

## Why role models?

Exposing students to role models is a popular intervention to support recruitment & retention of underrepresented groups in STEM<sup>1,2</sup>

Benefits include increasing:

- Students' **academic & social sense of belonging**<sup>8,9</sup>
- STEM students' **academic self-efficacy**<sup>4,5,8,9</sup>

- Students' **personal identification** with STEM (benefits **academic performance**<sup>4</sup>)

## For positive effects, highlight role models<sup>15</sup>:



### Competence & success

Role models highlight career options in STEM & when **described as competent** (not exceptional) can increase **student motivation & performance**<sup>15</sup>



Note: role models should **recognize challenges** including feelings of not belonging<sup>5,25</sup> to **validate students' experiences**

### Meaningful similarities with students

Connect with students by **sharing hobbies & values** e.g., spending time with others,<sup>8,32,33</sup> & persisting through failures & challenges<sup>5,9,25,28,34</sup>

Hearing how role models **defy stereotypes**<sup>11,21,27</sup> can lead to **higher self-efficacy** (e.g., "if she can do it, I can too"<sup>6</sup>)



### Attainable paths & success

Emphasize **hard work over brilliance**<sup>6,27,28</sup> – brilliance is seen as **unachievable** If role models' success is seen as exceptional, they use inaccessible language<sup>15</sup>, or are seen as too stereotypic<sup>8,16</sup>, it can **backfire**<sup>8,24</sup> & dissuade students & their interest in STEM



## Prioritize underrepresented groups<sup>15</sup>

Underrepresented groups have a **lack of role models**<sup>30</sup> in STEM

Underrepresented role models can have **positive effects on all students, & reduce students' stereotypes**<sup>31</sup>

Role models from majority groups<sup>4,7,32</sup> can **highlight stereotypes of STEM fields** that make them unwelcoming<sup>18,26</sup> This can be overcome if the role model can **build other connections** (e.g., contradicting STEM stereotypes<sup>8,33</sup>)



Black & Latina women tend to identify more with a role model who shares a racial/ethnic background than one of the same gender,<sup>7,8,4,14,30,36,37</sup> however this is not always the case<sup>15</sup>



Note: **avoid additional labour** for underrepresented STEM professionals by **using videos** or **reading materials**; they are just as **effective**<sup>15,20</sup>

## How to bring in role models

Role models can include:

### Peers

Can increase sense of belonging, motivation, & mentorship, which can lead to stronger retention<sup>2,7</sup>

### Instructors

Gender can matter<sup>10</sup>, especially in male-dominated fields<sup>4,11-13</sup>

### Industry mentors

Exposures **do not have to be in person** or **long** to have an effect<sup>8,29</sup>

Examples

**Speakers & panels**<sup>35</sup>

Can be done virtually!

**Video**<sup>29</sup>

Calls or viewing

**Project-based learning experiences**<sup>38</sup>

**STEM camps & after-school programs**<sup>38</sup>

**Reading excerpts or biographies**<sup>9</sup>

**Industry visits**

**In-person events**

**Museum visits**<sup>38</sup>

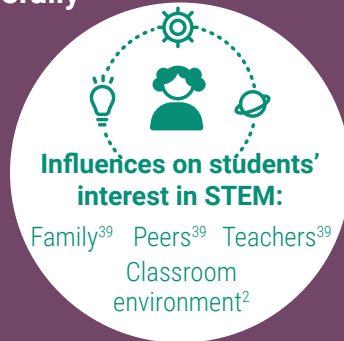
While there is no noticeable difference in the effects of a role model intervention based on student age<sup>15</sup>, there are some age-related aspects to consider when planning a role model experience or intervention.

## Considerations for school-age (K-12)

### Choose role models carefully

**Perceiving similarities** to a role model is important for this age<sup>11</sup>; students can be put off if they are **frightened** or **intimidated** by the role model<sup>24,40</sup>, or find them too **stereotypic**<sup>16,17,40,41</sup>

STEM professionals should talk about their work in **age-appropriate** & **interesting** ways<sup>2</sup>



### Reflect on intended audience

High school internship programs tend to **attract students** who already have a **high level of STEM interest**<sup>46</sup>

Consider interventions that **target all students**. Role models can have the biggest effect on high achieving students<sup>21</sup>

**After school programs, camps**<sup>47</sup>, **hands-on activities** in school<sup>43,48</sup> can have a wider reach

### Build connection through activities

Elementary student interventions with role models often focus on activities that are<sup>15</sup>:

- Communally-oriented<sup>42</sup>
- Focused on real-world situations<sup>42</sup>
- About helping people<sup>42</sup>

Consider projects that continue over several weeks<sup>44</sup> to **build personal connections** with role models<sup>11,45</sup>

Sixth grade students completed a difficult math test after reading about one of two role models:<sup>28</sup>

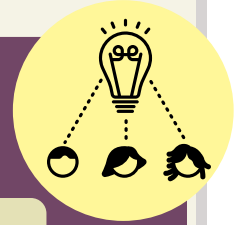
#### Hardworking role model

- Girls & boys scored equally well
- Boys' & girls' math self-efficacy increased

#### Gifted role model

- Boys outperformed girls
- Students did not identify as much with them

Attributing hard work to role models' success can increase their effect<sup>28</sup>



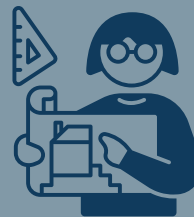
## Considerations for post-secondary

Post secondary students & recent graduates can face **subtle gender bias** in hiring & promotion, evaluation of their scientific work, & non inclusive STEM climates<sup>2</sup>

Effect of instructor gender on undergraduate calculus students<sup>4</sup>

#### With a woman professor,

- All students, regardless of gender, participated more & asked more questions than when taught by a man<sup>4</sup>
- Women's association with & liking of math increased



### Underrepresented students in post-secondary benefit from<sup>19</sup>:

- Peer networking events<sup>2</sup>
- Academic clubs<sup>22</sup>
- Mentorship programs<sup>2</sup>
- Peer study & support groups<sup>7,22</sup>
- Mentors trained in cultural responsiveness<sup>21,22</sup>
- Participating in undergraduate research<sup>22</sup>

Role models can have **positive effects** on young women's success in STEM<sup>10,20,22</sup> at all ages, especially when interventions are intentionally facilitated<sup>3,5,7</sup> with a structured program



### Before a role model session

**Ask students to reflect**<sup>13</sup> on their similarities to the role model(s)<sup>15</sup>

Reflection can **shift students' perceived stereotypes**<sup>23,47</sup>

E.g., thinking about their:

"**current academic self**" instead of "**best**" or "**future self**"

can make a role model's success seem more attainable<sup>5,24,47</sup>



Role models are most effective when students feel connected to them.<sup>4,8,14</sup> For the greatest effect for all students, combine a variety of interventions<sup>1,23</sup> to improve recruitment & retention of underrepresented groups in STEM.

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## About Engendering Success in STEM (ESS)

Engendering Success in STEM (ESS) is a research partnership focused on evidence-based solutions to foster positive working environments for people in STEM (Science, Technology, Engineering, and Math). We bring together social scientists, STEM experts, and stakeholders in STEM industry and education to use an evidence-based approach to break down barriers people face on their pathway to success. Canada's Social Sciences and Humanities Research Council reviewed and funded this project.

## Resources:

Skype a scientist: [skypeascientist.com](https://skypeascientist.com)  
 I am a scientist: [iamascientist.info](https://iamascientist.info)  
 ESS' Designing Gender-Inclusive (STEM) Classrooms: [successinstem.ca/resources](https://successinstem.ca/resources)