Supporting Girls in STEM
Amplifying the Voices of Girls and Women

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The Background

It has been well documented that there is a lack of representation of girls and women across STEM fields. Women are half of the US workforce but only 27% of STEM workers. Similarly, “while women have surpassed men in college attendance and completion rates, women received only 19 percent of bachelor’s degrees in engineering, 19 percent in computer science, and 21 percent in physics in 2007.”

When girls and women are not represented in STEM, not only does this lead to a lack of opportunities for women and girls, but also has an overall negative impact on our world as a whole. Women and girls bring an important perspective and contributions to the table; a lack of representation is a swath of untapped human potential that is being left on the table.

As a company dedicated to equity in STEM, as well as being female-owned and majority female led, this is an issue that is personal to us. As a result, we wanted to better understand the research behind what is driving this persistent inequality and to ensure our interventions are research-based.

What It Isn't

Before we begin, it is important to understand what is NOT causing this inequity to persist.

The first thing to note is that there is no one event that “pushes” girls out of STEM. Rather, it is the accumulation of many smaller events.

One common misconception is the idea that women/girls do not explore STEM as a career option because they are less skilled at it. It is simply not the case that girls are underperforming in STEM. As almost every study reviewed for this project stated, the gender gaps in science and mathematics performance (often measured through standardized tests) have been closing for decades and are currently at a point where they cannot possibly serve as any serious factor that is driving this continued inequity.

Similarly, it is important to note that it is not a true lack of interest in STEM that drives this continued inequity. While it is the case the women/girls’ interest in STEM wanes as they age, this has more to do with gendered socialization rather than supposed “biological” gender differences. The idea that gendered behaviour is based in biology is, to put it simply, untrue. However, as will be discussed in the “Key Findings” section in more depth, gendered socialization and stereotypes being perpetuated at all levels (by peers, teachers, parents, society at large, and even individuals themselves) play an enormous role in this lack of representation.

One thing to keep in mind throughout this research is that the lack of girls and women in STEM is an intersectional issue. The interplay of gender with race, (dis)ability, class, and more can have a large impact on youth’s interest in STEM in ways that can be difficult to research. While this project has primarily focused on the social identity of gender, it is key that we keep in mind that the experience of white women/girls vs. women/girls of colour have both similarities and differences that are difficult to capture in their entirety. It is critical that we at STEM Minds continue to research and explore the role that other social identities play in promoting or prohibiting access to the world of STEM.
Key Findings

SECTION 1: What Is The Pipeline and Where Is It Leaking?

It is common in research about girls/women in STEM to use the metaphor of a “leaky pipeline” to describe the problem at hand, as represented in the graphic below.

Typically, the first stage of the “pipeline” is conceived of as starting in high school, with students identifying whether they plan to pursue STEM at the post-secondary level. The second stage is students who declare STEM as a major in their post-secondary education and the third is students who actually graduate with a STEM degree and enter a STEM career. As visualized in the above graphic, women/girls “leak” out of the pipeline when they do not advance on to the next stage (e.g. from taking courses in high school to actually declaring a STEM major during post-secondary education).

However, much of the research demonstrated that it is very important to consider what is happening before high school (which can be conceived of as extending the pipeline back further).

As noted across much of the research, youth as young as 12 have already formed biases against STEM that make it significantly less likely that they will pursue STEM at the high school level beyond what is required to graduate.

It is also important to critically examine what the model of the leaky pipeline does and does not tell us. To better understand this, we need to first define the “complete persistence pathway”, which is when women/girls “enter” the pipeline in high school and exit out the “end” of the pipeline with a STEM degree and enter a STEM career without ever “leaking” out.
In this understanding, it is certainly the case that we have a “leaky pipeline”. However, this is not in fact the only pathway that women/girls take. Many women/girls end up switching their majors during the course of their post-secondary education. It has been noted that “most female STEM baccalaureates entered the STEM education during college, after indicating interest in non-STEM fields in high school, whereas most male STEM baccalaureates followed the early entry and [complete persistence] pathway.” This late entry pipeline is not always fully considered in all research and can therefore lead to an incomplete picture of the experience of women/girls.

It is also important to understand gender differences in terms of when, how, why, and how often girls/women “leak” from the pipeline in comparison to men/boys. It is actually the case that “women were as persistent as men in attaining a STEM degree once they expected to major in STEM fields while in high school, and even more persistent than men once they claimed their initial major in a STEM field” (emphasis my own).

To put it simply; percentagewise, when women/girls DO indicate plans to enter the STEM fields, they are actually MORE likely to follow through than men/boys who indicate the same plans.

“43 percent of women who initially claimed a major in STEM ultimately attained their degree, compared with 38 percent of men who did so.” Additionally, the way in which “leakage” occurs at the post-secondary level differs for these two genders; while women are likely to switch to a non-STEM major, men are likely to drop out of post-secondary education altogether.

The issue at hand is that significantly fewer women/girls are indicating an interest in STEM; almost 30 percent of male students intended to major in STEM fields during high school but only 10 percent of female students had similar plans.

This highlights the importance of understanding the role of identity and self-efficacy that will be discussed in Section 2 as critical to improving gender equity in STEM by encouraging more women/girls to declare an interest in STEM at the “beginning” of the pipeline.
Key Findings

SECTION 2: What Keeps Women/Girls From Entering the Pipeline?

Now that we have a better understanding of the “pipeline” model, we understand that a core issue is that many women/girls never truly enter the pipeline in the first place. So, what causes this?

As previously discussed, it is NOT performance-based differences nor is it supposedly “biological” differences that are leading to a lack of women/girls in STEM. Rather the issue is a complex web of gendered socialization, stereotypes, identities, and beliefs. To put it simply, it is not an achievement gap, but rather an identity gap.

Gender Socialization

To begin, let us proceed with the recognition that women/girls and men/boys are socialized differently across almost all aspects of their lives, identities, and experiences and that this influences interest and participation in STEM.

For example, “feminine gender role stereotypes orient girls to be communal (e.g., socially skilled and helpful), focus on children and family, and gravitate toward activities that emphasize interpersonal relationships. Masculine gender role stereotypes orient boys to be agentic (e.g., acquire mastery, skills, competence), explore the physical world, tinker, figure out how things work, and gravitate toward activities that emphasize problem solving, status, and financial gain”.

Similarly (or even as a result), when it comes to what occupations youth are interested in, “boys and men value money, power, achievement, challenge, and risk taking, [while] girls and women emphasize altruism, interpersonal orientation, family time, and knowledge development. STEM fields are (mis)perceived to impede communal goals whereas service professions (social work, nursing, teaching, human resources) are perceived to facilitate communal goals.”

It is also important to note that gender stereotypes are not created equal across other social identity constructs such as race. In fact, very severe gendered stereotypes are most prominent among White people.

SECTION 2: What Keeps Women/Girls From Entering the Pipeline?

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Self-to-Prototype Similarity

While there are stereotypes about gendered roles, there are also stereotypes about who does STEM/belongs in the world of STEM. For example, STEM careers are widely considered to be the domain of men (particularly White men, which speaks to the intersection of race and gender). In fact, “although young children do not have profound knowledge about science subjects, they attribute masculine traits to science at an early age...as early as second grade children perceive that math is a male domain”.[11]

This is where the concept of “role confidence” comes in to play. Role confidence can be thought of as an “individual’s confidence in their ability to fulfill the expected roles, competencies, and identity features of a successful member of their profession”. As a result, if “scientists” are stereotyped as White men who are “nerdy geniuses”, then if people (particularly women/girls) do not perceive themselves to align with what they consider to be “expected” of them, they are less likely to consider this pathway for themselves.

This has can be conceived of as “self-to-prototype similarity”, and it has enormous effects on the participation of women/girls in STEM. As stated by Gonzalez-Perez, et al:

“There is evidence that among STEM women, perceptions of incompatibility between their gender and STEM identities (i.e., the extent to which people perceive their identity as a woman or man to fit with their identity as a STEM member) are related to a lesser sense of belonging, greater insecurity, and less motivation in STEM, as well as greater expectations of dropping out of STEM.”[13]

Gender Discrimination is Real

While it is easy to brush off “self-to-protype similarity” as something that exists only in the minds of women/girls, this is not in fact the case. Gender discrimination in STEM is real and it is perpetuated at all ages and by all people. A key barrier to women/girls’ participation in STEM is that they perceive that they will experience discrimination in STEM, so they avoid it.

The worst part? They aren’t entirely wrong to expect this discrimination.

“The vast majority of the literature underlined how challenging it was for female students to identify with STEM because the social environment provided a variety of signals that women do not belong in STEM and do not embody STEM prototypes.”

This is perpetuated by their peers of all ages. “A study among primary school students illustrated that stereotypical beliefs that STEM school subjects are more suitable for boys than girls were more strongly endorsed by boys than girls.” Similarly, “a study among first-year university students indicated that negative stereotypes of women’s engineering and mathematical ability were more strongly endorsed among male students.”

Now, this is not to claim that all men/boys are actively and intentionally discriminating against their women/girl peers. But rather, it speaks to the pernicious nature of both implicit and explicit bias and the importance of directly tackling STEM environments that are unwelcoming to women/girls.

SECTION 2: What Keeps Women/Girls From Entering the Pipeline?

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Identity is Central

The role of identity is complex, but its importance in regard to its impact on the participation of women/girls cannot be overstated.

Whether or not a person sees themselves as someone for whom “STEM” is a part of their identity can be conceived of as a social identity, which is “the extent to which individuals see themselves in terms of their membership in a social group.” This is contrast to a personal identity, which are the categories used to define someone as a unique person.

There are two key aspects to social identity that are relevant here: belonging (seeing yourself as part of the community) and social acceptance (having the rest of the community recognize you as someone who fits in). This is an important connection back to Items 2 and 3; if women/girls EITHER do not perceive themselves to be a part of the community OR do not have other members of the community accept them, then they are unlikely to pursue that social identity.

To put it simply, when women/girls do not think they will fit in to the world of STEM, they will not pursue it. A focus on developing a “STEM identity” is extremely important and will be discussed in more detail in Section 3.

SECTION 2: What Keeps Women/Girls From Entering the Pipeline?

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5

It’s All About Perception

As previously stated, it is not the case that women/girls underperform in the STEM subjects. In fact, women/girls actually do just as well in science and math. The issue is that they PERCEIVE their abilities to be less.

As stated by Ma, “women at the same achievement level tend to give a lower self-assessment on their math ability than do men, and this negatively impacts women’s choice in math-intensive fields. Further, a positive self-assessment in math often bodes well for early interest in STEM. Studies have consistently shown that one of the key reasons for students to choose STEM is that they think they are good at math.” 19

This affects students at all levels of achievement. A high number of studies have shown that “academic self-concept and subject interests are among the most relevant determinants in students’ selection of [post-secondary] majors….gender stereotypes have a negative impact on students’ STEM-specific self-concept even among students with good grades in STEM.” (emphasis my own) 20

Compounding this issue is the fact that women/girls are more likely to attribute their success to luck and their failures to a lack of ability, while men/boys are more likely to attribute their success to ability and their failures to luck (or lack thereof). This is key because attributing your success to ability increases positive self-concept.

As a result, because women/girls do not perceive themselves to be effective in the fields of STEM (even though their performance would indicate otherwise), they are less likely to pursue them.

Summary

To summarize, there are a number of factors that contribute to a lack of women/girls in STEM, and include:

1. Gendered socialization
2. Stereotypes about STEM
3. Real and anticipated gender discrimination
4. Identity perceptions
5. Self-concept and efficacy

Now that we have an understanding of what barriers are preventing women/girls from being fully represented in the world of STEM, what exactly can be done about it?

Key Findings

SECTION 3: What Are Effective Interventions?

Based on the research, there are several effective interventions that can support increased equity in STEM for women/girls. As this is an issue with complex and multifaceted sources, it will also require a multifaceted response.

1

Be Specific About Areas of Underrepresentation & Support High School Course Taking

It is important to note that “women are not uniformly and universally underrepresented across STEM subfields. Women’s increasing representation in life science [compared to their] persisting token status in engineering and physical science have been well documented.”

To put it simply, how we define STEM is important. For example, while science is a foundational subject for nursing (a majority-female profession), these “life sciences” are often left out of the conversation about STEM. As a result, it is important that we be specific when we are talking about where interventions are needed to increase gender equity. Specifically, the key areas of interest include (but are not limited to) engineering, physics, and computer science.

When we recognize which areas are demonstrating the most persistent inequity, it becomes increasingly important to ensure that high school aged students at the beginning stages of the pipeline are enrolling in courses that will allow them to pursue those pathways. Studies demonstrate that “high school coursework matters more than high school test scores and GPA” and that there continues to be a gender gap in science course taking, with physics being the most stubborn. Because of “the importance of physics to college STEM degree attainment, [this is] one of the key factors of women’s underrepresentation in STEM fields.” As result, it is important to take a very active stance in advocating for increased participation of young women/girls in high school science courses.

Start Young

As previously discussed, the “pipeline” model typically starts at the high school level. However, it is actually middle school and younger that is the key time for intervention as it is typically around age 12 when interest in STEM significantly drops. Even further back, “children as young as 6 to 7 absorb stereotypes [about STEM], and by age 10, girls like math less than reading.”

This also connects back to the key idea that we need to increase the number of women/girls who are interested in pursuing STEM in high school, as this is a foundational cause of the lack of representation at the post-secondary and career level (as women/girls who indicate an interest are more likely to persist throughout the entire pipeline). As a result, in order to address the lack of female representation, we must ensure that more women/girls enter high school and continue throughout high school with both an interest in STEM and a strong belief in their own capabilities and self-efficacy.

Role Models and Representation at the Instructor Level Matters

Several studies noted that having representation at the instructor level helps women/girls (mostly for white women; the data was more inconclusive with women/girls of other races due to a smaller sample size) feel more included and interested in pursuing STEM, while having no impact (either positive or negative) on men/boys. As a result, an increase in female STEM teachers and instructors is critical.

Similarly, the use of role models and “guests” can also have a particularly positive effect. As noted in one study, “consistent exposure of young women to [female role models] can foster perceptions that female interest and success in STEM are not rare and atypical but normative and prototypical.”


Because of a lack of representation in the STEM labour market, many women/girls do not perceive STEM professions to be within the range of possibility for them. Having encounters with female role models who are currently being successful “has a positive and significant effect on [STEM] enjoyment, importance attached to [STEM], expectations of success in [STEM], and girls’ aspirations in STEM, and a negative effect on gender stereotypes. Additionally, the female role-model sessions significantly increase the positive impact of expectations of success on STEM choices.” ²⁸

Importantly, “the higher the counter stereotypical character of the sessions [with guests], the higher the relationship between expectations of success in math and the choice of STEM”.²⁹ In other words, the more those female role models counter perceived stereotypes about STEM (e.g. that STEM is for socially inept, “nerdy”, super geniuses), the more successful they are in positively influencing young women/girls.

Girls Need a Safe and Welcoming Environment, So Girls Only Programs Can Be Effective

While the evidence on the effectiveness of girls only programs was somewhat limited, there was clear indication that they can be effective. It was noted that programs that are explicitly intended to increase interest among female students are usually successful.\textsuperscript{20}

Additionally, when extracurricular projects in STEM involve teamwork (more on this in item 5), girls are most eager and participatory in teams that have gender parity or a female majority and far less engaged in teams with female minorities.\textsuperscript{31} Girls-only programs appear to be most effective in areas like engineering where boys tend to have more prior experience and can sometimes dominate the learning environment.\textsuperscript{32}

Similarly, there is “strong evidence that students adjust their preferences to those of their friends (friend influence). Moreover, girls tend to retain their STEM preferences when other girls in their classroom also like STEM (peer exposure).”\textsuperscript{33} As a result, programs where girls are able to participate with their female friends and peers can have a positive influence on their own perspective on STEM.

While we are by no means claiming that girls should only participate in gender-specific programs (and there is lots of value in programs that have a mix of genders and other identities), girls-only programs can be a helpful tool in supporting girls/women, especially when they are unsure about or less experienced with STEM.


The Way We Teach and Promote STEM Matters

Speaking to the fact that women/girls and men/boys are socialized differently based on their gender, the way in which we teach STEM matters a great deal.

It was noted in multiple studies that women/girls are less likely to be interested in the technical/mechanical aspects of STEM. They are instead highly motivated by being able to help others (communal interests).

Unfortunately, the way we typically speak about STEM in our society tends to focus more on those technical/mechanical aspects rather than on how important STEM is to make our world a better place (more on this in the “Recommendations” section of this paper).

It was explicitly noted that “STEM activities attract girls when the activities are communally oriented – that is, organized around real-world problems and helping people.” As a result, it is key that we focus on promoting STEM in a way that centers the real-world impact.

Additionally, the way we actually teach STEM matters. Traditionally, STEM topics tend to involve a lot of focus on technical/mechanical aspects as well as independent work. It was noted in several papers that the transition to environments that promote collaborative learning, hands-on experiences, creativity, and problem solving is crucial to engaging women/girls (more on this in the “Recommendations” section of this paper).

This is a critical component for ensuring that STEM environments are more welcoming to women/girls and also create opportunities to share new perspectives and ways of knowing. Focusing on the way in which STEM is taught (both in traditional school settings as well as extracurricular programs like the ones offered at STEM Minds) is therefore of the utmost importance to improving gender equity in STEM.

SECTION 3: What Are Effective Interventions?
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Summary

To summarize, there are a number of interventions noted as being highly successful in increasing gender equity in STEM, including:

1. Being **specific about which areas in STEM women/girls are underrepresented** and encouraging high school course taking in that area.

2. “Pushing the pipeline back” and encouraging girls/women to **develop a STEM identity at younger ages**, with a particular focus on the middle school years.

3. Focus on **positive female role models** and female representation among instructors.

4. Offering **girls-specific programs**.

5. Approach STEM with a **focus on how it can be used to help others** as well as use teaching strategies that are more focused on collaboration, creativity, and problem solving.

Now that we have an understanding of what interventions are most effective, we can discuss what STEM Minds is already doing well in addition to how we can continue to do better.
What STEM Minds Is Already Doing

As the representation of women/girls in STEM has long been a focus at STEM Minds, there are many things STEM Minds is already doing well based on the team’s prior knowledge of the issue as well as their general intuition about what would best serve their students.

1. Offering Programs for Youth

It sounds obvious, but just offering programs for the age group that STEM Minds targets (ages 4-14) is a step in the right direction. Past research “has found that females’ attitudes and interest in STEM-related fields can change as a result of their participation in afterschool activities” and that “participating in an outreach program with a STEM focus significantly increased girls’ interest in pursuing engineering as a career.”

Continuing to offer a broad range of STEM programs for this age group is critical to encouraging all youth, but especially women/girls, to consider STEM as an important part of their future.

2. Focus on STEM Identity

As previously noted, “adolescence is an important time to form STEM identities by aligning “who I am” and “who I want to be” with a STEM field. As such, a strong STEM identity can be an important factor that helps lead young women toward a STEM career in the future.”

Over the last several years, STEM Minds has been explicitly measuring elements of STEM identity in participant feedback surveys, which is an important metric to understanding impact. It will be important for STEM Minds to continue and deepen their commitment to understanding their performance in this area.

What STEM Minds Is Already Doing

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3

Female Representation & Role Models

As a woman-owned and majority women-led business, STEM Minds has long recognized the impact that positive female representation has on the youth they work with. Continuing to prioritize this diversity among the STEM Minds team will be key to the success of the business and their students.

4

Taking a Different Approach to STEM

With a focus on building 21st century learning skills and a holistic approach to STEM that focuses on the interconnections of all the tools and skills, STEM Minds long been on the right track regarding teaching STEM in a way that resonates with students, particularly female students.

Similarly, the focus over the last several years on integrating the United Nations Sustainable Development Goals (SDGs) as a key framework and problem-solving-based approach for the projects and activities include in STEM Minds programs is clearly a positive strategy that engages female students.

While there is much that STEM Minds is already doing well, there is always room for improvement. Let us end with a discussion of 10 recommendations for STEM Minds moving forward.
Pay Even Closer Attention to Our Youngest Learners

While the research discussed throughout this document has primarily focused on students ages 10 and up, it is important that we recognize that the gendered socialization that impacts both young boys and girls begins much earlier. It is key that we understand that these behaviours and beliefs can play a role in the experiences of students in programs for ages 4-7.

For example...

It has been consistently reported in the literature that girls do not have access to STEM resources in the same way as boys. During STEM activities, boys tend to rush and gather up the materials and equipment, whilst girls tend to wait and find themselves without enough resources to effectively engage in STEM. When girls do have access, boys have been shown to persuasively ask girls to give them up.

The second challenge is girls’ access to the spaces where STEM is undertaken. The research has shown that boys get in early into the construction spaces, and girls’ attempts to enter are blocked. Once near the STEM related spaces in preschool, such as the block area, girls try to navigate a way in...girls acted as helpers and passed blocks to the boys to support their building. Studies have also shown that when girls do build, boys push them out by building alongside of them and progressively taking over the available space. Girls respond by creating micro spaces to feel safe and play unencumbered.

Further, research has shown that when teachers design spaces for STEM, such as an engineering activity setting, girls appear to be as interested in being in the new space as boys. Unfortunately, this study also found that girls became progressively excluded from the space over time, due in part to the problems identified above.
Recommendations

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(...) It has been shown that boys tend to build with a view to knocking down their constructions, whilst girls build to support a social purpose in play. That is, boys build in relation to the process of constructing, whilst girls build to play with what they made...

Fourth, it has been shown in the preschool engineering literature that when the teacher sits with children within STEM related areas during free play time, that girls are more likely to gravitate to these areas.\textsuperscript{39}

While the above points are speaking to a traditional pre-school/kindergarten experience, these are behaviours and patterns that may be witnessed in extracurricular programs as well. Moving forward, it will be important to monitor how these possible behaviours impact the youngest learners in order to develop age-appropriate interventions.

Focus On Presenting STEM As Helping Others

At STEM Minds, everyone on the team is aware of the role that STEM plays in making our world a better place. However, students themselves, particularly women/girls, often "seem not to associate STEM fields as helpful for their community until college where they may become more familiar with STEM fields. They did not realize the utility and significance of STEM fields during high school, and this contributes to the lower likelihood of early entry and persistence in STEM fields."  

As outlined in one paper, “the message that STEM fields are of tremendous significance to our community and the world at large needs to be clearly conveyed to women during relatively early stages of their schooling.” While STEM Minds already takes a holistic and problem-based approach to teaching STEM, it is important to continue to deepen this approach as central to the success of our female students. This should be addressed not only in the actual teaching and learning experience, but also in STEM Minds’ marketing and course descriptions. For example, “under the condition that course descriptions were related to communal goals, girls showed greater interest in learning to code compared to the agentic-goal condition of the course description”, thus supporting the idea that the way courses are presented to the public through mediums such as the STEM Minds website, social media profiles, digital ads, etc. can be extremely important to increasing gender diversity in programs.

STEM Minds is therefore encouraged to continue to design programs and learning activities that focus on using STEM skills and technologies to help others/focus on real world problems, while also ensuring that all program descriptions and marketing highlight this focus as well.

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3

Actively Encourage STEM Courses At High School Level

“When a student successfully finishes a high school course in advanced science or mathematics, it increases the possibility that they will go on to pursue a degree in a post-secondary institution in a STEM-related profession...Just one remedial mathematics course in high school severely constrains a student’s opportunity to complete an advanced level mathematics course by the time they graduate”.  

While STEM Minds primarily targets youth ages 4-14 (i.e. at the elementary level rather than the high school level), there are many students that we work with over a period of many years, often seeing them into high school. As a result, there are many opportunities for our team to have informal discussions with students themselves and with their families to promote high school STEM course taking.

STEM Minds is encouraged to actively have these conversations, use this information in marketing efforts, and to even consider partnerships with schools and school boards to promote STEM course taking at the high school level.

4

Update Pre & Post Surveys

While STEM Minds already includes questions to measure student’s relationship to STEM as a part of their identity as well as their confidence and feelings of self-efficacy, they are encouraged to continue to review their survey questions in order to ensure that the data being collected is rigorous and useful in understanding their impact.

For example, some questions that might be considered (taken from Mosatche, et al) may include:

- I know what scientists and people who work in technology do
- I know what it means to be an [career]
- I do science related activities that are not for schoolwork
- Adults have told me I should think about a career in science, technology, or engineering
- I have talked to a scientist, engineer, or technology worker about their job

While there is no 1 question or survey that will give a full picture of how a student perceives their STEM identity, continued review in this area will ensure that this element is a focus for understanding STEM Minds’ success.

Continuing to Research Role of Race

While the research for this document primarily focused on the specific social identity of gender, the role of race as it intersects with gender is less well understood. However, as one paper noted, "black students’ probability of majoring in STEM increases if they have a black instructor for a STEM course," further promoting the idea that representation and positive role modeling matters when it comes to racial inequity in STEM.

STEM Minds is encouraged to continue to research the role of racial inequity in the world of STEM in order to better understand how to effectively support racialized students, especially female students.

Have Good Role Models

As noted in one paper, “the optimal way to encourage young girls to pursue emerging high-growth roles, particularly those requiring STEM math skills, is to expose them to the professional and personal experiences of actual female role models with a successful professional trajectory in STEM fields.”

To put it simply; the role of role models cannot be overstated.

While STEM Minds already does very well in terms of positive female role models on their team, it may be advisable to also bring in guest speakers to further support with this endeavour.

Continued emphasis on hiring a diverse team is similarly recommended to further support this item.

Recommendations CONTINUED

7

Change the Conversation About What STEM Is (And Isn’t)

There are “two stereotypes that affect the level of recruitment and retention of women in the STEM fields. On one hand, there is the idea that STEM studies are difficult, and a person should be a brilliant or gifted student to succeed in them. On the other hand, there are cultural and social stereotypes about the characteristics of scientists and scientific jobs (i.e. people lacking social abilities, with an unattractive physical appearance, or freaks) that undermine the interest that girls may have in STEM, as they do not match these stereotypes.”

While STEM Minds already takes a strong focus on moving away from stereotypes about STEM, they are encouraged to continue to deepen that focus and intentionally integrate items that combat these misconceptions across all programming.

This will also be especially relevant during work directly with teachers, as the vast majority of elementary teachers express discomfort or lack of confidence with teaching STEM. Ensuring that teachers (the majority of whom are themselves female) are not internalizing and therefore spreading these stereotypes themselves will be key to broadening our reach in this area.

Focus on 21st Century Learning Skills Like Problem-Solving

Given that women/girls learn best in STEM environments that promote collaboration, creativity, and problem solving, a continued emphasis on an approach to teaching and learning STEM that is grounded in 21st century learning skills is critical for STEM Minds.

According to the National Academy of Engineering, “the extent to which middle and high school girls’ age, and interest and confidence in a) problem solving and b) creativity and design predicted their interest in four STEM subject areas... results revealed that interest in problem solving was a positive predictor for interest in all four STEM subject areas... [and] interest in creativity and design was a positive predictor for interest in computers and engineering.”

To put it another way, “girls who are interested in STEM, 87% also indicated an interest in problem solving; compared with those girls not interested in STEM, only 70% indicated an interest in problem solving.”

Continued use of approaches like project-based and problem-based learning are effective for supporting the learning of women/girls. Similarly, the integration of the arts in STEM (STEAM) is further recognized as key to this approach.

As a result, STEM Minds is encouraged to continue to actively integrate 21st century learning skills (e.g. communication, collaboration, creativity, critical thinking, etc.) and a problem-solving focus into all programming.

Recommendations CONTINUED

9 Actively Encourage STEM Courses At High School Level

As discussed in the Key Findings section, **girls-only programs can be effective in areas where boys are likely to dominate the learning environment.** It may be advisable for STEM Minds to consider offering girls-only programs in key areas such as advanced coding, eSports, and other topics that tend to see a mostly male clientele.

10 Continue to Stay Abreast of Research to Further Inform Practice

As the wealth of research in the area of gender equity in STEM demonstrates, this is an area of interest for many researchers and there is much to still be accomplished. The STEM Minds team is encouraged to continue to stay abreast of new developments in the research to continue to better understand the causes and consequences of the issue as well as to identify effective interventions.

For more information on how we plan on implementing these recommendations in the coming years, visit our **2021 Impact Report**.

Conclusion

While there is still much work to do in regard to achieving gender equity in STEM, the good news is that the causes can be understood and that reasonable, common sense, and relatively low cost interventions can have a truly strong impact on young women/girls at moments in their lives where they most need them. With hard work, intentionality, positive partnerships, and an ethic of care, STEM Minds will continue to have a positive impact on all youth, female students in particular.