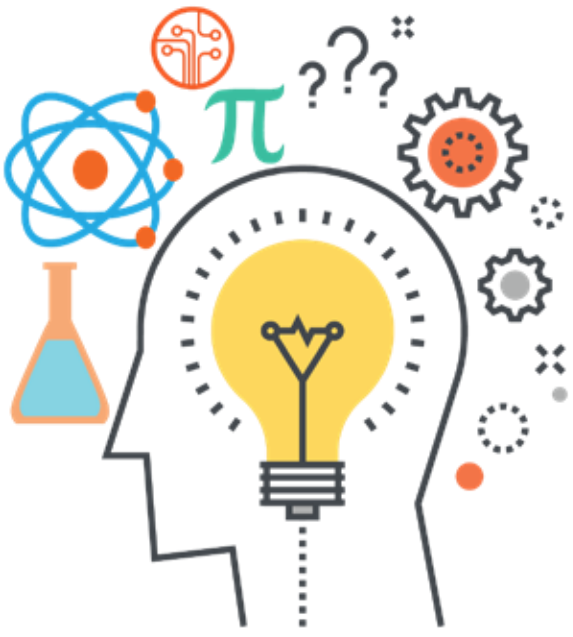
TIP SHEET

STEM²D Messaging for Parents

Here are some key messages that can be shared with parents, both to convince them of the value of STEM²D education and career options and to help them promote and maintain their child's interest in STEM²D:

- Many parents are interested in knowing the job and salary prospects of their child's preferred career choice or of the options out there for those who have not decided. Students majoring in STEM²D fields can, on average, expect to earn about $15,000 more annually than students majoring in non-STEM²D fields. Their job prospects overall are also more positive in terms of market demand, and their higher salaries mean there is a lower chance of them needing to work more than one job to have a stable income.[1]
- Due to prevalent stereotypes regarding gender and STEM²D fields, parents may be hesitant to promote or support their child (especially a girl) pursuing a career in this area—seeing it as too challenging and/or unwelcoming towards girls. It's important to remind parents that girls and boys can be equally successful in these fields, and this is supported by research on the topic.[2] While certain fields may be more welcoming to women, this is strongly influenced by a given cultural context. Girls and young women should be aware of this fact, especially in societies where gender norms and roles are more conservative. However, these norms often change over time, and such challenges can be faced and should not hold talented girls and young women back from following their aspirations.
- Parents, like teachers, can also promote a 'growth mindset' with their child. This means emphasizing that intellectual skills are developed and strengthened through practice and continuous learning and are not based simply on inherent talent. The human brain is constantly making new connections that rewire it and reinforce new and existing abilities. Research has shown that having a growth mindset can shield girls from being affected by negative stereotypes about girls and math ability.[3]



CASE STUDY

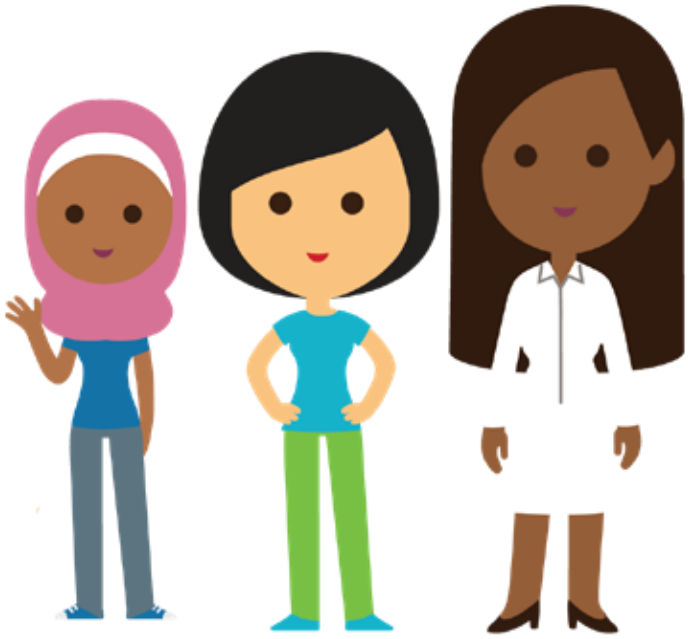
In one study, a group of low-achieving middle school math students was divided into two sub-groups. Over a period of two months, one group received tutoring on study skills (the control group) while the other participated in sessions about intelligence as an effort-based achievement and related strategies they could use in their studies (the intervention group). According to the researchers:

> ***"The students in the intervention group were taught that learning changes the brain and they should think of the brain as a muscle that becomes stronger, developing new connections and strengthening existing ones as someone learns. As a result, the person becomes smarter. The lessons also stressed that mistakes made in the course of learning are necessary and help students learn. The lessons concluded with the message that students are in charge of this process and that being smart is a choice. The results of this intervention were remarkable. While grades for all students in the experiment were declining on average before the intervention…for those students who were taught that intelligence is malleable, the decline in grades was reversed and their average math grades improved within a few months of the intervention. In contrast, the students in the control group continued to experience a decline in grades. This study provides evidence that the learning environment can influence an individual's mindset (fixed or growth)."[4]***

Research is ongoing into the complex connections among a growth mindset, gender, and different STEM^{2}D fields. However, the undergraduate degrees with the heaviest focus on math—physics, engineering, math, and computer science (PEMC)—also have the lowest proportion of female students.[5] Promising strategies such as the promotion of a growth mindset can help combat girls' internalization of gender stereotypes about their ability and help increase the chance that they will choose and persist in a STEM^{2}D field, particularly those focused on math.

- Parents can also stimulate and strengthen children's interest in STEM^{2}D fields by increasing their exposure to different topics. The local public library can be a wonderful resource, especially for parents who may have time and/or resource constraints. The library should have educational videos and of course many books about a variety of STEM^{2}D topics. It might also respond positively to a request to host a STEM^{2}D role model or other STEM^{2}D-themed presentation as a free public event. The Internet (which is also available at local libraries) can additionally provide parents with stimulating resources. Websites such as National Geographic and https://www.datasciencedegreeprograms.net/stem-websites-apps-kids/ provide compilations of STEM^{2}D learning resources for different age groups. Parents can also encourage children to participate in science fairs, where they may need to focus on a certain subject, such as geology—and prepare thematic projects. They can spend recreational time visiting educational events, museums, science centers, etc., where children are exposed to a variety of STEM^{2}D topics. For example, a nearby museum may have an exhibit on astronomy and space flight technology; a children's science center may cover a variety of topics, ranging from biology, to robotics, to Earth science.

- Finally, parents can reinforce that women can be successful in STEM^{2}D fields, by introducing girls to real-life role models and by sharing stories in the news about female role models. (See the Resource box for examples of female role models. One or more of these could also be highlighted in a newsletter.) Parents can reach out to teachers to identify ways to bring in female role models as guests in the classroom, such as by partnering with local businesses or with individual professionals.



RESOURCE: FEMALE ROLE MODELS

Science (General)

- 17 Top Female Scientists Who Have Changed the World: https://www.globalcitizen.org/en/content/17-top-female-scientists-who-have-changed-the-worl/
- Organization for Women in Science for the Developing World: https://owsd.net/

Technology

- Women in Technology Hall of Fame Awards: https://www.witi.com/conferences/2018/summit/hall-of-fame.php

Engineering

- The 39 Most Powerful Female Engineers of 2018: https://www.businessinsider.com/the-most-powerful-female-engineers-of-2018-2018-4
- The Women's Engineering Society (includes awards for top 50 women engineers): https://www.wes.org.uk/

Math

- Women Mathematicians in Their Own Words: https://blogs.scientificamerican.com/roots-of-unity/women-mathematicians-in-their-own-words/
- Five Rebel Women Mathematicians Who Changed the World: https://medium.com/however-mathematics/five-rebel-women-mathematicians-who-changed-the-world-3628b47bfda0

Manufacturing

- Manufacturing Institute Past Honorees and Emerging Leaders: http://www.themanufacturinginstitute.org/Initiatives/Women-in-Manufacturing/Past-Honorees/Past-Honorees.aspx

Design

- 12 Train-blazing Women in Design to be Inspired by: https://www.creativebloq.com/inspiration/10-inspiring-women-in-design

VISIT WWW.STEM2D.ORG

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1. Jacobs, P. Science And Math Majors Earn The Most Money After Graduation. (May 28, 2019). Retrieved from https://www.businessinsider.com/stem-majors-earn-a-lot-more-money-after-graduation-2014-7.
2. Hill, C., Corbett, C., and St. Rose, A. (2010). Why So Few? Women in Science, Technology, Engineering, and Mathematics. (American Association of University Women). Retrieved from https://www.aauw.org/research/why-so-few/
3. Ibid.
4. Ibid.
5. Nix, S., Perez-Felkner, L., and Thomas, K. (June 9, 2015). Perceived mathematical ability under challenge: a longitudinal perspective on sex segregation among STEM Degree Fields. Frontiers in Psychology 6:530. https://www.frontiersin.org/articles/10.3389/fpsyg.2015.00530/full