

WOMEN IN STEM

DISCUSSING DIVERSITY, EQUITY, AND INCLUSION (EDI) IN STEM

RESOURCES FOR EDUCATORS

These resources were designed to support exploration of concepts related to social issues like gender discrimination and societal change in relation to science, technology, engineering, and math (STEM).

Like many other fields, STEM fields have long experienced a lack of diversity – notably, diversity can mean different things to different people, like diversity of ideas or attitudes. However, most often diversity is discussed in relation to demographic diversity, which refers to how people identify with various groups, for example one's race, gender, religion, or ethnicity.

We encourage you to lead discussions and activities that relate to equity, diversity, and inclusivity (EDI). It is important to remember in such discussions that all students may start with a different understanding of social issues. While all students may have unique experiences and perspectives because of their own social identities, it is essential to conduct discussions with mutual respect, compassion, and dignity for all.

GRADE LEVEL

Discussions can be modified for different grade level. Given the content involves people, attitudes, and some more sensitive topics related to social equity or discrimination, educators should consider what is appropriate for discussion among their specific classes. You will find adaptations and resources for the following grades:

Grades 4-6

Grades 6-8

Grades 9+



THE POSTERS

This series of posters profile women in different STEM fields. These posters can be used to spark discussion and engagement around topics related to inclusivity in STEM, given the persistent and historical underrepresentation of women and marginalized people historically in these domains.

Each example serves as a reminder that when we discuss women (or any other particular social group) we are not discussing a homogenous group, but rather a collection of individuals with diverse life experiences. As the posters demonstrate, women across different ages, cultures and disciplines participate and succeed in STEM. Some example lesson plans and recommended posters are included in this document, and the posters are also linked to more general guiding questions and potential discussion topics across grade levels.

USING DISCUSSION AS A TEACHING TOOL

Class discussion is an approach to teaching in which either guided or spontaneous dialogue is used to communicate information and achieve learning objectives¹. Research shows that discussion-based teaching helps students develop skills to benefit them in future education and work, including critical thinking skills², communication, collaboration, and understanding others' perspectives³, and greater problem-solving abilities⁴. Cultivating these global competencies will benefit students across disciplines and grade levels.

¹ Jahng, 2012

² Pederson, 1992

³ Sibold, 2016a, 2016b, Steiner et al, 2013

⁴ Chiang et al, 2013



KINDS OF DISCUSSION-BASED APPROACHES

Experts identify several approaches to discussion-based learning, including **structured controversy**⁵, **deliberative discussions** or **debates**⁶, and **problem-based discussions** in which students generate solutions to challenges⁷.

This resource provides examples of each of these different styles within lesson plans so that educators can experiment with implementing a variety of discussion-based teaching techniques.

CONSIDERATIONS FOR USING DISCUSSION-BASED APPROACHES AND TEACHING

1. Group composition: Who is in the group? In what ways is the group demographically similar or different? How are groups formed?
2. Educator bias: How will educators remain neutral in debates or conflicting dialogue? How might bias toward one perspective impact the discussion?
3. Controversial opinions: How will educators respond to discussions that involve conflict? How can students engage in safe discussions while still learning about diverse perspectives and critical thinking?
4. Evaluating outcomes: How will educators determine the success of discussions in learning outcomes? How will outcomes be evaluated? How can educators understand and account for individual differences like personality in participation differences?

⁵ Bull, 2007

⁶ Goodin & Stein, 2008

⁷ Bradshaw, 2011



GLOSSARY OF TERMS

Here is some useful terminology to review with students

Terms	Definitions
<i>Ageism</i>	Prejudice or discrimination based on a person's age.
<i>Ableism</i>	Prejudice or discrimination based on a person's abilities.
<i>Bias</i>	Prejudiced attitudes or actions against a person or group because of their demographic variables.
<i>Discrimination</i>	Prejudiced attitudes, actions, or treatment based on a person's demographic variables.
<i>Diversity</i>	The inclusion of different social groups, including different genders, races, ethnicities, religions, sexual orientations and identities, or socio-economic statuses etc.
<i>Empathy</i>	The ability to think about and understand the perspective and feelings of another person.
<i>Equity</i>	The quality of being fair or impartial; freedom from bias or favouritism. People get what they require to meet their needs.
<i>Equality</i>	The quality or state of being equal or the same. People receive equal treatment, regardless of their needs.
<i>Explicit attitudes</i>	A person's outward attitudes that they hold consciously.
<i>Gender</i>	The set of behavioral, cultural, or psychological traits typically associated with one sex (e.g., men, women, trans, non-binary).
<i>Inclusive</i>	That which is broad in scope and includes all people, regardless of demographic or other factors.
<i>Implicit attitudes</i>	A person's attitudes that exist beyond their conscious awareness.
<i>Intersectionality</i>	<p>The intertwined and additive way in which multiple forms of discrimination (e.g., racism, sexism) combine or intersect to create complex experiences, especially of underrepresented groups.</p> <p>Note. In Canada, there are four designated groups identified under the Employment Equity Act: Women, people with disabilities, Aboriginal peoples, and visible minorities.</p>
<i>Racism</i>	Prejudice or discrimination based on a person's race.
<i>Sex</i>	The biologically-determined categories based on reproductive organs and structures (e.g., male, female, intersex).
<i>Sexism</i>	Prejudice or discrimination based on a person's sex or gender.
<i>Social Location</i>	Where a person 'comes from' in society; the social identities or groups with which they might identify (e.g., gender, ethnicity, nationality).
<i>Stereotypes</i>	Overgeneralizations of a group of people that are often associated with negative qualities.
<i>Tokenism</i>	The practice of acting only to prevent criticism and create the appearance of equity (e.g., hiring or promoting a person who belongs to a minority group to make it seem like the environment is diverse or fair).



REFERENCES

- Bell, S. T., Villado, A. J., Lukasik, M. A., Belau, L., & Briggs, A. L. (2011). Getting specific about demographic diversity variable and team performance relationships: A meta-analysis. *Journal of Management*, 37, 709-743.
- Blickenstaff, C. J. (2005). Women and science careers: leaky pipeline or gender filter? *Gender and Education*, 17(4), 369-386.
- Bradshaw, M. J. (2011). Debate as a teaching strategy. In M.J. Bradshaw & A.J. Lowenstein (Eds.), *Innovative Teaching Strategies in Nursing and Related Health Professions* (5th Ed.). Sudbury, MA: Jones and Bartlett Publishers.
- Bull, M. J. (2007). Using structured academic controversy with nursing students. *Nurse Educator*, 32(5), 218-222. DOI: 10.1097/01.NNE.0000289386.21631.c3
- Chiang, V. C., Leung, S. S., Chui, C. Y., Leung, A. Y., & Mak, Y. (2013). Building life-long learning capacity in undergraduate nursing freshmen within an integrative and small group learning context. *Nurse Education Today*, 33(10), 1184-1191. doi:10.1016/j.nedt.2012.05.009
- Crenshaw, K. (1989). Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine. *University of Chicago Legal Forum* (139–168).
- De Welde, K., & Laursen, S. (2011). The glass obstacle course: Informal and formal barriers for women Ph. D. students in STEM fields. *International Journal of Gender, Science and Technology*, 3(3), 571-595.
- Hango, D. (2013). Gender differences in Science, technology, engineering, mathematics and computer science (STEM) programs at university. *Insights on Canadian Society*. Statistics Canada Catalogue no. 75-006-X.
- Hewlett, S. A., Buck Luce, C., Servon, L. J., Sherbin, L., Shiller, P., Sosnovich, E., & Sumberg, K. (2008). *The Athena Factor: Reversing the brain drain in science, engineering and technology*. Harvard Business Review Research Report. Boston: Harvard Business Publishing.
- Jahng, N. (2012). A systematic review of small-group communication in post-secondary online courses. *Journal of Open, Flexible and Distance Learning*, 16(2), 26-40. Retrieved from: <http://journals.akoatearora.ac.nz/index.php/JOFDL/index>
- Knobloch-Westerwick, S., Glynn, C., & Huge, M. (2013). The Matilda effect in science communication: An experiment on gender bias in publication quality perceptions and collaboration interest. *Science Communication*, 35(5), 603-625. doi:10.1177/1075547012472684



Moss- Science faculty's subtle gender biases favor male students. *Proceedings of the National Academy of Sciences*, 109(41), 16474-16479.

National Science Board. (2016). *Science and engineering indicators 2016 (NSB-2016-1). Digest (201602)*. Retrieved from <http://www.nsf.gov/statistics/2016/nsb20161/#/report/chapter-2>

Pederson, C. (1992). Effects of structured controversy on students' perceptions of their skills in discussing controversial issues. *Journal of Nursing Education*, 31(3), 101-106. Retrieved from <http://www.healio.com/nursing/journals/jne/1992-1-31-1>

Romano, A. (2014). Barbie book about programming tells girls they need boys to code for them. *The Daily Dot*. Retrieved from: <https://www.dailydot.com/parsec/barbie-engineer-book-girls-game-developers/>

Rosser, S.V. (2006). Using POWRE to ADVANCE: Institutional barriers identified by women scientists and engineers. In *Removing barriers: Women in academic science, engineering, technology, and mathematics*, Bystydzienski, J. M., & Bird, S.R. (Eds.). Indianapolis: Indiana University Press.

Sibold, W. (2016a). Discussion-based learning in nursing education: Integrative literature review. Unpublished manuscript, University of Calgary.

Sibold, W. (2016b). Project proposal: Discussion group instructor guide. Unpublished manuscript, University of Calgary.

Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social Psychology*, 35(1), 4-28.

Steiner, S., Brzuzy, S., Gerdes, K., & Hurdle, D. (2003). Using structured controversy to teach diversity content and cultural competence. *Journal of Teaching in Social Work*, 23(1-2), 55-71. DOI: 10.1300/J067v23n01_05

Swim, J. K., & Hyers, L. L. (2009). Sexism. In T. D. Nelson (Ed.), *Handbook of prejudice, stereotyping, and discrimination* (pp. 407-430). New York, NY, US: Psychology Press.

Williams, W. M., & Ceci, S. J. (2015). National hiring experiments reveal 2: 1 faculty preference for women on STEM tenure track. *Proceedings of the National Academy of Sciences*, 201418878.