the researchers shared related recommendations:

Academic expectations may be built through: scheduling new ninth graders in class every period each day and engaging students with required credit activities; emphasizing the practices of assisting ninth grade students in completing all school work and conforming to the process; and offering character education for all ninth grade students. Offer an individual learning plan, for struggling students, and for those not ready for high school. Have in place, grade retention/remediation practices. Invite parents and community members to present their careers to students as an information presentation for motivation. A number of systemic changes may further enhance ninth-grader academic achievement: as a building practice, eliminate the tradition of ninth graders' ability to drop a class; change the policy and practice regarding the opportunity to earn whole credits for a year-long class to earn credits for completion of course work by the semester; and consider evening classes for families of new ninth graders. (pp. 76-77)

In their article entitled, *The Importance of the Ninth Grade on High School Graduation Rates and Student Success*, authors McCallumore and Sparapani (2010) describe the plight of the 9th Grade student as well as strategies that they have encountered to assist students in adjusting through the transition period:

Researchers target 9th grade as the make or break year for completing high school. During the 9th-grade year, many students for the first time have to earn passing grades in core courses, and these core courses are typically some of the toughest and most rigorous academic classes a student must take in high school. Furthermore, the rising use of standardized tests to measure school performance, and exit exams required to earn a diploma add to the difficulty and importance of doing well in high school. Statistics generated from the freshman year are concerning. Ninth graders have the lowest grade point average, the most missed classes, the majority of failing grades, and more misbehavior referrals than any other high school grade level. . . . Some solutions are simple and affordable. It can be as easy as providing each 9th-grader with a bell schedule and a map to help them better understand where they need to go and when, or handing out sample packets of 9th-grade tests and homework assignments to help answer questions about the level of difficulty of high school classes. Other solutions may include a meet-the-teacher night, an orientation for both 9th-grade students and their parents before school begins, student mentors, and providing information that debunks myths. These transition solutions should continue throughout most of students' 9th-grade year. Other ideas and programs . . . require more time and often money. For example, a high school in Georgia created a class called High School 101, where students learn high school survival skills such as time management,

decision-making skills, study skills, test-taking strategies, social tolerance, computer research skills, and career alignment. Other school districts have implemented summer programs that provide after school homework and study help, seminar periods, and block scheduling. Additionally, teachers, administrators, and guidance counselors can help by providing tours of the high school, engaging in more interaction between the middle school and high school, and developing a more rigorous middle school curriculum as well as summer enrichment programs. Research shows that it is imperative that measures be put in place to smooth the transition. Schools with fully operational transition programs have an average dropout rate of only 8%, while schools without such programs have a dropout rate of 24%. (pp. 60-64)

Finally, researchers Jao and McDougall (2015) report on their *Collaborative Teacher Inquiry Project* (CTIP) which was a professional development initiative that brought together educators from nine schools across four neighbouring school districts in southern Ontario who were seeking to improve their Grade 9 Applied Mathematics program (see also Stoilescu, McDougall, & Egodawatte, 2016). Teacher participants attended topic-specific workshops based on schools' goals for professional growth and had opportunities to collaborate with other participants to create and share teaching materials for the Grade 9 Applied Mathematics course. Qualitative data from teacher interviews and written reflections indicated that the teachers felt that a mixture of collaboration and professional development made the project successful. Based on findings, Jao and McDougall noted:

Professional development sessions allotted time for participants to engage in discussions about their Grade 9 Applied Mathematics. . . . Participants overwhelmingly spoke of enjoying working with and meeting other Grade 9 Applied Mathematics educators. The opportunity to engage in discussions with colleagues provided some participants with reassurance that they were not the only person facing the challenges and issues that they experienced in their classrooms. (pp. 14-15)

Similar to what we have seen in the CIIM study findings (Suurtamm & Graves, 2007), the Jarvis (2013) "family of schools" PD model research, and the EQAO St. Stephen Secondary School feeder school teacher meetings (EQAO, n.d.), the Jao/McDougall study once again underscores the importance of providing regular professional development opportunities for teachers. These types of PD initiatives, especially those that are cross-panel in nature, serve to both raise awareness and to build math teacher confidence and pedagogical consistency surrounding the critical transition from elementary to secondary school.

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2. MKN Exploratory Research Findings and Discussion

Having been directly involved in a number of the above-mentioned Intermediate initiatives (e.g., TIPS writer/researcher; CIIM study graduate student researcher; RE4MUL8 Project developer; CAPTIM external evaluator), I felt well positioned to contribute to the *Critical Transitions* Community of Practice of the Mathematics Knowledge Network. To better understand the specific student transition from elementary to secondary school, and given the available MKN funding and the timeframe for Year 1 implementation, I proposed to complete a related, baseline literature review and a small qualitative study of various education stakeholders to ascertain the critical issues involved in this particular transition.

After gaining Research Ethics Board approval for the study at Nipissing University, and then receiving permission from five Ontario District School Boards (in the Ottawa, Kingston, and North Bay areas) and from the nominated participants via signed Participant Information Letters (PILs), I conducted seven interviews (some individual, some in pairs, and two focus groups) in June 2017, with a total of 16 participants sharing their insights regarding the critical transition of students from elementary to secondary school. This group included High School Math Teachers, Math Coordinators, Student Success Leads, Department Heads, and a Guidance Counselor. A number of these participants were also parents with adolescent children who, in this sense, were also familiar with this specific transition and with the secondary school issues surrounding math courses and content as discussed in their feedback. Interviews were transcribed verbatim, and copies of each transcript were sent back to the respective participants for “member checking,” allowing for any corrections regarding accuracy.

After reading and signing Participant Information Letters (PILs), as per REB protocol, participants were asked the following three general questions regarding school transition during the scheduled interviews:

1. What do you think are the **biggest challenges facing students** as they transition from Gr. 8 to Gr. 9 mathematics study? Would you say that **streaming** decisions are central to this transition?
2. What **supports, resources, or initiatives at the elementary school level** have been adopted in your board to help students navigate this significant transition with success? Are you aware of **other strategies** that you have heard about in other boards/locations that have been effective?
3. What **supports, resources, or initiatives at the secondary school level** have been adopted in your board to help students navigate this significant transition with success? Are you aware of **other strategies** that you have heard about in other boards/locations that have been effective?

These three questions shall also serve to frame the following findings and discussion sections. Please note that participant pseudonyms have not been used for quotations since the two focus group interviews did not permit the differentiation of speaker voices. Direct quotations appear in blue font.

Grade 8 to Grade 9 Transition Challenges

Many of the challenges that have already been discussed in Section 1 were touched upon by participants in answering the first interview question. One participant in particular provided a rather comprehensive description of the adolescent’s experience during this significant transition, noting changes in environment, scheduling, social hierarchy, teacher expectations, and student-teacher relationships.

I think that structure is an issue because of the environment, the scheduling—there’s a lot of scheduling issues that are very different in the elementary world versus the secondary world.

Also, just the social side of it—students are going from the top of the totem pole down to the bottom of the totem pole in two months time. . . . There are some students that find that a bit difficult, and can get caught up in it. Teacher expectations as well—I was thinking about that. I think that our Grade 8 teachers, because they have Grade 8's for at least half of the day right up to most of the day in some of our schools—so, what I've noticed is that there tends to be a bit more of—I don't want to say mothering but—there's a lot more relationship being strengthened through an entire year versus now heading over and having only one semester and only 65 or 70 minutes per day with the student. Structurally, there's a whole bunch of differences, socially for children there's a lot of changes also—expectations for teachers are very different in regards to their relationships with students.

Streaming, or what is known in other jurisdictions as “tracking,” involves students having to choose the appropriate level of secondary school courses in which they will be enrolled during their first semester. This choice is not easy, and can be very stressful for both students and for their parents/guardians who are often the ones who ultimately make this decision on behalf of their child. Many factors come to bear on this educational decision, and the stakes are perceived as being very high, thus the anxiety associated with this significant choice. Among these shared factors are: student mindset and self-confidence levels, peer influences, and the input and guidance provided by parents/guardians, elementary and secondary school teachers, Guidance counselors, and board-level Student Success leaders/coordinators.

As one participant noted, “I see so many kids come into Grade 9 having no confidence in their math abilities at all, and so that develops this culture within a group of kids that, ‘I've never been good at math, and I'm not going to be good at math.’” Another interviewee mentions the persistent and unfortunately common stigma that exists between the streaming level choices.

Well to be honest, they're scared. I think most decisions are based on the fear that if they don't choose Academic then they're closing doors, or they're not good enough. There's still that taboo behind Academic versus Applied, and unfortunately the kids who do choose Applied think they're not good enough. Their whole mindset—it's a whole mindset issue.

In adolescence, one's peer group can have tremendous influence on a child's decision-making processes. Some students therefore decide to pursue a particular course pathway in order to share the experience with their closest friends, rather than making the decision based on their readiness or learning style.

We even have one student this semester who's in an Academic course—socially wanted to stay there, and continue to learn there, but wanted to take a summer school course to get his Foundation [Applied Math credit]. So, he knows that he's not going to be successful in the math credit, but he didn't want to drop it. . . . This is pretty rare, and the parents in this case were totally game with that. He wanted to stay in the class socially, with his friends, but also to still learn.

Parents and legal guardians have perhaps the most influence since the decision more often than not rests ultimately on them, whether or not they have been well-informed about the child and the various options. Most participants agreed, in terms of their shared comments, that parents/guardians often perceive the selection of the Applied stream as an action that potentially closes doors and opportunities for their child.

Parents do make that final decision. . . . I think it's a societal thing too, you know, “University is the only place where you can be successful in life.” I think there are lots of things that have happened in the last few years that have changed that [mindset], and we do see some parents who are open to that, but most parents still think—especially from families where nobody has gone [to university] yet, and there's a possibility that this kid will go, and so the kid basically has to go. And

then, even worse, there are families where everybody's gone to university, and so the kid has to go to university as well. I think that parents who most understand their child's needs get it, and they totally support the right place for them.

Beyond perceived career destination arguments, parents/guardians often also harbour perceptions of Applied and Locally Developed Compulsory Credit (LDCC) classrooms as spaces wherein behaviour is routinely negative influence on their child and where resultant learning is therefore reduced or minimal.

The other critical issue is that parents think they know what an Applied level learning classroom is like, and that they know their child so well, and so they decide that their child is not going into that classroom environment. There's a terrible stigma there, still. . . . "My child is not going into that type of Applied 9 environment—so I'm going to put him in Academic 9, even though he might be better off in the Applied level for the content.

There may also be adult peer pressure at play, with parents/guardians wanting to be able to tell their own social group peers that their child has been enrolled in the Academic 9 stream in high school.

Well, there's also the "across-the-fence" neighbour pressure. There's that feeling that my son or my daughter is in the University Math, or my son or daughter is in the College Math. There's more than just the student that we have to help through this transition, there is also a transition that we have to help the parents through. If we can make the parents feel more comfortable, then maybe there will be less stress. If the parents' stress goes up, students' stress goes up.

One specific concern was shared in this regard in which a Student Success Lead noted that one of reasons parents/guardians sometimes make poor streaming decisions is that they fail to notice that their child's program has been modified in certain subjects like mathematics, even though their marks may be high.

The big gap that I see is that they don't realize that some of their students are in modified programming for math. So, that's a little tiny box on their report card that they're not recognizing. So, they may be working at a Grade 5 level math, but on the report card be getting an 80% in that [subject], because the modified box is checked off. So, when the parent reads the report card, they're thinking that they're good to be in Academic 9 Math, and that's not so much the case.

Another major influence on pathway choices in the transition years is that of classroom teachers, both those who have taught the child mathematics in Grades 7 and 8, as well as secondary school teachers who may be involved in Student Success teams and who are hence in the process of analyzing student data. Sometimes these teachers are well informed and can therefore provide good advice to the family, but at other times, they may lack information or hold particular biases that influence their parental directives.

So, we do have, for the most part, in our schools Math Specialists and a lot of them are making recommendations for students. It is, ultimately, the parents' decision as to what pathway their child takes. Different schools handle things individually about how they try to ensure that the student is choosing a pathway that they're going to be successful in—where they have the best opportunity of being successful. That being said, parents are allowed to choose the pathway and sometimes go against recommendations of the teachers, not to say that the teachers' recommendations are 'bang on' all the time. . . . It's based on a number of factors—it's based on their academic performance, it's based on their learning skills, it's based on classroom management behaviour issues also.

Some teachers may base their advice to families on behavioural, rather than pedagogical, reasons:

I guess one of the concerns I have is that I'm not sure that all of our Grade 7 and 8 teachers are equipped to make those recommendations. I think if you don't have a really solid understanding of the content in the [math] curriculum and where that content is going in Grade 9, or maybe you're not particularly comfortable with math in general as a Grade 7 or 8 teacher, you may be making recommendations for the wrong reasons. . . . Sometimes it's a penalty for behaviour, so a Grade 7/8 teacher might be saying [to him/herself], "That kids been a real pain all year," or, "That kid hasn't handed in homework the way I would have liked, even though the kid really seems to get the math." It may be that the teacher in that situation feels this kid isn't "worthy" of being able to pursue that [Academic] stream? . . . I feel very lucky to work with the Grade 7 and 8 teachers regarding this transition, and I think for 95% of the time, if not 98%, our teachers do a pretty good job in describing those kids in terms of the needed skills and the work habits. It's not [only] the cognitive part, really, because they'll even say, "This student should be taking Academic 9 but due to this, this, and this, they may not be as successful."

There appears to be significant differences, even among the five boards represented in this study, in terms of how involved they would like the elementary and secondary teachers to be in the streaming decision process. In some cases, teachers are provided with information and resources and encouraged to actively take part in analyzing student data and counselling families, and in other cases, where perhaps there have been related problems in the past, they are asked not to do so: "It's actually discouraged in a lot of cases, that we actually give our two cents worth. . . . We're being asked not to be an influence as to what the parent and the child decide to pick." Clearly this is an area that warrants further investigation.

Guidance Counsellors and Student Success Leads are also heavily involved, by virtue of their role and responsibilities, in the students' critical transition experiences and related streaming level choices.

In conversations with teachers, the teachers give us kind of where they think [the student] fits, we go back to the timetable and see what the parent selected, but then it's like another conversation with the teacher, but it's a longer process. I think if we just nail it straight off and educate the parent on the proper course choice for their child based on whatever the child's career choices are, and on what the gaps are for their child—that's going to be much more helpful.

Part of the counsellor's job is to communicate the actual level of difficulty, the required work habits and skills, and the learning experiences associated with each of the various Grade 9 course options.

But that also comes into the skills that are needed to be in Academic Math—that has to be discussed, and what are the support systems at the high school level if that student decides to say, "Yes, I'm going to stay in Academic regardless of the amount of work it's going to take, and the perseverance and the struggle."

I was going to say that I think the conversation should start in Grade 7. . . . I think it all comes down to work habits. I think that every single kid has a math brain, but if they don't have the work habits and the skills to be able to do it, by the time they get to high school—I've always said, in a sense, we're kind of setting them up for failure a little bit. I've always said that Grade 7 and 8 should so much parallel Grade 9, it really should, in terms of that aspect.

Participants in these roles recognized the difficulty involved with making recommendations, even with solid data-based rationales, since other factors such as changing student maturity levels, Grade 8 teacher influence, parental input, and past student performance and behaviour may all influence eventual "fit."

It's a tough call because, I mean, I've seen students in Grade 8 do very well with a sudden burst, then sign up for all of Academic and I wonder, "Oh, gee." Then vice versa. I've seen students steady, steady, and have a really good background of learning skills and attitude and yet want to do Essential or Applied when we think they could be doing Academic. Then you've got the whole parent attitude on that, in terms of what they want their child to be signed up for. There needs to be some work around that, for sure, in the transition years anyway.

In this section we have explored the various influencing factors that come to bear on the important and complex decision regarding Grade 9 course selection in Ontario schools. In the next section, we shall look at effective shared strategies for supporting elementary students as they transition to secondary school.

Strategies for Supporting Successful Elementary School Mathematics Transition

As mentioned by a participant in the previous section, **a focus on work habits and learning skills** in the years leading up to the elementary to secondary transition can be even more important than content mastery in the disciplines in terms of setting up students for success in the secondary panel.

I definitely agree about the work skills being so, so important. There is a difference between Academic and Applied based on the amount of homework getting sent home every night, pacing, content knowledge as well, and I think that's one of the biggest things. . . . Students are coming from all different feeder schools, and so sometimes some are a little further along than others as well, and that can affect their stream choice one way or another too, whereas going from Grade 9 to Grade 10, maybe that's not as big a jump, because they all have the same teacher, or the same couple of teachers. But that work skills piece—definitely a big thing, whether it's time management, getting used to homework, even self-assessment skills. I know our school has really been pushing that at all levels, but especially in Grade 9—trying to develop those skills more.

Another strategy for successful transition is to try and ensure that **pedagogical strategies** in terms of math curriculum implementation and assessment are similar in both panels. For example, one interview participant described a recent initiative that had begun in his school and was expanding into elementary.

Over the past, I'm going to say seven or eight years, we've worked at coming up with common assessments. So, basically their end-of-unit type assessments that have a mix of question types, a lot of them EQAO-style question types, and we've really worked to make the format the same from Grade 4 all the way up to Grade 10. . . . So students will be very used to that format of questioning—it's not going to be a big shock when they hit the next grade. That's been important for us. . . . Now, it's not complete yet, so from Grade 4 to 6 we have only the Number Sense strand that has been addressed with these assessments, but I believe that from Grade 7 to 10 all of the math strands have been covered with these assessments. . . . We've been bringing together teams of teachers to write . . . Grade 7-10 teachers first, and now we're working with Grade 4-6 teachers.

One of the most productive ways to facilitate a raised awareness of curriculum expectations and assessment practices from both panels is to adopt a **cross-panel, "family of schools" professional development model**. As one former principal recollected during his interview: "One year, as an acting administrator in one of our schools . . . there were transition meetings where we had people from secondary school that came over to meet with the Grade 7/8 teachers to talk about that transition piece, and I thought that was really neat." While such events can be both expensive and time-consuming, they also offer rich, worthwhile opportunities for teacher collaboration, resource sharing, and new learning.

Parent Nights, whether they are held at elementary or secondary school sites, formed another very common strategy that had been adopted in all of the boards represented by participants in the study.

We talk to the students and explain things to the students, but for parents we have Parent Information Nights specifically for Grade 7 and Grade 8 parents, then for Grade 9 parents because the parents want to know about the transitioning . . . picking classes from Grade 8 to Grade 9, and so that's where we discuss all of those issues. . . . We usually have the Department Heads there, plus the Guidance Counsellor who hosts the meeting.

Another participant referred to the event as their "Partners with Parents" night. In attendance at these events is usually some combination of secondary school teachers, department heads, counsellors, and in some cases even Grade 9 students.

Our Guidance Department would visit Grade 8 classrooms in the wintertime and talk about the differences between levels and the courses that they can take. . . . Sometimes you might have a teacher go, yes, and usually we bring former students, so a kid who's in Grade 9 this year, or two or three, from that particular feeder school—we take them back, and the kids have a familiar face to talk to, and ask questions. . . . I think sometimes they are from different streams, but I think for the most part it would be the Academic.

In some boards, the Grade 8 **students are invited to the local secondary school** in order to experience first-hand the kind of learning that will take place in math classrooms, and to be able to ask questions.

So the Grade 8 students will come here over the exam break that we have in February, and they'll spend a day with us. We'll have a math classroom set up, and they'll come to our classroom and we'll talk about what math is like in high school, but again, we don't tend to talk about streams.

One participant described a **3-day, end-of-summer "Head Start" event** for Grade 8 students that they had begun hosting in their board in order to better understand student capabilities and learning gaps.

We do three days of math gap filling for the transition piece. . . . So, it's all focused on math growth mindset and on learning skills. . . . The last three days of August, so just before Labour Day weekend, we do three full days. . . . It's not for credit. We advertise it as every Grade 8 should come, and we try to make sure that all of them are here. We had 80% of our Grade 8s here last year. . . . We piloted it a couple of years ago and we continue to run it. Not every school in our board does the same thing, but it's been working really well for our school. . . . Usually we know by then who's teaching the Grade 9 Applied Math, specifically, and so they are the ones who are teaching in our Head Start camp. They're seeing the gaps prior to going in on the first day [of school]. They're meeting the kids, developing those relationships. . . . It's actually a really nice three days, because there's such a really cool balance of kids in terms of doing the station rotation activities. It's very activity-based. It's not like sitting in a classroom.

Not only does the Head Start program provide teachers with a helpful window into student capabilities and learning styles, but it can also have the effect of increasing student engagement and building confidence in math. Notwithstanding, some students end up recognizing that their Grade 9 course selection may not be entirely appropriate, and further discussions with parents can lead to switches.

That's our whole goal on those three days is to develop their confidence in math. . . . The stream choices would have already been made, but it allows us to have that early sight into if that's a proper stream choice. So, at the end of the three days, we sit down—just our team first of all, and

then we do some phone calls with parents. . . . Parents are dropping them off everyday, so after the first or second day we're like, "We're not sure Johnny should be in Academic Math," then we can have that conversation with the parent. . . . Within those three days, the kids start to realize it too—they are buying in and saying, "This is going to be super challenging." . . . I would say for most cases, we're able to have who's supposed to be in those [courses] on the first day. If not, then by the end of the first week, because we've been able to make those early phone calls to parents. We already have a good idea by doing the sharing meetings, by looking at report card data and at Grade 3 and 6 EQAO data, to see what growth they've made, and then in conversation with the teacher. So, we have all those pieces of data, and I chart out what course selection was made by their parent, and then what I think should be happening as well. But it sometimes surprises me, because sometimes elementary school isn't a good judge of their future success.

In the above section, we have examined a number of effective strategies for supporting Grade 8 students and their parents/guardians in light of the critical transition between school panels. In this final section, we shall look at comparable strategies and resources designed to support secondary school students.

Strategies/Resources for Supporting Successful Secondary School Mathematics Learning

One method for ensuring a positive learning experience for all Grade 9 math students is the **purposeful selection of quality and experienced math teachers** in all three streams of the Grade 9 program. By this, I do not necessarily mean math subject specialists, although they often are great teachers due to their deep knowledge of the math content, but rather I refer to teachers who have taken the time to thoroughly explore the Ontario Curriculum (2005) and who enthusiastically attempt to adopt the teaching and learning strategies recommended therein.

Yes, and you can obviously see the ones that are coming from an elementary school teacher who is specialized in Math, or who loves it—loves the subject area. So, that [range from the different feeder schools] makes it super challenging. We have our strongest teachers in our Grade 9 Math courses. . . . Yes, that includes the Applied level, and even the Locally Developed—we have one of our strongest teachers in our Locally Developed Math because we want to build that culture of, "I can do it, and I'm really good at it," because it's such an important set of life skills.

Administrators actually assign the courses. They will seek input from the department, so generally the way that it works is within the school, teachers will request certain courses they'd like to teach. Department Heads may offer additional input on that, but it's ultimately the administrator who makes a decision about who teaches which courses. But yes, purposeful staffing, and for the Grade 9 Applied specifically, is critical. . . . having a trained Math Specialist with experience teaching those courses is definitely a key piece.

In some schools, **full-year mathematics courses** are strategically offered in place of the usual semester-length versions of the same Grade 9 courses. In so doing, teachers attempt to provide students with longer exposure to the mathematics content practice, as well as avoiding potential long gaps between mathematics courses which can easily happen in a semester-based program.

They've found that by stretching it out all year, they have more of a chance to close any gaps that students may have coming into Grade 9, and it also avoids the situation where a student does Grade 9 math in Semester 1, then Grade 10 math the following year in Semester 2 and they've had a one year gap in between with no math at all. And particularly for students who have just had ten years of having math everyday, they're used to an hour of math instruction everyday.

Furthermore, shorter daily math classes, or fewer math classes each week, within the full-year model reduces the harm done by missing any one particular class, or the likelihood of missing a class at all, respectively: “I think it gives more time for students to digest the concepts, and to just work with it. . . . Not to mention we have an every-increasing number of bus cancellation days, and those are lost days.”

One participant described an Integrated Studies Program approach in which two teachers co-deliver four Applied 9 credits, including Math, to a relatively small class and throughout the entire school year.

We have an Integrated Studies Program here at the school, which is a smaller class where it kind of models Grade 7 and 8 a little bit for the morning. So, the kids are with two consistent teachers where they’ll do the English and the Math. . . . Class size is maximum 16. The two teachers deliver four credits together through the whole year, so Math, English, Religion, and another Literacy course. . . . Then in the afternoon, they’re regularly integrated into other classes. . . . It’s an Applied level credit, not Locally Developed. . . . When they come out of that Grade 10 Applied course they generally go into the Grade 11 Workplace level Math and it fits nicely.

Parallel course scheduling means that secondary schools purposefully offer both the Academic and Applied versions of Grade 9 Mathematics during the same schedule timeslot, thereby facilitating the movement of students in either direction, as needs may warrant, without having to re-timetable. Almost all participants in the study mentioned this particular strategy, therefore it may be common practice.

Another scheduling option—and again, it’s easier in a larger school where there are multiple sections—is if you ensure that you schedule an Applied section off-set from an Academic. That way, kids can move without having to change their entire timetable. If a kid needs to move from Academic Period 3 to Applied Period 2, then you need to change their whole schedule, and it’s really problematic, and so it’s likely not going to happen.

So, there is the scheduling strategy that happens in some schools, not all. I think it’s a double-edged sword because if it’s used effectively, then it’s good, because I’ve seen schools where they’ve done mobility in both directions, as in two weeks in and we realize this kid is in Applied, but they’re getting everything and they’re bored, they need more of a challenge, so they move them to Academic. Or, a student who’s learning skills just aren’t compatible, and maybe they have a lot of attendance issues, so let’s put them where they’re going to find some success in Applied 9 rather than failing an Academic credit. But other times, I’ve heard of schools where it’s used as an EQAO strategy where the thinking is, “He doesn’t look like he’s going to be Level 3 or 4 achievement”—whether it’s Academic or Applied—“So, we’re going to move him.”. . . Some schools are actually strategically timetabling to make sure that their courses are staying under the cap for the level. So, they make sure their Applied course hasn’t exceeded the Locally Developed cap, so that leaves that [student mobility] option open, which, if it’s being done in the student’s best interest, I have no problem with that, but when it’s done politically, or for EQAO scores, that’s not cool.

Another strategy that is sometimes used in boards, owing to a number of different factors, is where **students of mixed ability are taught together** within the same class and then eventually sorted out into those working towards either an Academic 9 or an Applied 9 Math credit. While this somewhat resembles the de-streaming approach that previously existed in Ontario, it is different in the sense that the Locally Developed course students usually are not involved, and it is often only implemented when a series of other support mechanisms have already been exhausted and the student is exhibiting real effort.

Yes, there's one school in our board doing this. . . . In that particular case, they don't have enough students, so they actually can't separate them. So, they teach them together, and at the end they decide if they've achieved the Applied or the Academic credit.

So, if something has happened at mid-term, and we're still battling the parents, and they're kind of fighting us on it, and we're not able to do the move, then we have to decide. . . . So, at midterm we have that conversation, "Okay, this is the situation that we have here, Johnny can stay in the same class, but we will have this lens of the Applied level credit for his assessment" . . . a different exam.

Yes, this does happen. . . . If a kid chose to stay in the Academic but they didn't get extra help, that wouldn't likely be an option. . . . If the kid has worked their butt off, come in for extra help, done all these things, and still is unsuccessful, then they may award an Applied credit. But if there's no indication that the student has done extra work, or gotten help, then they would need to redo it.

Participants frequently reported using the strategy of assigning a **Resource Period**, in place of an elective, for students to receive math help while completing either their Academic or Applied 9 credit.

Then sometimes we suggest a resource period for those students, depending what program line they're in, but a resource period as an extra support. . . . Leaving them in the Academic, yes, if we think they're that borderline student and just need that extra push, then we'll sometimes put them in a resource room. . . . One of their periods, so that would often take out an elective section, so that's sometimes hard. . . . It depends on if they're a student who's identified with an IEP or not. So, it's either a GLE or a GLS course code. . . . Yes, and normally we are able to staff it so that there are certain periods that are math-focused periods.

The scheduling of such a resource period allows students to receive consistent, individual support: "Other times, the intervention would be to have them come out of an elective class and be assigned to a resource period where they could get more one-on-one support with myself or other teachers."

Many schools offer free **tutoring** support from math teachers during lunchtime or after school.

I wanted to comment on the Math ARC [Assignment Recovery Centre] program, from a parent perspective. My son is at [secondary school] right now and he misses a fair bit of school just because he's on a lot of sports teams. He's in Academic Math and he's thinking of pursuing a career in Engineering. He loves math, and so Math ARC has just been a godsend for him. . . . If he's missed a Friday class because his team has gone off for a tournament, or whatever, he's able to go into Math ARC on the following day when he's back and the teacher there will support him in making sure that he's up-to-speed on everything that he missed. Because of that, he's been able to be involved in lots of teams, do lots of things, and still be very, very successful in math. I just think that's the best program. . . . What I also like about this is that it fits into his regular school day. He likely would not take the time in the evening, because he also plays on other sports teams. So, the fact that he can slip in there for a half-hour at lunch is really helpful.

A Math Department Head shared one particular strategy where the math teachers at his school offer their time, on rotation, during Monday evenings to provide such tutoring support to interested math students.

The other thing that we do here is that we have lots of extra help. Extra help at lunch time, extra help after school, extra help on Monday nights for an hour-and-a-half, for students who want to really, really work hard to see just what their optimum mark in a course might be. It's basically having them say, "If I work this hard, where does it get me?" and, "How can I advocate for myself

through the extra help?” Then it comes to a point where we say, “Well, you’ve done all of this work, and this is where you are. Is this where you want to be? Is this going to help you get in the direction of where you want to go?” Because there is a maximum of time that students can spend on one course, because they all have other courses to do. . . . They show up here on Monday nights at 7 until 8:30 pm. . . . We all do a night, and we all know the courses, and we can do all the questions in all the courses. It’s for kids that can get here on their own—they usually go home after school, and then come back. . . . Parents sometimes will go and hire a tutor, and I actually discourage that. I tell them that this is way better than a tutor, and it’s free. Our challenge is that the social time for the students is at lunchtime, and then after school they’re in sports and so forth. So, it’s hard to get them to come and see me. So, I say to parents, make a deal with your kid at home: “All right, go in and get math help twice a week on Tuesdays and Thursdays, and then Mondays, Wednesdays, and Fridays—that’s your time with your friends.”

The **OME/TVO Math Homework Help** website was also reported by multiple participants as yet another commonly used support tool for math tutoring, often with class time being spent registering students.

Tonight at the Parent Night that we’re doing, all of [the students] are going to register for Math Help Online with the Ministry. That’s another piece that we push.

Yes, our students use the Math Homework Help . . . we’ve got stats to prove it. . . . We visit every Grade 7 to 10 Math class, at the start of the year and get them signed up for that resource.

It was common to hear about the role that **Student Success Teachers** now play in the various boards in terms of understanding individual student needs and assisting them in their course selections and study: “We do have Student Success teachers within schools, as well, that are looking out for students and in particular, are trying to make sure that students that are having challenges at being successful and getting credits—that certain things are being put in place for them.” In what follows, we are provided with a detailed glimpse into one particular Student Success Teacher’s approach to transition support:

I meet with all of the Grade 9 teachers one-on-one before the semester starts, usually on our PD day, and we just have a conversation on the sharing notes and what they need to know, and I present them with a data sheet so they can kind of see where all of their kids are at. We have *Compass* too, which has been a great tool for us. It’s an online tool where teachers are able to go into and they see all of their students’ data, based on whatever class they’re in, and even previous data, so that’s super helpful. . . . By the end of the second week, before early reports, I’m in touch with the Grade 9 teachers to see how they’re feeling, and usually they just come and say, “These are the four kids that are going to be hugely at-risk in my class, at this point.” I usually meet with each student and then make a phone call to the parent. . . . I think we only had one student fail first semester, fail a math course. . . . because of all the strategies that were working. It was a student that just really wanted to stay in the Academic class and we couldn’t convince her of the need to change, and she said, “I’ll just take summer school instead.” . . . We tried lots of strategies along the way—parent conferences, things like that, but it just didn’t change her opinion, and so she failed. So, that’s a big goal for us, [decreasing the number of misplaced students by recognizing that problem] early on—it is super vital, because then as they carry through, we can help fill gaps.

One participant reported the use of a **Transition Planner** for each student which is reviewed by the Student Success Leader along with other members of the secondary school’s **Student Success Team**.

What we do here at the school, is we have a Student Success team. So, once we’ve collected information from every elementary school, for every Grade 8 that’s coming into our school, and

the teachers have identified if certain students are at risk . . . we'll sit down as a team and discuss the math [course selection], discuss what we think is an appropriate level, then if we deem that a follow-up phone call is necessary, that's when we'll phone the parent. Parents often have all kinds of questions that they want to ask, so I will have a conversation with them. We've been working really, really hard to get the kids into the correct streams for their particular work habits, etcetera. . . . We have a Transition Planner where every Grade 8 teacher has to go in and identify if the student's going to be at-risk. So, for example, if the kid is at-risk for the wrong level of math, that's identified on the Transition Planner to help use with our planning. . . . If they have an IEP, that's also indicated in the Planner. . . . I think [the Transition Planner] is a Ministry initiative relating to Student Success, but we have developed our own as well, and we keep updating it in terms of risk factors. . . . We go through every student, but we highlight mostly the at-risk students. . . . Also, in high school, we've just decided, in terms of the streaming, we've created a new form, and I think it might help us going forward. The Math Department indicates, based on results for the kids, what course the kids should be in for next year. Then the three of us in Guidance can take a look at what teachers are recommending for each student. . . . It will help us to communicate and to have a consistent message, in order to make sure that we're getting kids in the right pathways.

Teaching strategies are, of course, directly related to student engagement and achievement levels. For example, the following teacher describes the use of multiple whiteboards and varied assessment.

So, they are referred to as 'vertical, non-permanent surfaces' and now we use it in Grade 10 as well. Our hope is to move the strategy on every year. So, basically the kids work in collaboration on big, deep problems using white boards and standing up. . . . Because the intention is if they get stuck, and I'm only one person as the teacher, amongst 26 or 13, depending on the class—is that they can help each other. They can go see each other. They can even—if they don't know how to start—they can take a peek at others' work—it's very easy to erase and restart. It's not threatening. . . . I can see that they're working, so they can't hide it if they're not working. They can help each other more easily. Towards the middle and end of the school year, kids started saying, "So and so, can you help me with this?" and "Oh, I'll come see you for that." It builds collaboration without me having to tell them that that's what we're doing, because everybody sees everyone else's work. . . . I wouldn't go back to working in desks for group work. It's part of the hands-on idea, and even when we use materials, the kids just move their tables closer to the white boards.

We were lucky enough to go to some "deep learning" seminars and they were discussing maybe using collaborative tests. . . . with part that you do alone, worth maybe 25%, and hand in, and then you go back to the same test, but as a team and the second part is worth 75%—but just the learning that happens there. . . . We're trying to push a lot of oral communication to explain your thoughts. So, in one of my schools, they're trying to use apps so the students can videotape themselves answering a deep-reflection, deep-learning type question and then also give feedback.

Finally, with the advent of secure, server-based support tools such as **learning management systems** and **student tracking software**, some boards facilitate the use of blended learning strategies (i.e., classroom + online interaction) including electronic communication with students and their families.

A lot of us are moving toward a blending learning type of classroom too, where if the student is away for whatever reason, all of the lessons are posted online so they can get caught up when they return. Some who are struggling, if they're going to be away, they can even use this to get help beforehand. . . . We use Google Classroom and D2L [Desire to Learn]. . . . Some even do videos too, especially with lots of snow days. . . . Screen capture, voice-overs—so it's been kind of moving in that direction. . . . I'll send out regular emails or reminder texts to the students. Most times it's a

general email to everyone in the class that goes out a couple of times during the school year. If a student's struggling or something, then I'll contact them privately.

We also have the new reporting tool that we're piloting this year—EDSBY, which has everything live, so that parents can see marks, assignments, etc. . . . A profile of their child, yes, and we're working on the communication tool through there as well. . . . It's a purchased platform. . . . The high school's been piloting the EDSBY platform, and I believe that in September, we're also starting with it in Kindergarten. So, parents can see their child's marks, attendance, and even e-Portfolios, all throughout their schooling.

In this section, we have examined a number of shared strategies for supporting Grade 9 math learners, particularly those who are struggling and who may have made an inappropriate course selection upon entering secondary school. Ensuring student success during their first year of secondary school is clearly a significant part of supporting this critical transition in student mathematical development.

Discussion: Debunking Five Common Math Myths

In interviewing participants, and then in reading through their transcripts, several mathematics-related myths that are commonly held by some parents/guardians, students, and teachers became evident. In what follows, I would like to directly address and debunk five such myths, using relevant quotations.

Myth 1: Grade 9 Course Options Directly Correspond to Difficulty Levels

In the *Ontario Curriculum: Mathematics, Grades 9-10* (2005, p. 6) document, we read in the preamble what actually constitutes the envisioned difference between the Grade 9 Academic and Applied courses:

Academic courses develop students' knowledge and skills through the study of theory and abstract problems. These courses focus on the essential concepts of a subject and explore related concepts as well. They incorporate practical applications as appropriate.

Applied courses focus on the essential concepts of a subject, and develop students' knowledge and skills through practical applications and concrete examples. Familiar situations are used to illustrate ideas, and students are given more opportunities to experience hands-on applications of the concepts and theories they study.

Note that there is no actual reference to difficulty level, but rather an emphasis on learning style and suggested pedagogical strategies for mathematical learning. However, it was shared by a number of participants that this "harder/easier" mindset around the 1D [Academic] and 1P [Applied] still exists.

I feel that that myth or stereotype of the streams representing difficulty levels still exists with the Grade 8 teachers that I talk to. They're good in math so they're going into Academic. They're not looking at that learning skills piece, and mindset, and attitude, and preparation for learning.

I think it's hard for teachers—we are university educated, and so we tend to consider ourselves as highly educated, having taken the Academic stream, and so we have a bit of a bias there, I think. We tend to think of Academic as being more difficult, and so we'll say things like, "No, student, because you don't have x, y, and z, you can't go in this stream, you need to go in that stream."

Raising awareness among Grade 9 teachers surrounding this issue, and hence also via Parent Nights and communication with the home, will serve to better inform student course selections and teacher practice.

Myth 2: University is More Prestigious and Offers More/Better Career Opportunities than College

Even though there may be changing perceptions in Canadian society around the comparative value of university degrees and college diplomas in terms of their correlation to graduate career opportunities, there may still be a lingering bias, particularly among university-educated teachers, that the University pathway is a much better option and thus should be pursued by students whenever possible. Several comments made by participants in this study directly address this issue of perception.

I also think it's the mindset of parents—we need to communicate that university is not the be-all-and-end-all in this day and age, but parents are still stuck there. When in all honestly, you take a look at the jobs in the apprenticeship areas, you take a look at the jobs and the percentages of kids that graduate from college and have better paying jobs than university grads. So, I really think that somewhere that has to be worked on. This mindset has to be broken down, because at the end of the day when that kid is forced into the Academic stream just because mom and dad want this—somehow we have to get that message out there.

We find that sometimes parents, and even teachers, they'll recommend Academic not because they think it's the suitable course for the child, but they think it's to avoid Applied, for whatever reason. . . . So, there's that bias that we're fighting, and I've had parents, and I've also had teachers say to me, "Well, that's a nice kid, so I want them to go into Academic 9." No, no. So, that's what we're perpetuating somehow. We have to fight that—to value the Applied stream, because those are the people that we highly educated people will be paying \$300 to show up at our house in the middle of the night when something breaks. But it's valuing that, and it's a different pathway, and so to choose a pathway where the student is going to experience the most success in Grade 9.

Both the Applied and Academic pathways can lead to many interesting and well-paying jobs. Perhaps the most important thing is for teachers and coordinators to encourage students to take that fourth Grade 12 Math credit, at whatever level is appropriate, and to support their mathematics learning accordingly.

Myth 3: If a Student has an IEP, They Should Automatically Only Take Certain Courses

If an Ontario student has been through the formal identification process and has received an Individual Education Plan (IEP) that documents any relevant accommodations for their learning, he or she should be able to approach the Grade 9 course selection process with a variety of options just like any other student. However, these students are apparently sometimes placed in Applied or LDCC courses by default, with little or no discussion regarding their career goals and related pathway options.

Well, there are problems with teachers recommending because they're basing it on sometimes marks, sometimes immaturity, sometimes behaviour, and that may not necessarily be a good reason as to why someone should be in the Applied stream, because maybe it's more a behavioural issue. If they're capable, and cognitively at-or-above average intelligence, they should be able to go into certain streams, even if they have an IEP—so sometimes there's a mindset around those teacher recommendations, so we've tried to move away from those.

The other groups that I'm thinking about are students with learning disabilities transitioning, because again, in terms of what we think students are capable of. I've seen communications where it's "If you have any kind of IEP, you should be taking this course here," and that is an awful message. It is very limiting, and I feel like we need to pay attention to some groups in those transitions more particularly.

One of the participants offered an important disclaimer surrounding this particular issue, highlighting what she perceives as the significant difference between accommodations and modifications in this light.

I completely agree, if you have an LD [Learning Disabled] student who is accommodated only, then they should be like any other student and should be able to pick the correct stream for them—Academic, Applied, Locally Developed. But when we have students who've had their program modified and who are continuing to be modified in Grade 8, if they're not working on Grade 7 or 8 expectations in Grade 8, then they should be taking Applied, if not the Locally Developed level. Because we get students at times in Grade 9 Academic courses, who when you look back, they were having modified Grade 3 or Grade 4 expectations while in Grade 8.

In the case of student with accommodations for learning, as detailed in their IEP, teachers and counsellors, in consultation with parents/guardians, should consider all possible course options.

Myth 4: Pathway Selections Must be Identical for All Grade 9 Courses

A fourth myth that deserves debunking is that course selections in Grade 9 should always involve the same level choices across the various disciplines. Several participants highlighted this issue:

Parents are stressed because they think that in order for their son or daughter to go to university, they have take University pathway courses across the board—but they don't. . . . Let's say that you love History and you want to go to university and you want to do History and Political Science, and you want to work for the Government in Ottawa. You don't have to have University level Math to do this. You're going to apply to a university and they will want your top six courses. You have to have 4U English and you need five other 4U courses, but they can all be in Social Science. You're going to look at the [university] course calendar and it's not going to say that you have to have a Grade 12 U Math credit. . . . The idea that my son or daughter can't go to university unless all of their Grade 9 credits are at the University level is not correct. So, after that conversation, you can see the parents take a sigh of relief, because they think it's the most important decision.

It's a really hard sell when it's like that. That's the tough part because parents, for the most part, think that their child needs to be in all Academic programming. . . . They don't understand that their child could take the Applied [Math] because their program may not even require math in university, so they could take the College level math courses. There are a lot of students that, say in Grade 11, decide that they want to go to college now instead of university, but continue to take the University level Math thinking that's going to better prepare them for their college program. It's hard to explain to them that even though it's a "higher level" math, it's actually not going to prepare them well for the program that they're going to do in college. So, that's a messaging part later on that we struggle with, and are working on.

This problem can apparently have a particular manifestation within enrichment or other specialized programs wherein students are taking all Academic credits as part of unique student cohort in secondary school, even though they may be struggling greatly with their mathematics learning and would thus be more successful in an Applied Math course: "So some of our students are in enriched programming with us, but should be in Applied Math and not the enriched program line for that subject [math] because they still have lots of gaps to fill. That's been a bit of a challenge because then it doesn't fit with our timetable."

Every parent/guardian should be informed that pathway/course selections should be made according to student learning capabilities and future goals, and that these decisions may involve a variety of levels.

Myth 5: There is Little/No Flexibility Once Streaming Choices Are Made

Finally, we arrive at perhaps the greatest and most damaging myth that seems to be commonly believed by many parents/guardians and their children in transition—that streaming choices are permanent.

It's the parents, they all say, almost to a person, "I don't want to close any doors for my child." To them, that means they want their child to take the best math possible. . . . My message to the parents is, "Why don't we pick a math for your son or daughter where they'll be successful?" If that's at the Applied level, then we'll get those students to be successful at Applied, and then at the end of that course, you and I will get together and say, "Should we be taking that Transfer course to take Academic." . . . I just emphasize to them that, "You're not closing a door in Grade 9."

Well, I think it's all about the way that people were brought up as well—their own memories of school as parents. When they went to school, it was likely more like "You choose this stream, this stream, or this stream, and there is no changing." We need to know there's a blending of that process now, and that's okay. And if there are gaps to be filled, then we need to fill those gaps.

There are ways to change later—we've had kids do 1L [Locally Developed], then 1P [9 Applied], then 2P [10 Applied]; or 1P [9 Applied], then 1D [9 Academic], then 2D [10 Academic]; or others who take the Transfer course. It's not a life sentence, so choose for success in Grade 9, then worry about the pathway as you move through. . . . Another pathway that sometimes happens is a student will do 1P [9 Applied], 2P [10 Applied], and then they'll jump to 2D [10 Academic] and the principal will sign off on them making that jump. So, they double up on the Grade 10 Applied and the Grade 10 Academic, because the curriculum lends itself nicely to that because it comes across sort of like the 10 Applied is your intro, and the 10 Academic is more theoretical, more conceptual and in-depth. It's a point where students are maybe a little more mature to make that change in the level, and it also lends itself well to a number of our schools with year-round math.

By understanding that there exists multiple ways of changing a course pathway, if indeed this becomes a necessity, students and their parents/guardians can approach this important decision with far less stress.

3. Recommendations for MKN Critical Transitions (Grade 8 to 9) Community of Practice

Based on the review of the literature and existing Ontario resources, and on the results of the exploratory research study described above, I would like to recommend the following activities for Year 2 of MKN:

- **Host a MKN public event in 2017-18** that would serve to bring together representatives from the related stakeholder groups for this particular Critical Transition (i.e., Grade 8 teachers of math, Grade 9 math teachers, Guidance Counsellors, Student Success Leads) to discuss related issues and actions
- **Host a workshop during the OAME Annual Conference** (May 3-4, 2018) that focuses on the Gr 8 to Gr 9 critical transition to discuss related issues and to showcase the new CAPTIM resource

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