Youth Perspectives on STEM Education, Career Choices, and Influencers in Atlantic Canada 2016

WISEatlantic Survey – Executive Report

The WISEatlantic Research Group has completed the final year of their study focusing on the engagement of junior high school students in science and math subjects, their competency in such subjects, and influencers of their future career decisions, particularly those focused on careers in science, math, engineering, and technology.

For a copy of this report please contact WISEatlantic.

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Researcher Biographies

Dr. Tamara Franz-Odendaal, Lead Researcher
Professor of Biology, Mount Saint Vincent University
NSERC Chair for Women in Science and Engineering, Atlantic Region

Dr. Tamara Franz-Odendaal graduated from the University of Cape Town, South Africa with a PhD in Zoology with a focus in paleontology and completed her post-doctoral studies at Dalhousie University in Evolutionary-Developmental Biology. Dr. Franz-Odendaal joined the Mount in 2006 as a Natural Sciences and Engineering Research Council of Canada (NSERC) University Faculty award recipient (2006-2011). In 2011, Dr. Franz-Odendaal was awarded the NSERC Atlantic Chair for Women in Science and Engineering for Atlantic Canada and subsequently launched WISEatlantic. She is one of five chair holders across Canada that are working to increase the participation of women in science and engineering and to provide role models for women considering careers in these fields. The aim of the WISEatlantic program is to provide junior and senior high school girls access to role models active in the sciences and engineering fields through mentorships, webinars, Girls Get WISE Science Retreats and Summer Camps. WISEatlantic also supports women in STEM careers through professional development opportunities. Her network has reached about 15,000 students, teachers, academics, professionals etc., and has directly engaged over 3000 youth with over 200 female role models in STEM. In 2015, Dr. Franz-Odendaal received the Mount's Research Excellence Award for her outstanding contributions to the research community and research climate at Mount Saint Vincent University.

Dr. Karen Blotnicky, Co-Researcher
Dept. of Business & Tourism, MSVU

Karen Blotnicky is a faculty member in the Department of Business and Tourism at Mount Saint Vincent University in Halifax, where she specializes in marketing. She holds a Ph.D. from Northcentral University in Arizona. Dr. Blotnicky's research focuses on women in business, female entrepreneurship, and female representation in hotel management. Her varied research interests also include marketing philosophy in organizations and how it impacts the adoption of information and communications technology. She is a research specialist with over 25 years of experience combining industry and academic research. She is sought out for her expertise and is involved in many research collaborations and publications. In addition, Dr. Blotnicky was a small business columnist in both newspaper and radio, providing practical advice and an analytical perspective

to modern business challenges. As a woman who pursued non-technical studies, but who ended up with a passion for applied statistics, Dr. Blotnicky has much in common with youth who are the focus of this research study.

Dr. Fred French, Co-Researcher
Dept. of Education, MSVU

Dr. Fred French is a registered psychologist and a faculty member in the Faculty of Education at Mount Saint Vincent University. He holds a Ph.D. from the University of Alberta. Dr. French's primary areas of research deal with youth from the perspective of self-regulation and metacognition involving research into best practices in intervention and diagnosis. While his work is primarily with those who have learning disabilities, attention deficit hyperactivity disorder and behavioral disorders, he maintains an active long term interest in the career development of children and youth, particularly with the inclusion of women in science, technology, math and administration. He has provided leadership and consultative help to several initiatives in improving career development opportunities for youth in the public school system in several provinces. His research has implications for classroom practice, policy studies, leadership, exceptionality, human rights and inclusive practices; topics covered in various programs such as education, curriculum studies, educational and school psychology.

Phillip Joy, MSc., RD
Dept. of Applied Human Nutrition, MSVU

Phillip Joy taught within the Applied Human Nutrition department at Mount Saint Vincent University. He holds an MSc. in Biology from Dalhousie University in Halifax, NS with a concentration in Molecular Genetics and has earned his professional qualifications as a Registered Dietitian through the Bachelor of Applied Human Nutrition in internship dietetics program at Mount Saint Vincent University. Phillip brings a unique background to this research, integrating both applied statistics and a scientific inquiry to the research process. He also brings a qualitative research perspective to the project. His research interests are varied including the use of visual strategies in research, compassion in the community setting, healthcare ethics, employment and student Wellness programs, and novel low fat food product development for children. He started his PhD in September 2016.

About this Study

Educators have long been concerned that fewer women than men pursue STEM (Science, Technology, Engineering, Math) focussed programs at the post-secondary level. In addition, less than 25% of the STEM workforce in Canada is women. Research has indicated that this reality reflects a trend in high school that sees girls lose interest in STEM studies and careers.

The **goals of this study**, which focused on junior high school students, was to **understand how engaged** they were in math and science, **their future intention for study**, and the **likelihood that they would consider a STEM career down the road**. Research also addressed students' knowledge of how relevant science and math were across various types of careers. Gender and grade differences, and influencers on science and math study, were also examined.

Students in Grades 7 and 9 completed an online survey during school hours, supervised by teachers and staff. The sample was collected in two iterations, with the first sample collected in 2012-13 and the second in 2014-15. Data was collected from students in all four Atlantic provinces. The research design allowed comparisons of student cohorts from Grades 7 and 9, while also providing a large sample of junior high school students from across the Atlantic region. Data was weighted by grade and province of origin to control for sample variation across grades and provinces. A total of 1,448 surveys were completed.

The survey was administered in both English and French, but 99% of all responses were completed in English. Ninety-five percent of students indicated that their mother tongue was English. The majority of students were girls (58%) and just over half of the sample were in Grade 9 (52%). The age of respondents ranged from 11 to 20, with an average age of 13.5 years.

Most of the students did not indicate that they identified with a particular ethnic group. Of the 24% of students who did identify with a particular ethnic group, 58% were First Nation and 39% were African-Canadian. The majority of students lived with both parents (75%) and had siblings living with them in the home (81%). These demographics are summarized in Figure 1.

This research study was approved by the Research Ethics Board of Mount Saint Vincent University. In addition, permission was obtained from school board superintendents in each province. Researchers report the data results without further extrapolation or recommendations.

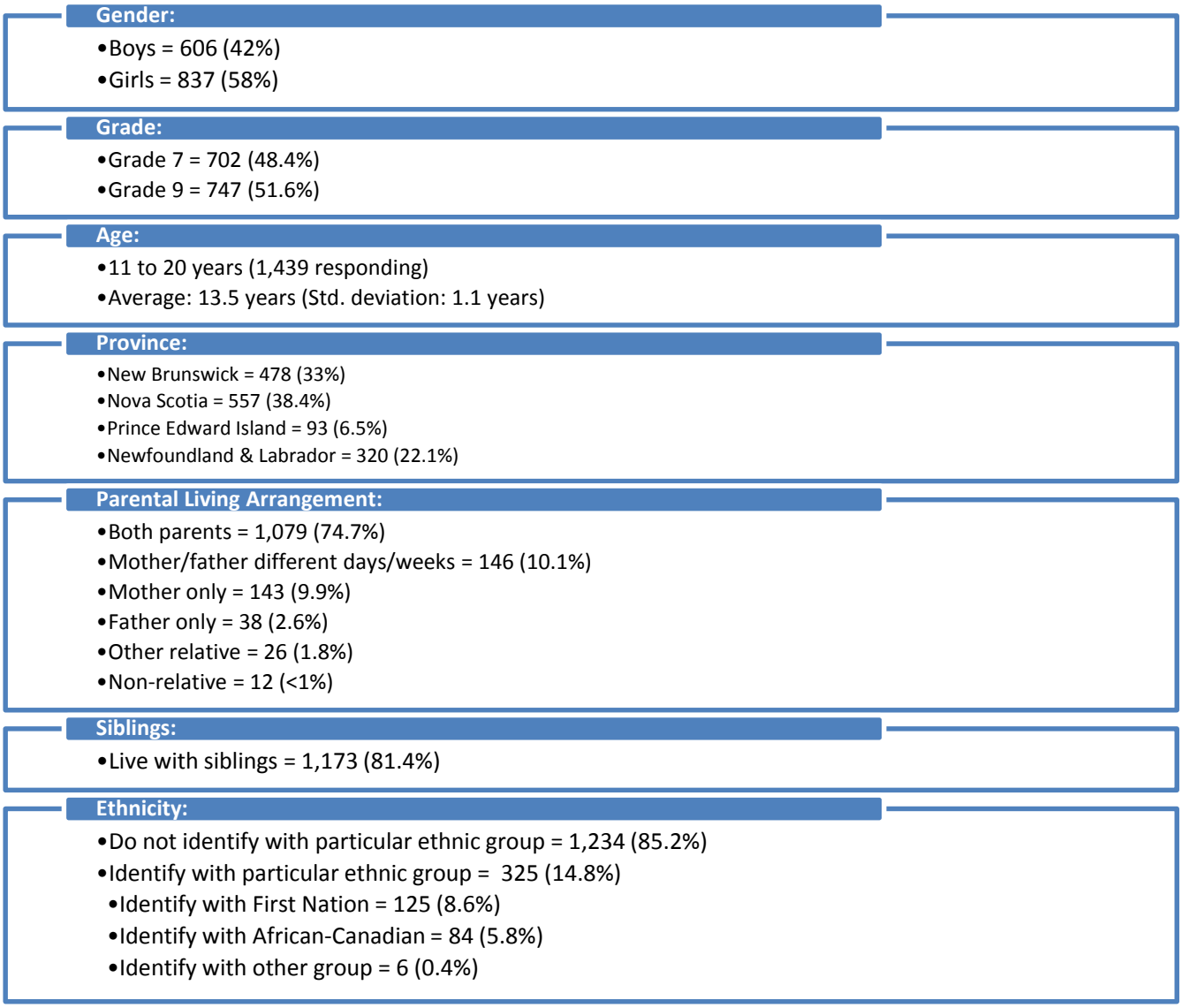

Figure 1 Sample Allocation by Demographic Profile. In total there were 1,448 respondents across all four Atlantic provinces.

Highlights

The results of this research study are summarized below.

Regarding perception of STEM subjects:

- All students had taken Math and a General Science course in school.
- All students were expecting to continue to take Math and General Science courses in their next school year.
- **More students ranked math and science classes** in their top two favorite subjects over non-STEM subjects.
- **Over 80% of students liked going to school** and 44% reported that they liked learning things in their classes.
- **No statistically significant gender or grade differences.**

Regarding engagement in STEM-related activities:

- **Over 65% of students had engaged in a variety of STEM activities** .
- Of these, 60% had participated in some highly engaging STEM activities while 34% of students did not participate in any STEM engagement.
- **Of those students who did not engage in any STEM activities, 42% indicated that they would do so if they had the opportunity.**
- **Statistically significant gender or grade differences.**

Regarding STEM career influences:

- **What influenced students when thinking about their careers?** Top sources of influence for students when thinking about their careers were their own future interests and passions (34%), school and teachers (17%), family friends (14%) and money (14%).
- **Who influenced students when thinking about their careers?** The most common influencers for students when thinking about their careers were family members (57%), teachers (16%), non-STEM role models (11%) and friends (11%).
- **How and why were students influenced?** The key ways in which students were influenced in career choice were through help and encouragement (49%), exposure and experience (21%), by doing something that they like and enjoy (20%).
- **Statistically significant gender and grade differences exist.**

Regarding student knowledge of STEM careers:

- **Many students did not have a clear knowledge regarding whether or not STEM careers required math/science skills.** Only 71% of students knew that mechanical engineering required math and/or science in high school. Surprisingly, approximately 30% of students could not identify that oil industry engineer, physiotherapist, oral hygienist, nutritionist, land surveyor, or ophthalmologist required math/science knowledge in high school
- **Students described what engineers do as building things (54%),** designing things (27%), engaging in math and science activities (9%) and making the world better a better place (5%). Twelve percent of students indicated that they did not know what engineers do.
- **Statistically significant gender and grade differences exist.**

Regarding students' future plans:

- **Most students planned to pursue post-secondary education.** Seventy-one percent planned to go to university, 11% planned to pursue a community college certificate or diploma program, 9% planned to enter the workforce directly after finishing high school and 10% wanted to take a year off from their studies after high school.
- **No statistically significant grade differences exist.**
- **Statistically significant gender differences exist.**

Regarding students' favourite career interests

- The top three career interests were working with people (50%), creative skills and expression (41%) and technical and scientific skills (40%).
- **Statistically significant gender and grade differences exist.**

Regarding students' favourite career activities:

- The top three career activities were artistic, unusual and creative activities (46%), working on practical, productive and concrete activities (39%) and taking responsibility, providing leadership and convincing others (36%).
- **Statistically significant gender and grade differences exist.**

Regarding the likelihood of students choosing a STEM career

- **Seventy percent of students indicated that they were 'very likely' or 'somewhat likely' to pursue a STEM career.**
- Students who engaged in high STEM activities were 2.3 times more likely to choose STEM than those who did not do so.
- Students exposed to STEM role models were 3.4 times more likely to choose STEM careers than those exposed to non-STEM role models.
- Several influencers had no statistical significance on the likelihood of choosing a STEM career. These were: family, friends, students themselves, teachers/school.
- **Statistically significant gender and grade differences exist.**

These results demonstrate that the most effective way to persuade students to consider choosing a STEM career is to expose them to STEM role models and to involve them in highly engaging STEM activities.

STEM Subject Perception

What is subject perception?

Subject perception captures how students feel about the subjects they take. Do they like them? STEM perception was measured by focusing on most-liked subjects and how students felt about school in general.

Subject Favourites

Students were asked to rank the following subjects in terms of their favourites: General Science, Math, English/French, History/Social Studies. The percent of students who ranked each subject in the top two of the four subjects ranked appears in **Figure 2.**

Sixty-eight percent of students rated General Science in their top two favoured subjects out of four subjects ranked. There were no statistically significant differences in preference for General Science based on gender or grade. Over 59% of students rated math in their top two favourite subjects. There were no statistically significant differences in preference for Math based on gender or grade.

Anglophone students were asked to rank English, and Francophone students were asked to rank French, among their subject favourites. Fifty-three percent of students ranked the subject in their top two favourites. There were no statistically significant differences in preference for English/French based on gender or grade.

Forty-seven percent of students ranked History/Social Science in their top two favourite subjects. There were statistically significant differences in the ranking based on gender, with more boys (59%) than girls (47%) rating the subject in the top two of their favourites. There were no statistically significant differences in the History/Social Science rating based on grade.

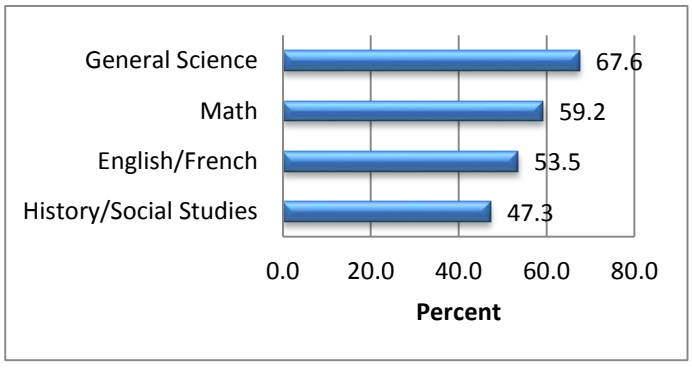

Figure 2: Rating of Top Two in Favourite Subjects
Sample sizes: General Science n=1,139, Math n= 1,233, History/Social Studies n= 1,162, English/French n= 1,209. The data for grade 7 and 9 are pooled.

Feelings about School

Over 80% of students liked going to school and nearly half reported that they also enjoyed learning things in their classes. Less than 10% did not like their classes, disliked going to school, or felt it was a waste of their time. School perceptions are shown in **Figure 3**.

There were no statistically significant differences in perceptions by gender, siblings, or grade.

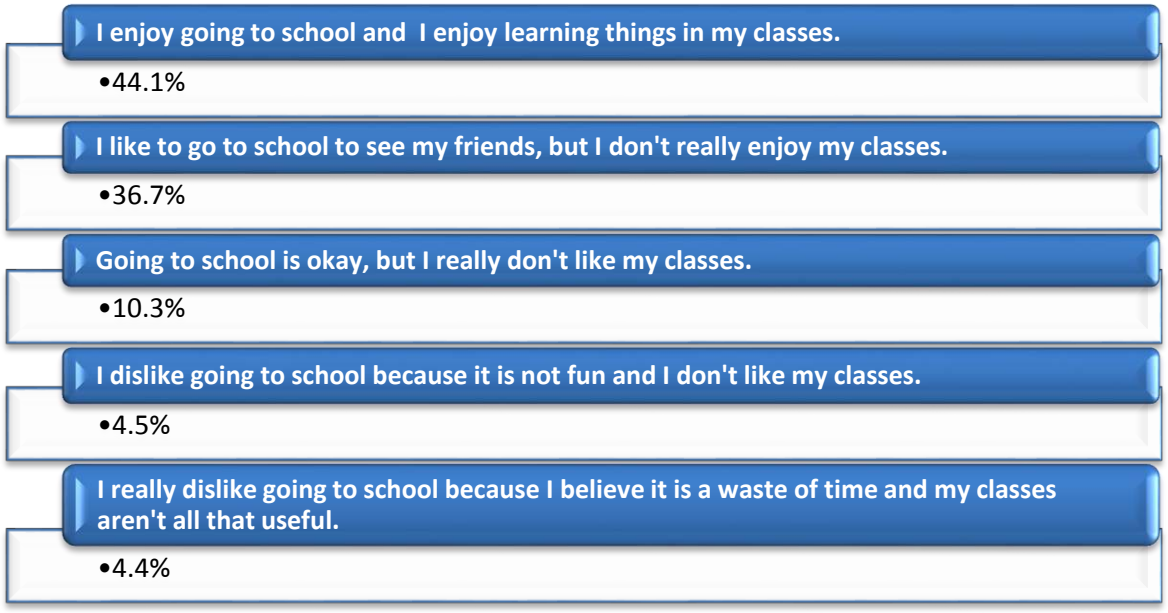

Figure 3: Feelings about School. Sample size: n = 1,421. The data for grade 7 and 9 are pooled.

STEM Engagement

What is STEM engagement?

Students can engage in a variety of STEM-related activities, both inside and outside of school. Some activities may require greater involvement, such as participation in math or science camps and competitions, or having special math/science programs in the school. Other STEM activities are more passive, involving visits to science centres, museums, and/or aquariums, and class visits for math or science groups. These different kinds of STEM engagement activities were studied by focusing on high and low engagement STEM activities. Students were asked to report their participation over the last 12 months.

Over 60% of students had participated in at least one highly engaging STEM activities over the past 12 months. These activities included participating in a science or math competition (47%), having a special science program[1] in school (31%), or attending a science camp (11%). In addition, most students had participated in low STEM engagement activities, included visiting a science centre or museum (60%), visiting an aquarium or marine life centre (44%), or having a math/science group visit their class (31%). Sixteen percent of students had participated only in low engagement STEM activities and 35% did not recall participating in any STEM-related activities. Forty-two percent of those without such experiences said they would participate in STEM-related activities if they were given the chance.

There were statistically significant differences based on gender and grade for having participated in high STEM engagement activities, as well as for having participated only in activities involving low levels of STEM engagement.

- **More grade 7 students participated only in low STEM activities (20%), while more grade 9 students had participated in high STEM activities (93%)**

Gender Differences in STEM Engagement

More girls (64%) vs boys (56%) reported having participated in high STEM engagement activities

The participation in various STEM engagement activities is summarized in **Figure 4.**

[1] Special science programs include activities that are designed to fully engage students in STEM activities, provide mentors, and/or other specialized experiences (eg: Techsploration, WISEatlantic, WISE-NFL, First Lego League Robotics, Let's Talk Science Challenge, etc)

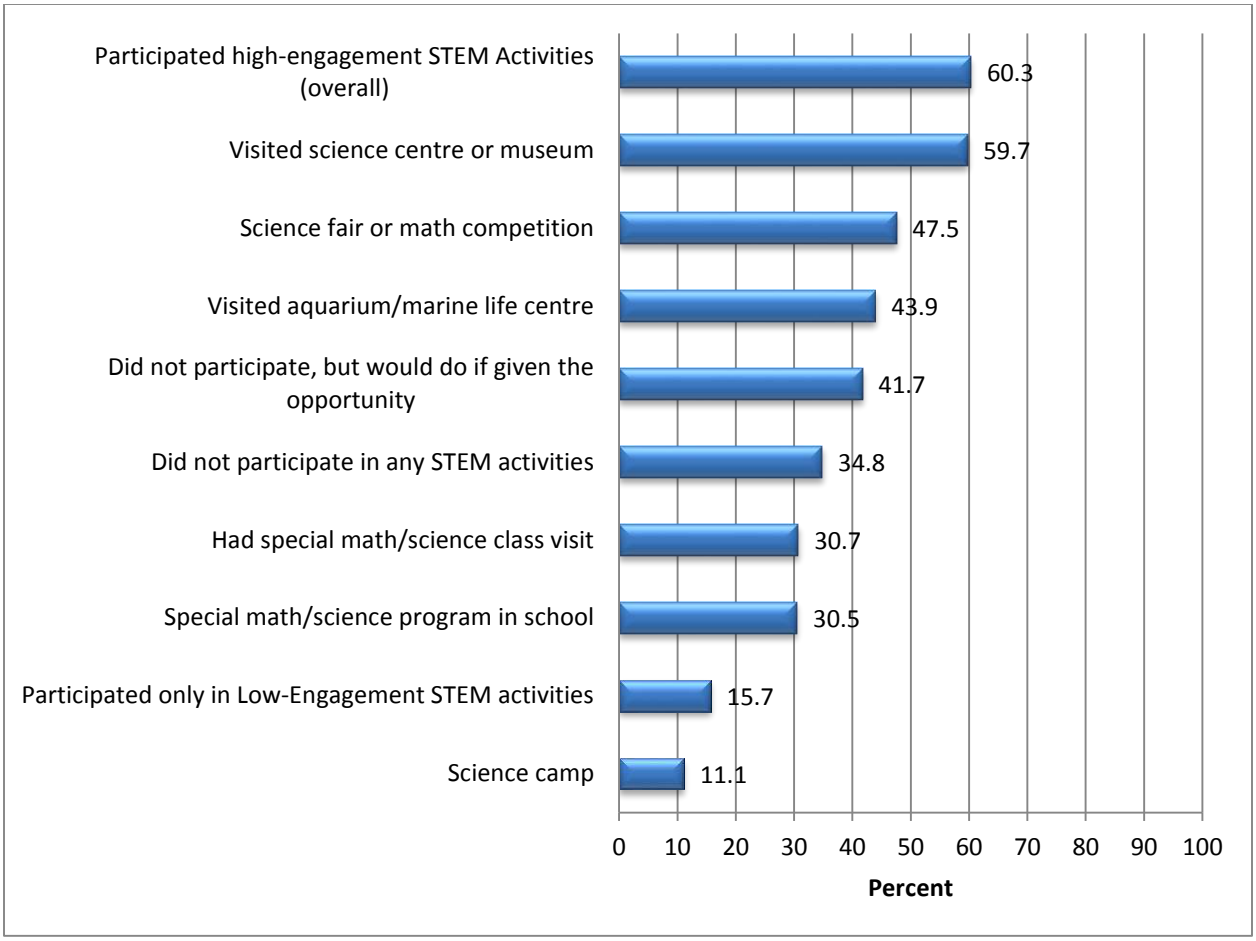

Figure 4: Engagement in STEM-related Activities

Sample sizes vary by breakout group: 1)n=684, 2)n=707, 3)n=575, 4)n=615, 5)n=132, 6)n=421, 7)n=526, 8)n=547, 9)n=602, 10)n=451. The data for grade 7 and 9 are pooled.

STEM Careers: Influencers

Influencers of STEM career choices?

Research focused on what, who, and how/why students' career interests were influenced. While the emphasis was on STEM careers, overall career influencers were gathered by asking students open ended questions.

What Influences Students?

When asked what influenced them the most when thinking about their future, several themes emerged. The most often stated influencers (5% or more) included STEM careers, STEM role models, other role models (eg: sports), non-STEM careers, media/art, money, family/friends, school/teachers, future interests/passions. About 4% of respondents did not know and 2% felt that nothing influenced them. One percent felt negative pressures related to what influenced them, such as depression, low self-esteem, and a fear of not being successful. The results are summarized in **Figure 5**.

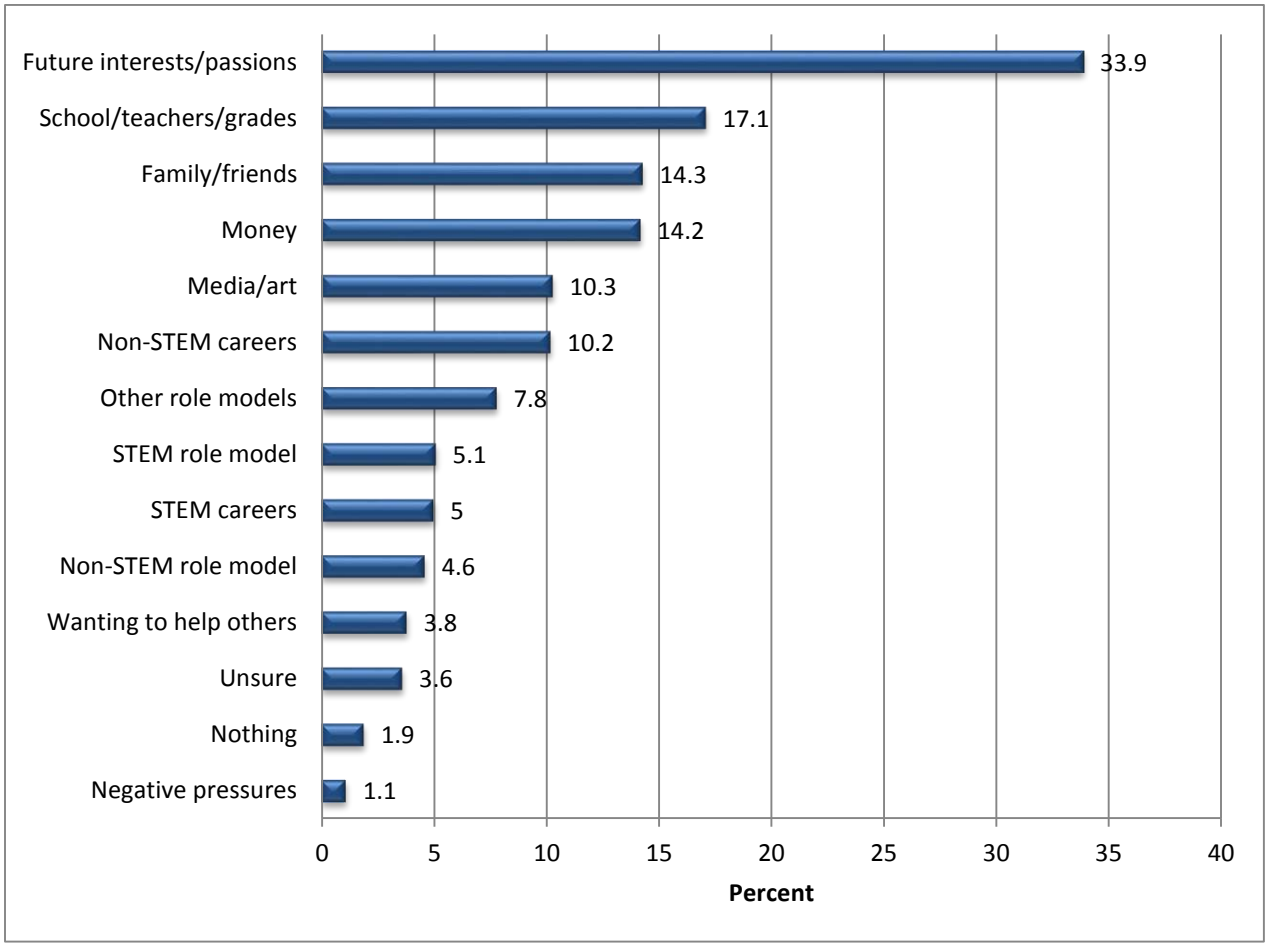

Figure 5: What Influenced Students When They Think About the Future?
Sample = 1,449 (14% did not respond). The data for grade 7 and 9 are pooled.

There were statistically **significant differences between students based on grade and gender** for some of these influencers:

- **More grade 9** than grade 7 students reported being influenced by future interests (37% vs 31%), money (17% vs 11%), STEM role models (7% vs 4%), school/teachers (21% vs 13%), and negative pressures (2% vs <1%).
- **More grade 7** than grade 9 students reported being influenced by helping others (5% vs 3%), media/art (13% vs 7%), other role models (11% vs 5%), non-STEM careers (13% vs 7%), and STEM careers (9% vs 3%). Also, more grade 7 than grade 9 students either did not know, or said they were not influenced by anything at all (3% vs <1%).

Gender Differences in STEM Career Influencers

More girls vs boys reported being influenced by:

- future interests (38% vs 28%)
- helping others (5% vs 2%)
- non-STEM role models (6% vs 3%)
- school/teachers (20% vs 14%)
- negative pressures (2% vs <1%).

More boys vs girls reported being influenced by non-STEM careers (13% vs 8%).

Who Influences Students?

Students were asked who influenced them the most when thinking about their future. From their responses, six key themes emerged with at least five percent of students reporting a particular theme. These themes included family, teachers, Non-STEM role models, friends, students themselves, and STEM role models. About 4% of students responded that no one influenced them. The results are summarized in **Figure 6.**

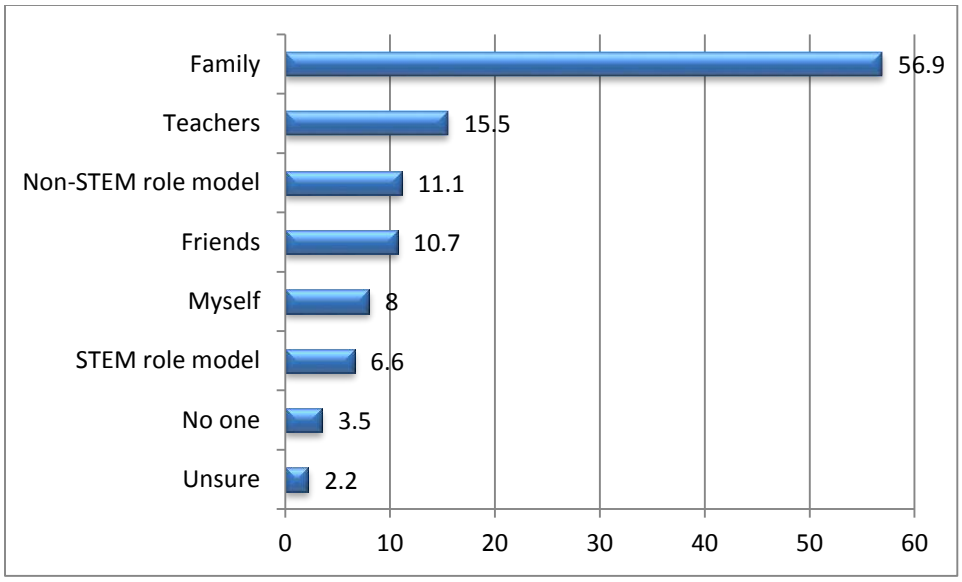

Figure 6: Who Influences Students When They Think About the Future?
Sample size = 1,449 (15% did not respond). The data for grade 7 and 9 are pooled.

There were statistically significant differences between students based on grade and gender for some of these influencers:

- **More grade 9** than grade 7 students reported being influenced by their friends (12% vs 9%) and themselves (10% vs 5%).
- **More grade 7** than grade 9 students reported being influenced by non-STEM role models (13% vs 9%, or were unsure (3% vs 1%).

Gender Differences in STEM Career Influencers

More girls vs boys reported being influenced by:

- family (61% vs 52%)
- friends (14% vs 7%)
- teachers (18% vs 12%).

The How/Why of Influence?

Respondents were asked to elaborate as to how or why these factors influenced their thinking about the future. The key influencers related to help and encouragement, exposure/experience, and enjoyment. The results are shown in **Figure 7.**

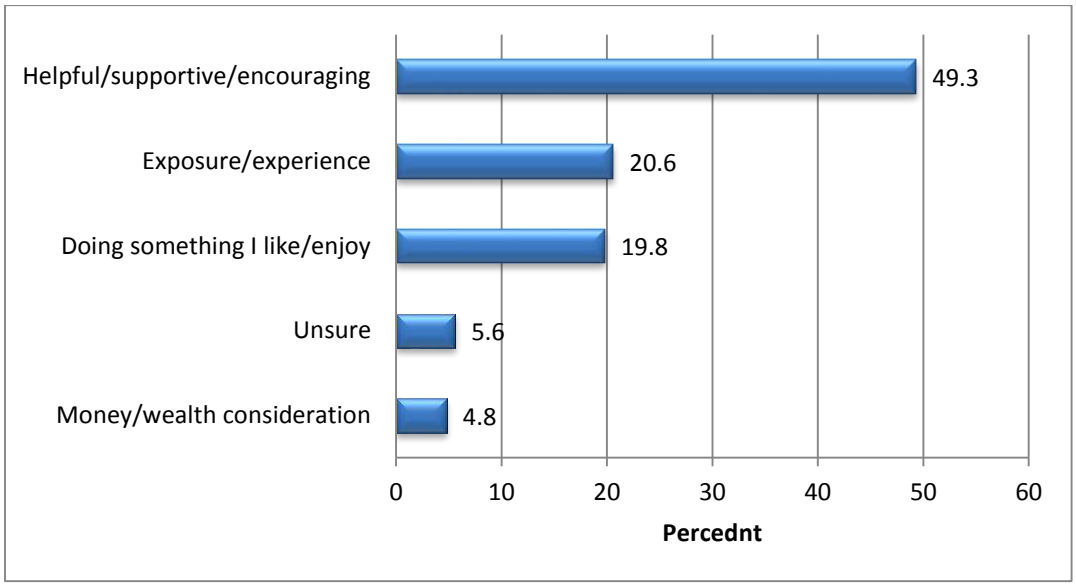

Figure 7: How/Why Students are Influenced When Thinking About the Future
Sample size = 1,449 (21% did not respond). The data for grade 7 and 9 are pooled.

There were statistically significant differences in how students were influenced based on gender and grade.

- **More grade 7** than grade 9 students reported being influenced by experience/exposure (23% vs 18%) or unsure (8% vs 4%)

Gender Differences in STEM Career Influencers

More girls vs boys reported being influenced by:

- doing something that they like/enjoy (22% vs 17%)
- being in a supportive/ helpful/ encouraging environment (55% vs 42%).

STEM Career Knowledge

What do students know about STEM careers?

Students were presented with 12 STEM-based careers. They were asked to indicate if each required high school math and/or science. Students could indicate yes, no, or that they were uncertain about the requirement.

A list of 12 STEM-related careers was presented to the students who were then asked to indicate if they believed that the careers required knowledge of math or science. **Mechanical engineer was the most accurately noted by students with 71% stating that it did require math/science knowledge**. Between 66% and 68% of students correctly classified the following careers as requiring math/science knowledge: computer hardware engineer (68%), pharmacist (68%), medical technician (67%), geologist (67%), veterinarian (66%). The remaining careers were tougher for students to correctly classify. While more than half of the students rated the following careers correctly, a large percentage of students indicated that they were uncertain on the requirements, or rated these careers as not requiring math/science knowledge: oil industry engineer (59%), physiotherapist (55%), oral hygienist (53%), nutritionist (52%). The remaining two careers were correctly classified as requiring math/science by less than half of the students in the sample: land surveyor (48%) and ophthalmologist (46%). Twenty-seven percent of students said that the land surveyor occupation did not require math/science knowledge and 33% of students were uncertain whether or not such knowledge was required to be an ophthalmologist**. The results are shown in Figure 8.**

There were statistically significant differences in the correct classification of STEM careers based on grade and gender:

- **Grade 9 students** were always more successful in correctly classifying careers as requiring math/science than Grade 7 students were. There was no statistically significant difference in correct classification for the land surveyor career. However, all of the other career classifications differed significantly, favouring grade 9 over grade 7 students. These results are shown in **Figure 9.**

Gender Differences in STEM Career Knowledge

More girls vs boys correctly classified the following occupations as requiring math/ science:

- Geologist
- Pharmacist
- Oral hygienist
- Nutritionist
- Physiotherapist
- Medical technician
- Veterinarian
- Ophthalmologist.

There were no statistically significant differences with higher ratings for boys. These results are shown in **Figure 10.**

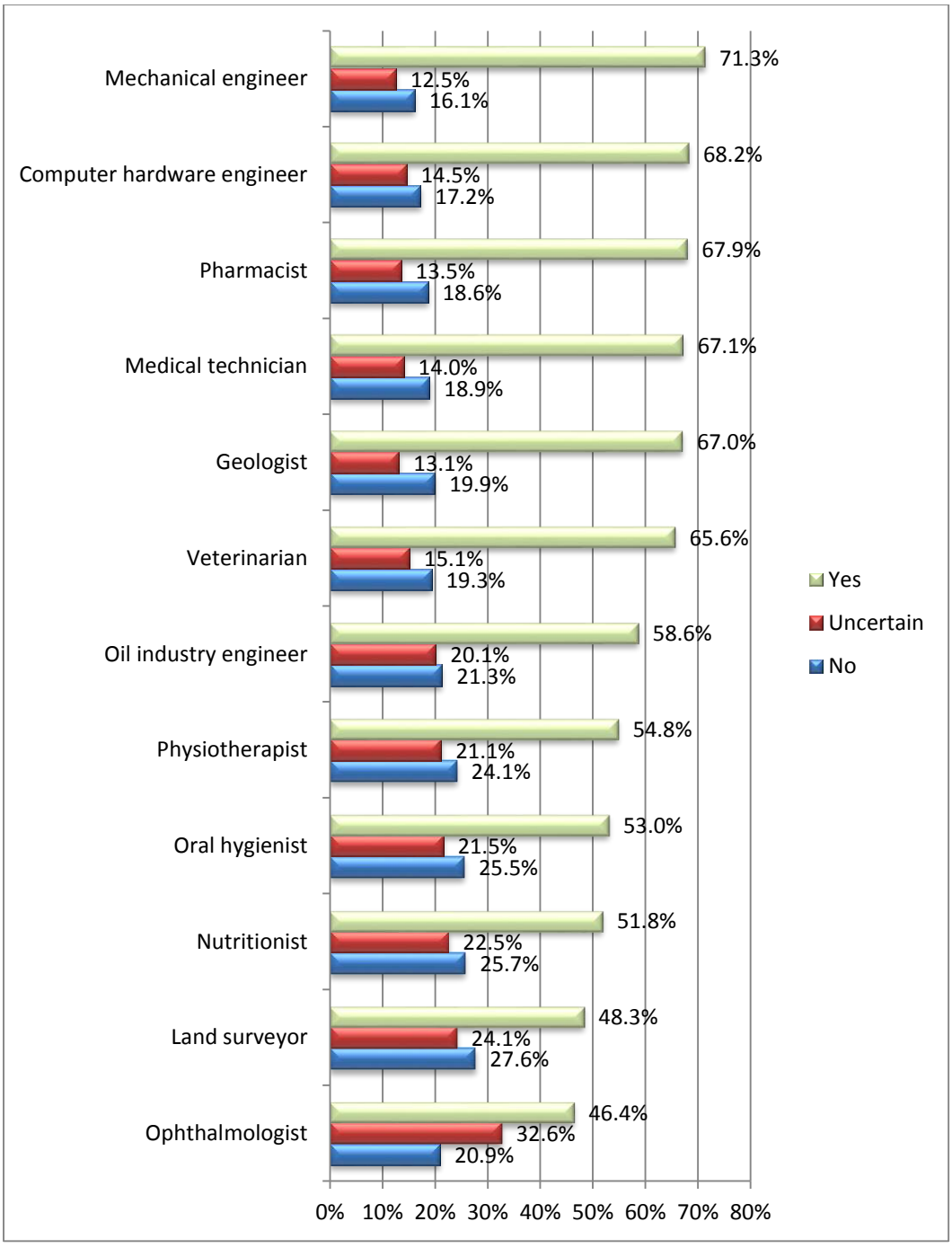

Figure 8: Classification of STEM-Related Careers as Requiring Knowledge of Math or Science

Sample sizes ranged from 1,223 to 1,252 across careers. The data for boys and girls, and grade 7 and 9, are pooled.

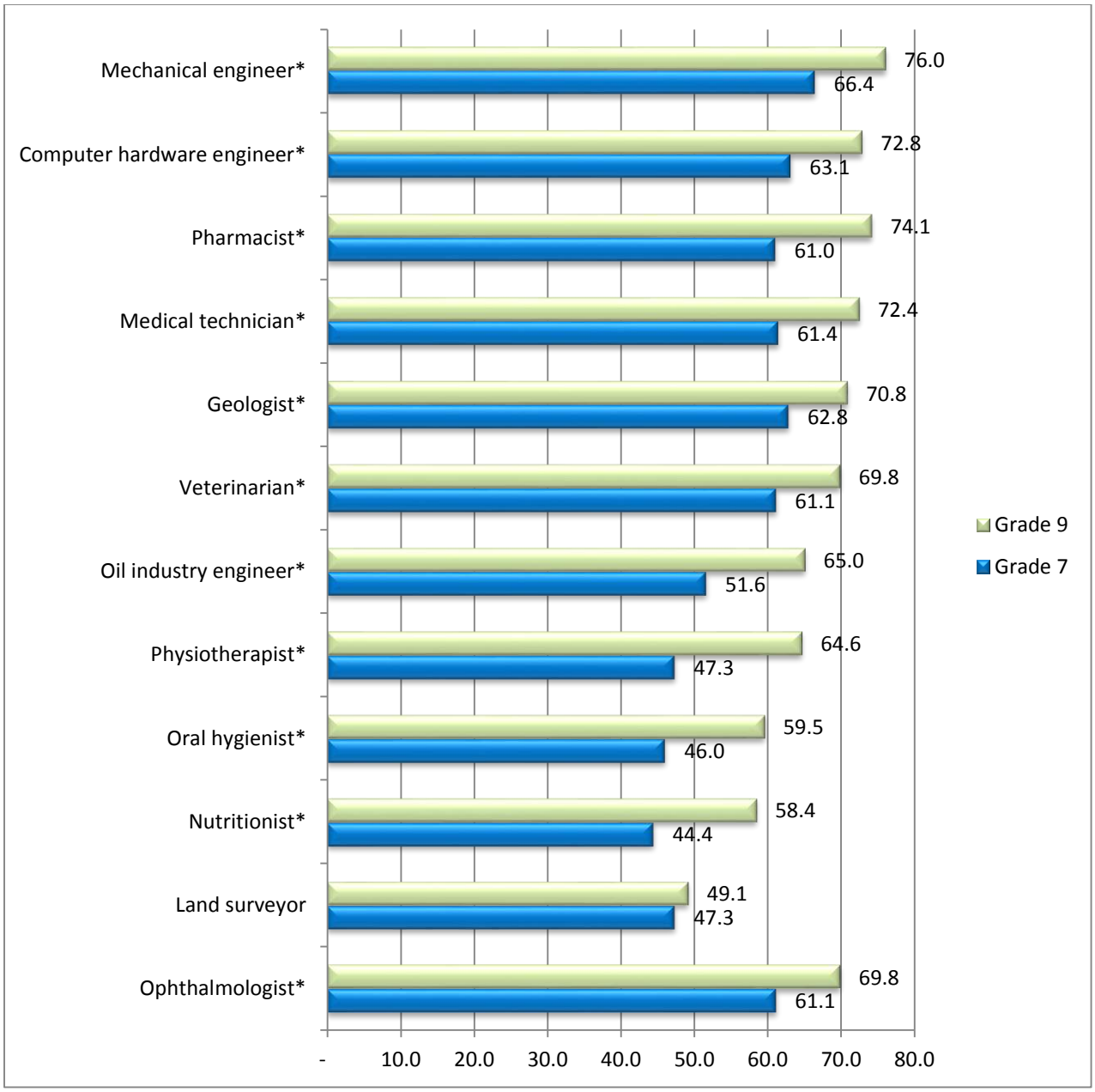

Figure 9: Correct Classification of STEM-Related Careers as Requiring Knowledge of Math or Science by Students in Grades 7 and 9

Sample sizes ranged from 1,223 to 1,259 per career. Graph shows the percent of students in grade 7 and grade 9 that correctly classified the career as requiring math/science. Responses do not include those who did not know (were uncertain) whether or not math/science were required. Asterisks show statistically significant differences between grade 7 and grade 9 percentages.

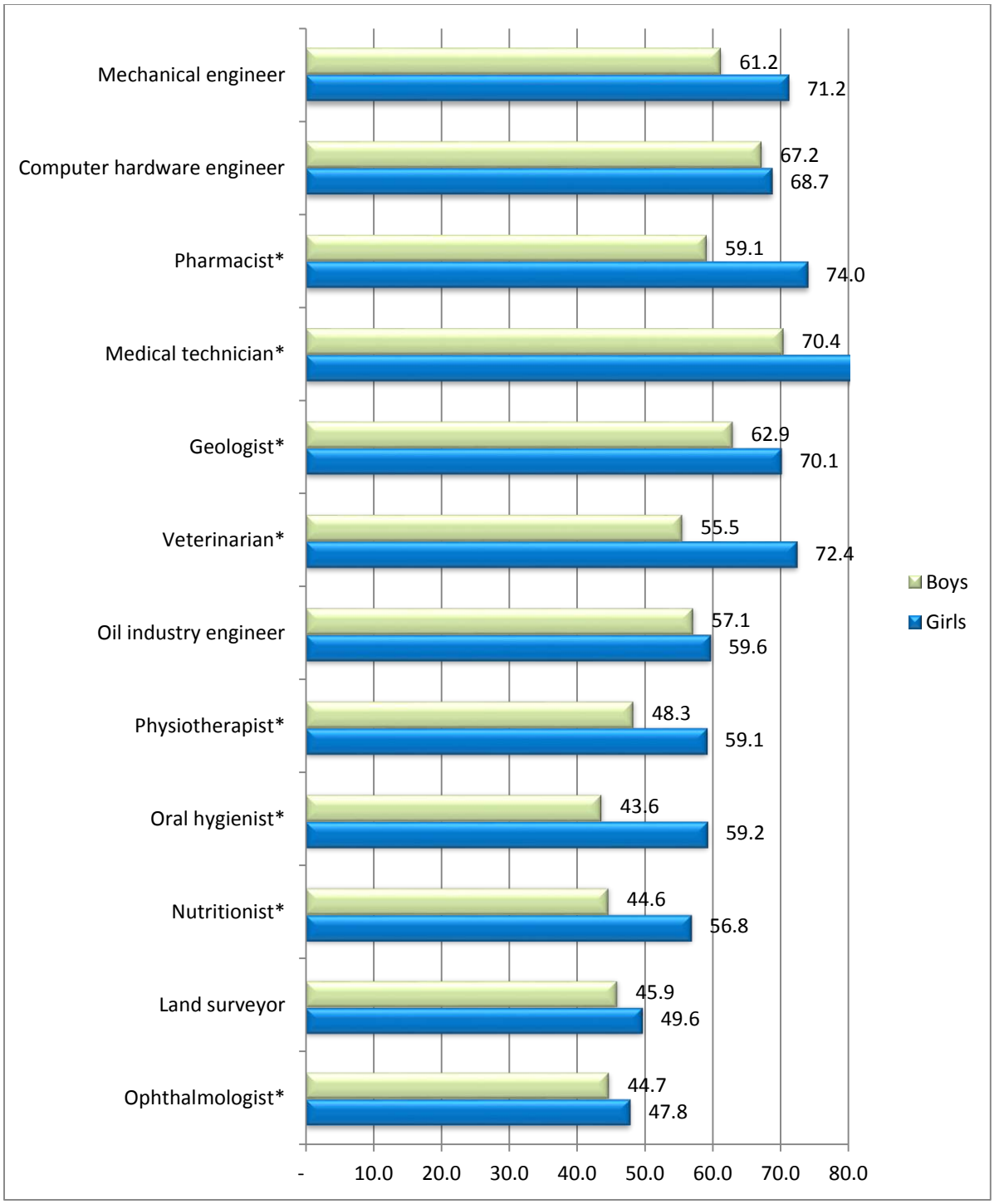

Figure 10: Correct Classification of STEM-Related Careers as Requiring Knowledge of Math or Science by Boys and Girls

Sample sizes ranged from 823 to 1,084 per career. Graph shows the percent of male and female students that correctly classified the career as requiring math/science. Responses do not include those who did not know (were uncertain) whether or not math/science were required. Asterisks show statistically significant differences between male and female percentages. Grade 7 and 9 data is pooled.

Future Plans

What were students planning to do after high school?

Students in grades 7 and 9 may be starting to think about what interests them and what they might do when they finish school. Researchers wanted to know about plans for post-secondary studies, workforce entry, and other activities following high school graduation.

Students were asked about their plans after finishing high school. **The results revealed that most students plan to pursue a post-secondary education and that most were planning to pursue a university degree (71%).** Only 9% planned to enter the workforce without pursuing further education and 10% planned to take a year off between graduating from high school and entering post-secondary study. The results are summarized in **Figure 11.**

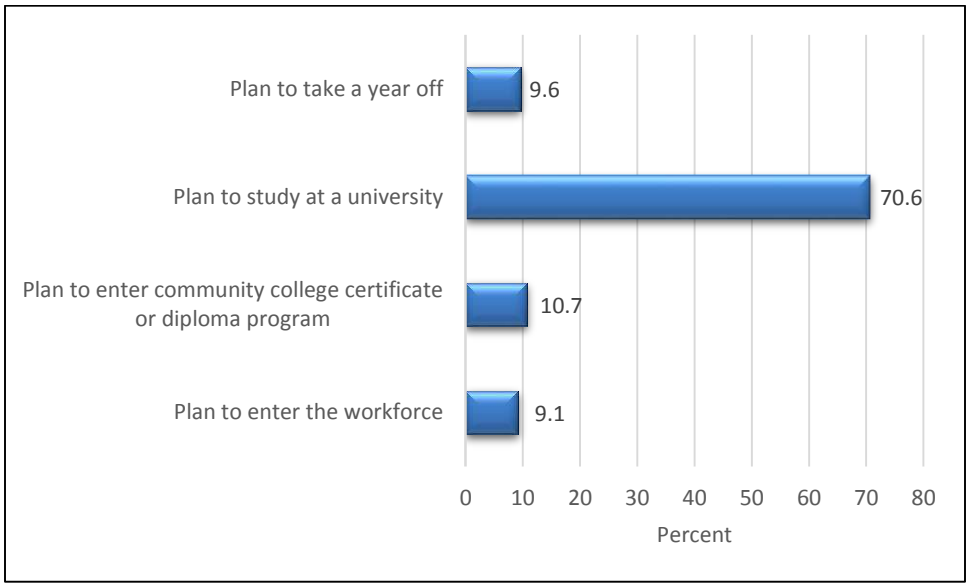

Figure 11: Future Plans Following High School Completion.
Sample size = 1,037. The data for grade 7 and 9 are pooled.

There were **statistically significant differences by gender.**

Gender Differences in Future Plans

More students planned to pursue post-secondary studies following high school, but there were statistically significant differences in the kind of study they planned to pursue.

- More girls vs boys planned to attend university (61% vs 41%) and
- More boys vs girls planned to attend community college (12% vs 5%).

There were **statistically significant differences** based on whether or not students had participated in highly engaging STEM activities. Specifically, **having participated in highly engaging STEM activities appeared to influence more students to pursue post-secondary studies.** More students who did not participate in highly engaging STEM activities planned to enter the workforce after graduating from high school (10% vs 4%).

Career Interests and Activities

What kind of careers are students interested in?

Researchers used two different career interest tools to understand what students enjoyed and how it may lead to future career decisions. One tool focused on activities that students enjoyed doing and the other focused on specific career interests.

Students were asked to rank a list of six unique kinds of engaging activities in order of enjoyment and to rank a list of different career interests. The activities and interest statements were chosen from a variety of research tools used to examine career choices and interests. The analysis focused on the percent of students that ranked each career activity and interests in their top two favourites.

Career Interests

Students rated working with people, creative skills and expression, and technical and scientific skills as the three most favoured career interests. The percent of students that ranked each career activity in their top two favourites is shown in **Figure 12.**

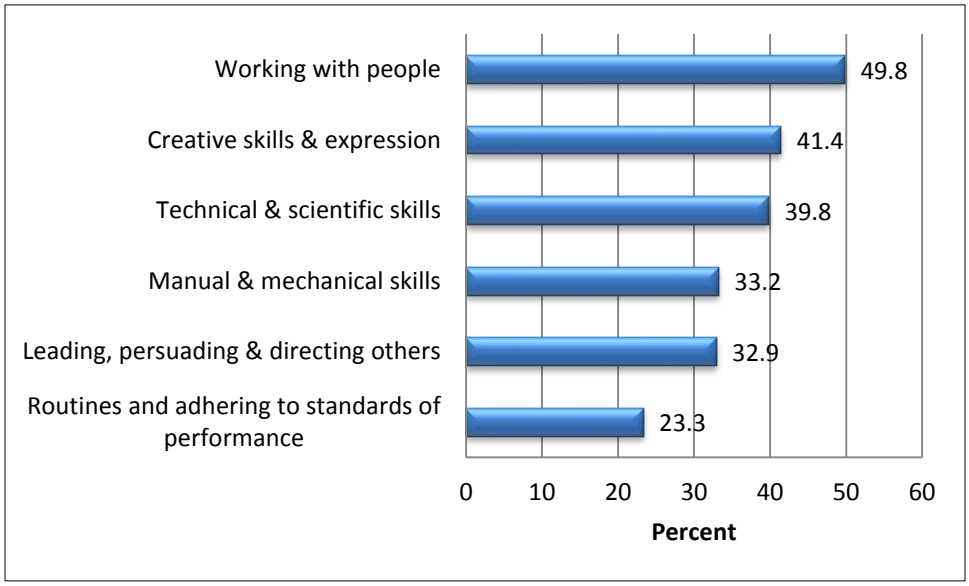

Figure 12: Percent of Students Ranking Each Career Interest in their Top Two Favourites (Favourite). Students ranked each activity from 1 (Most favourite) to 6 (Least favourite). Sample sizes ranged from 1,170 to 1,195 across the career interests rated. The data for grade 7 and 9 are pooled.

There were **statistically significant differences in the percentage of students ranking these career interests in their top two favourites by gender and grade.**

- **More grade 9** than grade 7 students rated working with people in their top two favourites (53% vs 47%). More grade 7 than grade 9 students rated manual and mechanical skills in their top two (37% vs 30%), as well as creative skills and expression (46% and 37%)

There were gender differences in the percentage of students ranking career interests in their top two favourites.

More girls vs boys rated the following career interests in their top two of the six career interests listed:

- Creative skills and expression (45% vs 36%)
- Working with people (59% vs 37%)
- Leading, persuading and directing others (37% vs 27%)
- Routines and adhering to standards of performance (24% vs 19%)

More boys vs girls rated the following career interests in their top two:

- Manual and mechanical skills (54% vs 19%)
- Technical and scientific skills (52% vs 31%).

Career Activities

Students were also asked to rank a list of six different career activities. The most highly rated career activity was artistic, unusual and creative activities (46%). The other activities were rated in the top two favourites by less than 40% of students. The six career activities and the percent of students who rated each their top two favourites is shown in **Figure 13.**

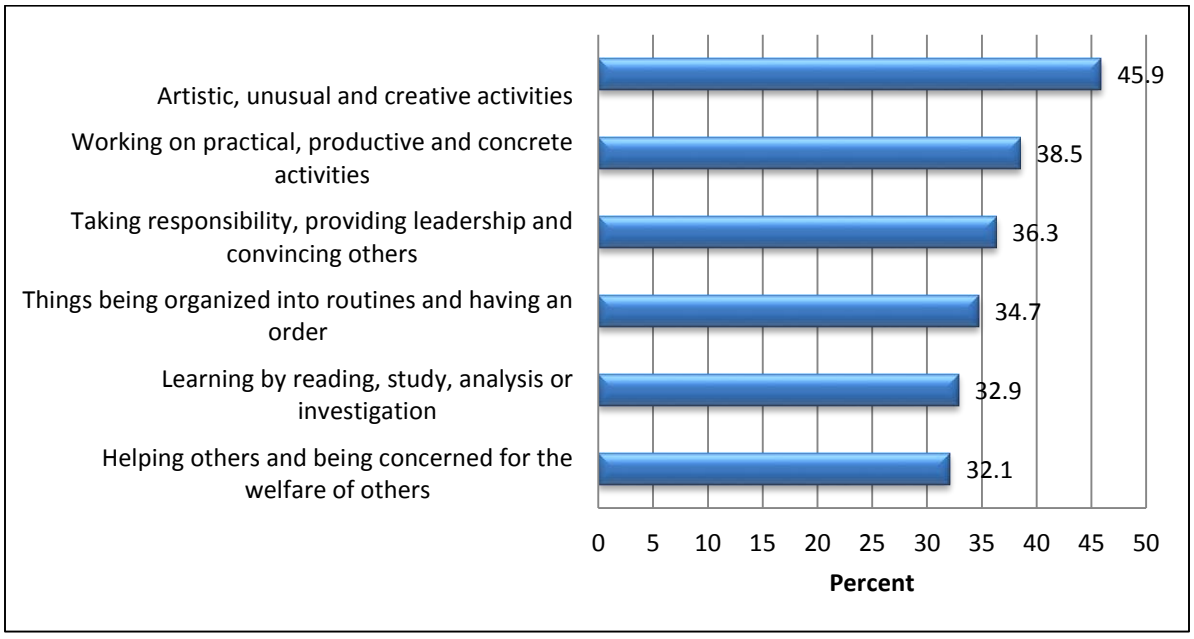

Figure 13: Percent of Students Ranking Career Activities in their Top Two Favourites
Students ranked each career interest from 1 (First choice) to 6 (Last choice
Sample sizes ranged from 1,182 to 1,199 across career activities. The data for grade 7 and 9 are pooled.

There were **statistically significant differences across the career activity rankings by gender and grade.**

- **More grade 9** than grade 7 students rated the following career activities in their top two favourites:
    - Helping others and being concerned for the welfare of others (35% vs 29%)
    - Things being organized into routines and having an order (40% vs 30%)
- **More grade 7** than grade 9 students rated working on practical, productive and concrete activities in their top two favourites (42% vs 35%)

There were gender differences in career activity rankings.

More girls vs boys rated the following career activities in their top two favourites among the six listed:

- Artistic, unusual and creative activities (49% vs 41%)
- Helping others and being concerned for the welfare of others (36% vs 26%)
- Things being organized into routines and having an order (38% vs 30%)

More boys vs girls rated working on practical, productive and concrete activities in their top two favourites (52% vs 30%)

Likelihood of Choosing a STEM Career

How likely are students to consider choosing a STEM career?

The ultimate goal of STEM educators, and those who are interested in encouraging more women to enter STEM fields, is to get students to consider a STEM career as early as possible. Students were asked **what** influenced them, **who** influenced them, and **how/why** it did so. Then researchers investigated **the impact of various influencers on the likelihood measure.**

Overall, about 70% of students indicated that they were somewhat or very likely to consider pursuing a career based on math or science. The average likelihood rating was 2.12 (Std Dev=1.03) on a 4-point scale: 1) Very likely, 2) Somewhat likely, 3) Somewhat unlikely, 4) Very unlikely. These statistics are shown in **Figure 14.** There were statistically significant differences in the likelihood of pursuing STEM based on grade level. Those in Grade 9 had a higher average scale rating than those in Grade 7 (2.03 (SD=0.99) vs 2.22 (SD=1.05)).

Scale Rating	Overall Sample (%)
1) Very likely	32.7
2) Somewhat likely	36.8
3) Somewhat unlikely	15.9
4) Very unlikely	14.6
*Total***	*100*
Average rating	2.12*
Standard deviation	1.03
Sample size	1,356

Figure 14. Likelihood of Pursuing a STEM Career.
**Percentages may not add to 100% due to rounding. * Differences are statistically significant on 4-point scale rating: 1) Very likely, 2) Somewhat likely, 3) Somewhat unlikely, 4) Very unlikely.

To better understand those most likely to consider choosing a STEM career, breakouts were analyzed focusing only on those who said they were very likely to choose a career in STEM (scale rating = 1). Approximately 33% of students indicated that they were very likely to consider a STEM career.

There were statistically significant differences by grade. More students who were very likely to choose a STEM career were in grade 9 than in grade 7 (36% vs 30%).

There were statistically significant differences based on whether or not students had participated in highly engaging STEM activities. **Students who had participated in highly engaging STEM activities were more likely to consider pursuing a STEM career than those who did not participate in such activities** (42% vs 22%).

There were statistically significant differences for influencers for students who were very likely to consider a STEM career. When asked **what** influenced their career decisions the following had significant impacts on this particular student group:

- Students who were **very likely to consider a STEM career were less influenced by**:
    - Other role models (eg: sports) (21% vs 34%)
    - STEM careers (17% vs 34%)
- Students who were **very likely to consider a STEM career were more influenced by**:
    - STEM role models (47% vs 32%)
    - School (teachers, grades) (40% vs 31%)
    - Non-STEM careers (56% vs 30%)
    - Negative pressures (56% vs 33%)

There appears to be some contradictory feedback on STEM-related influencers. **Students were more influenced by role models rather than careers in STEM.** Also, non-STEM career influences were noted more by students who were very likely to choose STEM than those who were not.

When asked **who** influenced their career decisions **the only statistically significant influences were STEM-related role models** such as doctors, scientists, veterinarians, engineers, and others. Of those who were very likely to consider STEM careers, 55% had been influenced by such people, compared to 31% of those who were not very likely to consider a STEM career. There were no statistically significant differences for those very likely to consider STEM based on **how** they felt thinking about their careers or futures, or **why** they felt that way. **Based on these results, role models in STEM are significant influencers on the likelihood to choose a STEM career.**

Critical Influencers for STEM Career Choice

What are the most salient influencers of STEM career choice?

Regression analysis showed that the greatest positive influencers on STEM career choice was involving students in highly interactive STEM activities, such as science camps, science fairs, and special programs, and exposing them to STEM role models.

A deeper analysis was conducted to determine what factor(s) had the greatest influence on a student's likelihood to choose a STEM-related career. By focusing only on those students very likely to consider a STEM career, a logistic regression analysis was conducted to determine which of the following influencers had a statistically significant impact on whether or not a student would be very likely to consider a STEM career:

- Who influences students:
  - Family
  - Friends
  - Students themselves (me)
  - No one
  - Non-STEM role model
  - STEM role model
  - Teachers/school
  - Student's uncertainty (unsure)
- Demographic characteristics
  - Grade
  - Gender
- Having engaged in highly interactive STEM activities such as participating in science camps and/or math/science competitions, and having a special math/science program in the school

The resulting analysis yielded a statistically significant regression function that explained approximately 46% of the variance in whether or not a student would be very likely to consider a STEM career. Of the eleven variables considered in the analysis the following proved to be statistically significant predictors of whether or not a student would be very likely to consider a STEM career:

- Having engaged in highly interactive STEM activities
- Exposure to non-STEM role models
- Exposure to STEM role models
- Gender
- Grade

The regression provides detailed feedback on how each of the influencers impacts the likelihood that a student would be very likely to consider a STEM career. **The most influential single factor was being exposed to STEM role models which increased the likelihood of a student seriously considering a STEM career by 3.5 times. The second most influential factor was having participated in highly engaging STEM-related activities which increased the likelihood of a student being very likely to pursue a STEM career by 2.3 times. Other important influencers were gender and grade. Male students were 1.5 times more likely to seriously consider STEM careers than girls, as were those in Grade 9 who were also 1.5 times more likely to consider STEM careers than students in grade 7.**

Exposure to non-STEM role models had a negative impact on the likelihood to consider a STEM career. Students who were exposed to non-STEM role models were only half as likely to seriously consider a STEM career as those who were not exposed to such role models.

The probability of being very likely to pursue a STEM career based on these influencers ranges from .35 for those exposed to non-STEM role models to .77 for those exposed to STEM role models. **The results are summarized in Figure 15.**

Influencer	Likelihood of Being "Very Likely" to Pursue STEM Career (X=Times)	Probability of being Very Likely to Pursue a STEM Career
Participation in highly engaging STEM-related activities	2.3X	.69
Exposure to non-STEM role models	0.5X	.35
Exposure to STEM role models	3.4X	.77
Male gender	1.5X	.61
Grade 9 level	1.5X	.60

Figure 15. Likelihood of Pursuing a STEM Career.
Sample size = 731. Data are pooled for grade 7 and grade 9 and boys and girls. McFadden's R-Square = 0.46; Chi-Square = 51.932, df=11, p=.000.

Methodological Notes

Various measures and statistical tests were used in this study. This note provides an overview of the methods used for analysis.

Overall results were analyzed by using counts and percentages for all survey questions, as well as averages and standard deviations for items measured on a scale (eg: Strongly agree (1) to Strongly disagree (5)). The average was used as a measure of central tendency that described the most typical case for scaled items. The largest percent was used to show the most typical case for non-scaled data.

For questions that involved ranking courses, career interests, or career activities (eg: Most favourite (1) to Least favourite (7), First Choice (1) to Last Choice (6), counts and percentages were used to highlight the two top-ranked items. To determine statistically significant differences between measures t-tests, Chi-Square, Analysis of Variance, and Regression were used.

When interpreting the results of this study it is important to remember that the researchers used the survey method of data collection. As a result, **cause-effect relationships are outside the scope of this research.**

A direct entry bivariate logistic regression was used to determine if key influencers had statistically significant impacts on the likelihood for students to be very likely consider STEM careers. Logistic regression provides information on the increase in likelihood (i.e the odds) that a predictor will result in an outcome (such as being likely to consider a STEM career). The regression function was validated on two holdout samples as well as through a bootstrapping procedure. The results met the required standards for a valid logistic regression analysis. **The regression equation correctly classified 68% of the cases in the sample,** which was an increase of 23% over proportional chance and within the standards required for logistic regression. The regression equation appears below.

Regression equation:

Very Likely to Choose STEM Career = -1.599+.405(Grade 9 student) +.430 (Male gender) + 1.234 (STEM role model) -.634(Non-STEM role model) + .819(Participation in highly engaging STEM activities)

A summary of statistically significant influencers on being very likely to pursue a STEM career are appears in **Figure 16.**

Influencer	*Odds Ratio**
Participation in highly engaging STEM activities	2.3X
Exposure to non-STEM role model	0.5X
Exposure to STEM role model	3.4X
Male gender	1.5X
Female gender	0.7X
Grade 9 student	1.5X

Figure 16. Statistically Significant Odds for Influencers on Being Very Likely to Choose a STEM Career

Sample size= 731. All results statistically significant at the .05-level or better. Data was pooled for boys and girls and grades 7 and 9. Odds ratio shows the likelihood of being very likely to choose a STEM career for each influencer. For example, students exposed to STEM role models were 3.4 times more likely to seriously consider pursuing a STEM career than those who were not exposed to such role models.

Closing Comments

The research team would like to thank all the sponsors of the NSERC-Atlantic Chair for Women in Science and Engineering, specifically NSERC and MSVU. We are deeply grateful to the School Board superintendents who authorized this study and to the many principals and teachers who rolled out the survey in their school. **We would be pleased to present this data to your organization, should you be interested.**

Regarding STEM career choices, this study has detailed some significant differences between girls and boys in Atlantic Canada and has also highlighted how perceptions of STEM careers and the future, change from grade 7 to grade 9.

Our key findings are that:

- **Students who had participated in highly engaging STEM activities were 2.3 times more likely to seriously consider a STEM career than those who did not engage in such activities.**
- **Boys were 1.5 times more likely to seriously consider a STEM career than girls.**
- **Grade 9 students were 1.5 times more likely to seriously consider a STEM career than Grade 7 students.**
- **Students who reported being influenced by STEM role models were 3.4 times more likely to seriously consider a STEM career than those who were exposed to non-STEM role models.**
- **A large percentage (≈30-60%) of students indicated that they were uncertain or did not know whether math/science was required for many STEM-based careers.**
- **Having participated in highly engaging STEM activities appeared to influence more students to pursue post-secondary studies.**
- **More boys than girls are interested in careers with technical /scientific skills while more girls than boys were interested in careers that involved creativity and working with people and leadership.**

We hope that you have enjoyed reading this report and we welcome comments and questions.

Sincerely,
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Co-Investigators: Dr. Karen Blotnicky
Dr. Fred French
Mr. Phillip Joy, MSc