

The Role of High Schools in Preparing Young Women for a STEM Career

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Abstract

There is a vast amount of literature documenting the need for trained workers in the Science, Technology, Engineering and Math (STEM) fields. There is special attention being given to the high number of women who drop out of a STEM major or leave a STEM career despite being equally or often times even more prepared than their male colleagues. This phenomenon is commonly referred to as the “leaky pipeline”, and universities and industries alike are paying attention to and attempting to remedy this trend. This brief examines the factors that keep young women from pursuing a STEM major in college, why so many women leave the STEM field after graduation and what role should our high schools play in order to prepare these young women for the type of work in which they are sorely needed. The literature suggests that better preparation during high school in the areas of math and science, introducing successful female role models into the curriculum and forming mentoring relationships with college students and professors can result in levels of higher interest and resilience for these young women.

Research Topic

How can high schools prepare and encourage young women to pursue a degree in a science, technology, engineering, or mathematics (STEM) field?

Introduction

In today's competitive society children are asked to determine their future, be it sports, hobbies, or educational aspirations, at earlier ages. Want to play soccer in high school? You better be on a select team by second grade. Want to play a musical instrument? Lessons begin before your hands can fully grasp the bow. The decisions are much more difficult in the educational spectrum. Many of the jobs of tomorrow (e.g., bioinformatics, cloud computing developer, and cryptographer) are often completely beyond the comprehension of teachers and parents. These careers fall under the umbrella of STEM.

STEM education creates critical thinkers, increases science literacy, and enables the next generation of innovators which leads to new products and processes that sustain our economy. Despite our historical record of achievement, the United States now lags behind other nations in STEM education at the elementary and secondary levels. The serious underrepresentation of African Americans, Hispanics, Native Americans, and women limits their participation in many well-paid, high-growth professions and deprives the Nation of the full benefit of their talents and perspectives. The problem is not necessarily the result of a lack of proficiency. There is also a lack of interest in these fields among many students. Recent evidence suggests that many of the most proficient students, including minority students and women, have been gravitating away from science and engineering toward other professions. (President's Council of Advisors on Science and Technology, 2010).

In order to increase the interest in these math and science fields, President Obama launched the “Educate to Innovate” initiative in 2009. A key component of this initiative is to “broaden participation to inspire a more diverse STEM talent pool” (Chu, Barret & Zaslav, n.d.). One of the groups targeted by this effort is women and girls.

The underrepresentation of women in these fields, especially fields that are math intensive is not new. While the gender gap in many professional fields such as doctors, psychologists, and veterinarians has decreased since the woman’s movement began in the 1960’s, the STEM fields still favor men (Ceci & Williams, 2009). Another report by the Department of Commerce noted that women make up 48% of the workforce, but only 24% of the STEM jobs (Milgram, 2011).

This brief will examine the reasons behind the shortage of women in the STEM fields, why a higher percentage of women elect to leave this field and, most importantly, what role high schools should play in preparing young women to be successful in STEM careers.

Summary of Findings

We have been hearing the warnings for several years, that there simply are not enough young scientists (both male and female) entering into the STEM professions to replace all of the retiring professionals (Brown, R., Brown, J., Harsh, Maltese, & Tai, 2012; Heilbronner, 2011; Scott, 2012). Expertise in STEM fields promotes inventiveness and scientific discovery while also opening up new job and economic opportunities. Due to technological advances, STEM jobs in the United States in the past ten years have grown at three times the pace of non-STEM jobs, and are projected to continue growing at this pace through the next decade. STEM jobs require technical expertise, specialized training, or higher education which makes the typical job seeker in the United States under qualified for a job in a STEM field. As a result, there are not enough

qualified job candidates in the United States to fill all of these projected positions, even during this time of high unemployment (Brown, et al., 2011). If our society is to improve, it must utilize the talents of its individuals for the greater good. Pairing this with the idea that diversity leads to the best ideas and solutions, we must find a way to increase the diversity of STEM workers. Ray McCarthy (2009) summed this up perfectly by stating, “We cannot afford to have 51% of our population left out of the important decisions that affect us today and in the future” (p. 4).

To fully understand the shortage of women in these fields, three factors must be examined: 1) What influences a young woman to choose (or not choose) a path that will lead to a career in a STEM? 2) What are universities or employers inadvertently doing to make women feel unwanted and unwelcome, leading to a high attrition rate, and what changes in their culture could yield large decreases in the gender gap? 3) What do high school administrators, counselors and teachers need to do to ensure that all students are prepared for the jobs of tomorrow?

Fewer Women Opt for a STEM Major

In elementary, middle, and high school, girls and boys take math and science courses in roughly equal numbers, and about as many girls as boys leave high school prepared to pursue science and engineering majors in college. Yet fewer women than men pursue these majors. Among first-year college students, women are much less likely than men to say that they intend to major in science, technology, engineering, or math. By graduation, men outnumber women in nearly every science and engineering field, and in some, such as physics, engineering, and computer science, the difference is dramatic with women earning only 20 percent of bachelor’s degrees. Women’s representation in science and engineering declines further at the graduate level and yet again in the transition to the workplace (Corbett, Hill, & St. Rose, 2010).

One reason for low numbers of women entering the STEM fields could be the negative stereotype about female math abilities that is often unwittingly created by their parents and teachers. Being told from a young age that girls are not good at math ultimately undermines their performance and interest in the STEM fields. It has been indicated that by age 12, children have formed hard and fast beliefs about the subjects in which they excel and those in which they fail. Girls tend to assess their mathematical abilities lower than do boys with similar mathematical achievements. At the same time, girls hold themselves to a higher standard than boys do in subjects like math, believing that they have to be exceptional to succeed in “male” fields (Corbet et al., 2010). This type of stereotyping (even if unintentional) erects one of the many roadblocks that get in the way of making STEM education options appealing and attractive.

It has also been demonstrated that lower grades lead to lower persistence in continuing in a major, and this effect is stronger for women (Griffith, 2010). Students who have not had a rigorous high school education with an emphasis in the STEM areas are often not well prepared for the types of courses required for this major. It is generally true that STEM departments are the most difficult grading departments at many colleges, and this may play a large role in the underrepresentation of women in these majors along with higher rates of attrition. Some schools have incorporated failure training as part of their science/math curriculums (Harsh, et al., 2012). The goal of this program is to teach students how to deal with disappointment from an idea that did not quite work out and how to take away valuable lessons from this type of experience. This type of training is especially important for women who are perceived to react to rejections more negatively than men.

Nancy Heilbronner (2011) reinforced this idea when she surveyed participants of both genders who competed in the Westinghouse Science Talent Search. She examined their

characteristics in four areas: 1) Ability to succeed in a STEM major 2) Interest in a STEM major, 3) Self-efficacy, and 4) Academics in order to determine the impact of these areas on declaring a major in a STEM field. The most surprising recommendation from this study did not deal with the talents of the students. Instead it indicated that those who work with these talented students must learn methods to build the students' self-efficacy so they are able to persist through difficult times, realizing that STEM courses will be challenging but rewarding if the students can persist.

Young women are also not well prepared for the gender disparity that exists in the STEM courses. The culture and climate of STEM departments in colleges and universities can be a barrier to women's recruitment and persistence in these fields (Hill et al., 2010). In the vast majority of upper level STEM courses, women are outnumbered and can feel like they do not fit in. It can be quite a shock to walk into a classroom to find that one is the only woman in attendance.

In terms of sheer numbers, nationally more women do appear to be declaring STEM major and entering STEM occupations; however there is a large difference in the types of STEM pathways taken by each gender. For example, more women tend to select biology as a major and fewer select engineering and physics (Heilbronner, 2013). This trend appears to be attributed to the desire of women to enter fields that allow them to be creative, to make a difference, and to change the world. Heilbronner also explored the perception of men and women in STEM areas in an attempt to determine whether experiences that enticed them to enter/leave this field had changed over the past decade. It was discovered that more women are entering STEM, and talented women embrace the competition that used to drive them away. Self efficacy is higher in men in the physics, computer science, and engineering fields, but both sexes appear to take challenging math and science courses in high school that should prepare them for a STEM major.

Why Women Leave

It is interesting to note that genetic disposition or lack of interest are not the causes of women exiting the STEM workforce. Data shows exactly the opposite. For the last three decades, women outnumber men in college enrollments, outperform men academically, receive more awards, yet they are less likely to graduate and enter a career in STEM (Cole & Espinoza, 2011). This low number is commonly referred to as the “leaky pipeline”, a metaphor used to describe the loss of female students from high school to college to the workforce. The two primary factors that lead women to exit a STEM career are the need to balance a career with family and a lack of professional networks.

Both men and women are affected by family demands that can disrupt a career. However, the need to balance work and family seems to affect women more. A married female PhD is 13% less likely to be employed than a married male PhD. If this woman is married with young children, she is 30% less likely than a single man to be employed (Rosser & Taylor, 2009). Our culture also contributes to this issue. Compared with their colleagues in other countries, scientists in the U.S. have fewer support systems such as paid leave for both parents, on-site daycare, and mandatory holding of positions while taking leave.

The lack of mentoring and networking also contributes to the decline of women in STEM. A study conducted at the Massachusetts Institute of Technology (Vest, 1999) found that women scientists tend to have fewer graduate students to support their work and are less likely than their male counterparts to be asked to serve as a consultant, participate on science advisory boards, or interact with industry. Women often list feelings of isolation, an unsupportive work environment, extreme work schedules, and unclear rules about advancement and success as major factors in their decision to leave. Research conducted by Cole and Espinoza (2011) found

that the desire to gain recognition from colleagues was significant for women's STEM careers, and women showed increased success when they have peers who believe they are capable of being successful.

Gayles and Ampaw (2011) studied this recognition factor in greater depth and found that a major contributing factor to degree completion was the amount of interaction the student had with faculty. The effect of this interaction was much stronger for females and was particularly significant when this interaction took place outside of the classroom. Surprisingly, meeting with academic advisors about course plans did not have a positive effect of degree attainment.

This problem has seen successful resolution at Stevenson University which is located near Baltimore, MD. This university is unique in that 100% of the department heads in the STEM courses are female as are 71% of the STEM faculty members. This university places a high priority on mentoring, both faculty-to-student as well as student-to-student (juniors and seniors are paired with one or more incoming freshman). The faculty-to-student ratio is low (1:14) which allows the curriculum to host an inquiry-based, research-rich learning environment that allows the student and faculty to develop strong relationships and students to learn by doing. The university also has an outreach program for the middle and high schools and a rigorous teacher education program that requires more math and science courses than traditionally needed (Gorman, Durmowicz, Roskes & Slattery, 2010).

Universities should also be made aware that Undergraduate Research Experience (URE) keeps students in the STEM fields. According to a study by Harsh et al. (2012), women are more likely to participate in UREs than men, and these experiences allowed the women to feel gains in self efficacy and interest. These outcomes need to be shared with the universities, the science community, and funding agencies so these experiences can keep women in the STEM fields.

Role of High Schools

In order for the gender disparity in STEM to diminish, change must begin in the schools. Administrators need to be willing to make the STEM curriculum a priority and an attractive field of study. This should start with the youngest of students and continue through college graduation. Elementary teachers need to become more familiar and comfortable with math, technology, and science in the classroom. It needs to be emphasized that everyone, not just boys, can be successful in these areas. This is sometimes difficult because these teachers, more often than not women, may have been raised and schooled to dislike science or believe that they could not do math well. Teachers must also continue to monitor their own behavior and make sure that they treat boys and girls equally in the science and math classes. Typically girls are called on less frequently and receive feedback related to cooperation and neatness; whereas boys are given feedback related to the content of their work and are often coached when they are unable to give a correct answer (Gayles & Ampaw, 2011).

An additional research study focused on the social and personal factors that positively influenced girls' motivation in math and science. Support from teachers and parents were important in making this decision, but the most important factor was peer support (Leaper, Farkas & Brown, 2012). Bearing this in mind, schools need to offer and parents need to encourage their daughters to participate in STEM related extracurricular activities. It was also noted that learning about feminism and gender equality positively motivated girls to do well in math and science.

LeBeau et al. (2012) studied the relationship between various high school characteristics and declaring a STEM major. It was a surprise to find that the high school math curriculum a student completed was unrelated to completing a STEM major – on average, high school

students are equally prepared for the type of math necessary for this career. The factors and skills that were necessary for success included a strong science background, the ability to be an effective member of a group as well as good problem solving skills.

School administrators should recognize that there is a lack of teachers who know how to teach science and mathematics effectively, and who know and love their subject well enough to inspire their students. This problem is not new. Teachers in these areas are difficult to retain due to job dissatisfaction or the allure of other jobs. Utilizing teachers not adequately trained in this field can significantly affect the math and science knowledge of the students and cause them to turn away from these disciplines (Hayden, Ouyang, Scinski, Olszewski & Bielefeldt, 2011).

This lack of understanding of what is intended by STEM education was clearly detailed in a study involving 172 teachers and administrators who were interviewed to determine two questions: 1) Do you understand STEM education? and 2) What do you believe about STEM education? Results of this study indicated that only one-half of those interviewed had a clear definition of STEM and that there is a lack of clear vision for STEM even amongst those who feel it's important. There was little evidence that STEM education exists in schools based on the lack of collaboration that exists and that STEM requires (Brown, Brown, Reardon & Merrill, 2011).

Schools must also make professional development for these teachers a higher priority as shown in the study conducted by Hayden et al. (2011). The study referenced the iQUEST project which provides professional development to enhance classroom learning experiences with Information and Communications Technology. The study examined a program funded by the National Science Foundation, brought technology enhanced learning experiences to middle school underserved populations (specifically Hispanics and girls). The study focused on two

main questions: 1) How does teacher professional development change how teaching occurs? and 2) Does this program boost student interest in STEM areas? Students in the program showed increased interest and attitudes and were provided with valuable skills along with increased career awareness related to STEM fields. Plans are in place to track these students through high school to see if this program impacts their course selection and career path. Another important piece is that teachers in the program were provided with additional opportunities to plan and collaborate with other project teachers. This is a vital part of STEM education that needs to be adopted by more schools.

Because students enrolled in Advance Placement (AP) Calculus, Biology, Chemistry and/or Physics are more likely to pursue a STEM major, it is recommended that schools encourage more woman and minority students to enroll in these courses (Rutz & Shafter, 2011). Rigorous preparation, in the form of AP courses, can potentially reduce college costs and be motivational to students. Another discovery was that schools that offer AP credit often have students from higher socio-economic background. These students have parents who understand the importance of a good education, lobby for more challenging curriculums, and have the political power to see that this does occur. Poor and rural schools are often unable to offer AP courses, and suggestions are being made to allow distance and online learning to be made available for these students. Further research is being conducted to study the attrition rate of these students (Robinson, 2003).

To study how other schools prepare their students for a STEM major, Catherine Scott (2012) studied ten schools that focused their curriculum on STEM education. Her results indicated the students who attended these schools outperformed their peers at similar schools. It was commonly felt that these schools had a more rigorous set of requirements with STEM-

centered electives. Students were consistently engaged in problem solving and often completed internships. These schools had a higher than average number of minority students which may indicate that given the opportunity and environment, any student can be successful in a rigorous STEM program. The principals attributed the success to fully committed teachers who have time to collaborate and participate in professional development.

McCarthy (2009) examined ways to increase the gender equality of students interested in STEM while in still in middle and high school. He found that using high school students as mentors for the middle school students positively increased the tendency for declaring a STEM major. Several other suggestions for increasing participation in STEM field included educating the guidance department and having them examine the work being conducted by a Massachusetts Institute of Technology consortium. (Mahoney, 2010). This group is channeling efforts to: 1) get high school technology courses to be considered a science course by the higher education community 2) encourage schools to start technology clubs that allow high school students to mentor middle school students and 3) host a technology open house for the community with fun activities planned for visitors.

Girls need to receive the message from a young age that woman can work in STEM careers and still have a personal life. Teachers must share with their students biographies of female role models that not only show their chosen career, but also how much these women enjoy their work while having personal and family lives. These biographies need to be incorporated into their lessons. Weisgram and Bigler (2007) reported that girls who were taught about gender discriminations, especially when the subject was a famous female scientist, who faced discrimination, increased their confidence in pursuing science and their belief in the importance of science to society.

Studies suggest that schools should seek to develop the equivalent of the Rosie the Riveter campaign that occurred during WWII. Schools need to develop material such as posters, brochures, and flyers that feature pictures of females in the STEM careers. They must try to imprint the images of these female role models on the minds of their students. These materials must also be sent to the parents to persuade them that this path is a good educational choice for their daughters. Administrators can make use of their computer applications teachers and have the curriculum include having the students develop posters, videos, and even screen savers of woman at work in the STEM fields (Milgram, 2011).

High schools should consider adding before school, afterschool, and/or summer programs that provide enrichment opportunities that will make STEM come alive for their students. Schools that have taken this step have seen very positive outcomes such as increased enrollment and interest in STEM related courses in school, increased self-confidence in tackling science projects, increased test scores compared to non-participants, and gains in 21st century skills, including communication, teamwork and analytical thinking (Afterschool Alliance, 2011). These programs provide engaging curriculum that sparks curiosity. They also promote teamwork and problem solving that put the students in control of their own learning. Parents of the participants reported an increase in confidence among their children, especially in young girls, which is vital to encouraging them to take the next step in pursuing a STEM career. Developing relationships with mentors and role models was also a benefit of these programs. These programs exist in vast numbers across the country and could be offered in conjunction with local businesses and universities as well as 4-H groups and the Girl Scouts.

Female college students and faculty can also be a resource to both elementary and secondary schools. They can help create positive images of women in STEM or simply inform

the students of possible careers in this area that they may not have previously considered.

Summer camps benefit both the university (as recruitment tools) as well the younger student.

Mentoring opportunities should not be overlooked as females do respond best when they work collaboratively. Naomi and Mark Chesler (2002) discovered that Carnegie Mellon University School of Computer Science was able to expand its undergraduate major from 7% female to 42% female in the span of five years by doing more to actively recruit female applicants, changing admission requirements to include less prior experience with programming, and changing the “peer culture” of the major. Hill et al. (2010) said, “The active recruitment of students is absolutely necessary. That’s a no-brainer but a lot of departments don’t do it, they just say, ‘Students will choose the majors they decide on,’ but inviting students to take an introductory course or to consider the major can really help” (p. 82).

Oklahoma State’s College of Engineering and College of Education examined the effects of mentoring as professors teamed up with middle school teachers to create a series of project based engineering activities for 6th and 7th grade students. This two-year project brought real world applications of science and math to the classroom and allowed the students a chance to express their creativity, and problem solving abilities. It also provided the female students with afterschool programming sessions led by university students. The students were significantly impacted showing higher confidence in science and math, greater effort in these courses, and greater interest in engineering as a career (Redmond et al., 2011).

Universities also need to be aware of some of the successful strategies for ending the decline of STEM students (especially women and minorities) from their freshman to senior year. Long term retention is significantly impacted by GPA of the last registered term, availability of financial aid (it takes STEM majors longer to graduate), gender and ethnicity, years living on

campus, high school rank, ACT scores, and learning community participation (this is very important for those who begin in a non-STEM major). It was also found that early academic and peer advising helped to direct and keep students in the STEM majors (Whalen & Shelley, 2010).

Implications of the Findings

Increasing the number of women in the STEM fields must be a joint effort of the family, schools, and community. An environment of encouragement needs to be created that removes the negative stereotypes about the ability of females to be successful in math and science and instead develops an attitude of confidence.

Make STEM Visible

Students need to know about the jobs of tomorrow. They must be exposed to the technological, science, and math skills that will be needed in order for the United States to remain a competitive leader in our world. Middle and high school administrators can support their female science students by spreading the word about girls' and women's achievements in math and science, helping girls recognize their career skills and supplying them with positive role models, and encouraging these students to take calculus, physics, chemistry, computer science, and engineering classes when available. Extra-curricular activities in the STEM areas need to be available and accessible to all students. Summer camps and afterschool programs should also be considered.

The Girls Scouts are at the front of the pack in changing the face of STEM careers for young women. They are focusing on developing solutions for what works for girls who show an interest in the STEM fields. The Girl Scouts recently unveiled a new program, *Imagine Your STEM Future*, which serves to inspire girls to follow career paths in science, math, technology, and engineering. It will be a four-series project (Imagine Yourself on the Cutting Edge, Imagine

Yourself in a Lab, Imagine Yourself as an Engineer, and Imagine Saving the Planet) in which the girls will team up to work together and will have the opportunities to meet actual women with STEM careers (NPR, 2013). The web site also includes a message of support from First Lady Michelle Obama.

School leaders also need make the best use of the school counselors who have the opportunity to work with students in a one-on-one setting. In order for this to be effective, counselors must be willing to work with the STEM teachers to become better informed regarding STEM education and need to become educated regarding the wide range of STEM activities and careers that are available for young women. Young girls cannot possibly consider opportunities they do not know exist. Counselors can also set up seminars, luncheons, or visits from college reps that can personalize this message and talk individually with the students. Both counselors and teachers can send personalized invitations to students who show an interest in the STEM fields. Knowing that girls prefer to have the company of other girls, invitations should be sent in groups.

Counselors and teachers also need to tailor their presentations to the female mind. Women as a group tend to care more about making a difference in the world, and using this as a guiding factor, the recruitment efforts need to focus on how the STEM programs help others while focusing on the concept of teamwork and collaboration.

If asked to name a woman scientist, most people immediately come up with Marie Curie, perhaps Jane Goodall, or even stretching it to Florence Nightingale, but after that the list of candidates gets pretty lean. Young women need role models to encourage them to enter what they might consider a male occupation. If a young woman's parents are not involved in a STEM related field, she needs to have other role models, such as her teachers, to emulate.

The lack of female role models in STEM fields is evident in the US. Who are the inventors of Facebook, Google, or even the famous hackers? Young women and girls need to see female role models that look like them, and they need to see this over and over again. Too often, young girls are told that they cannot do math or science, and the effect of this can be seen in the workforce. To counteract this, educators must continually reiterate the “you can do it” phrase on a daily basis.

Teacher Retention

Schools need to search for and retain qualified STEM teachers who are passionate about their subject and can create that spark of interest that is waiting inside so many students. Professional development in STEM fields needs to be a priority as the skill sets required of the students is constantly in flux. Teachers need to develop a mentor system that pairs their high achieving older students with young high school, elementary, and middle school students.

Get Parents Involved

Parents have to become more interested and knowledgeable in STEM education. A 2008 survey by USA Today showed that only 26% of those surveyed believe that they have a good understanding of science. Forty-four percent could not identify a single scientist, living or dead, whom they would consider a role model for the nation's young people (MacDonald, 2008). Hosting technology nights or inviting parents to hear presentations regarding STEM careers could open a line of communication between the student and parents that could lead to a never before considered career path.

Partner with the Universities

School leaders at the college level must actively recruit women into STEM majors, emphasize real-life applications, and show how these applications will better society. Colleges

need to take proactive steps to support women in STEM majors to retain these students through graduation. One method to create this support system is by encouraging faculty members to interact with their students both inside and outside of the classroom. Creating partnerships with the local high schools to show students how applicable STEM is to their daily lives could be a first step to recruiting the new STEM majors. This mentor system that allows college students to interact with the high school students will benefit both parties.

Application to the Metropolitan Omaha Education Consortium (MOEC)

This brief details several areas that are applicable to MOEC. Taking into consideration that technology is becoming more integrated into our lifestyles, and is often considered a necessity instead of a nicety, schools need to adapt their teaching to meet these needs. STEM must become more than just a buzzword and become an integral part of the curriculum.

The most logical starting point would be with the teachers. STEM education extends far beyond the walls of the science classroom. The skills of teamwork, collaboration, and communication should be included in all curricular areas and also within the school faculty. Professional development is needed for all teachers, but special attention should be paid to the math, science, and technology teachers. It is vital that they remain informed of the current job market and the skill sets necessary to be successful in these areas.

Teacher retention is another area that must be addressed. STEM teachers need to be groomed at the college level. It is not enough to simply do well in math and science. Schools need dynamic teachers who know about the STEM careers and have the ability to make their students get excited and interested in pursuing these careers. Schools must also work hard to retain these teachers as there are many lucrative STEM careers that these teachers would be more than qualified for.

Teachers also need to help their students learn to fail. Great ideas and innovations often grow from a botched experiment or idea that did not work. Students in the STEM classes need to know that it is OK to not have the “A” grade, and must discover that learning is dynamic, ever changing, and full of setbacks.

Next, the curriculum must be reexamined on a routine basis. For example, if one would examine the area of computer programming languages, it is easy to see how quickly the environment changes. Just in the past 25 years, this area has seen a shift from BASIC to PASCAL to FORTRAN to C to C++ to JavaScript, to JAVA, and now to PYTHON. Student success will depend on schools maintaining an up-to-date set of courses.

There is a budding relationship between the University of Nebraska Omaha (UNO) and the metro schools in the STEM areas that must continue to grow. Students have been introduced into the engineering fields through robots. The Robotics Expo provides students with challenges that require them to employ engineering skills, teamwork, and communication to achieve success. The computer science department at UNO recently implemented a program called Code Crush whose target audience is 8th and 9th grade girls. The girls are immersed into a five-day, hands-on experience that gives them a taste of the many career opportunities available in the computer science and IT fields. These students are also offered free registration at the Summer Tech Academy hosted at UNO.

A collaborative effort between the metro schools, the university, and the community to form afterschool and summer programs would provide a means to generate interest in the STEM fields. These workshops and programs would also assist the parents in understanding the types of careers available and would help them guide their children into these fields.

The university staff could also work with the schools to develop a mentoring program that allows the university students to visit and interact with students in other classrooms. Students would have role models to emulate and the university would have an excellent recruiting tool. This is currently occurring at the Architectural Engineering School with moderate success and could easily spread to the other STEM areas.

STEM careers will continue to grow, develop, and change. It is vital that we prepare all of our students, male and female, to meet these challenges. We cannot afford to dissuade or discourage prospective scientists, engineers, and programmers from reaching their potential, and this preparation must begin in our middle and high schools and continue through their college career.

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