Can Girls Do Well in STEM?

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Life is not easy for any of us. But what of that? We must have perseverance and above all confidence in ourselves. We must believe that we are gifted for something and that this thing must be attained.

Marie Curie

Stereotype vs. Evidence

STEM (Science, Technology, Engineering & Mathematics) education has been a hot topic among primary and secondary education sectors, in response to the rhetoric of deficiency in producing human capital regarding the globalized and blooming trend of innovation through information technology (Lun et al., 2016). The dominance of male in education and occupations in STEM-related areas, however, has widely been criticized as a consequence of hegemonic masculinity in private and public sectors, and education is always one of the crucial battle grounds (Blackmore, 1997; Arnot & Dillabough, 2006).

Education discourse on gender issues, based on persistent stereotypes under the assumption that differences among boys and girls in abilities, aptitude, performance and in turn choices in study and career in STEM disciplines, is biological rather than a socially constructed and manufactured reality (Weiner, 2017).

But is that true?

Evidence shows conflicting realities[1]:

- 2015 PISA results reveal that
  - about one quarter of both boys and girls would like to work in science-related fields, but a large disparity exists within the field with many folds of boys expecting engineering/IT professions and the vice versa for health and associate professions
  - though in almost all systems participating in PISA, boys outperformed girls in mathematics, the research team commented that gender gaps in school performance are not determined by innate difference in ability.
- A Hong Kong-based research study confirms similar variations.
- While Hong Kong boys and girls perform equally well in math and science, as evidenced in PISA and TIMSS, girls are much less confident than boys in learning and their ability in STEM-related subjects.

No education policy exists in power vacuum. In response to the potential hinderance of girls' development in STEM, affirmative actions would be crucial in the formulation of STEM education policy and public discussion or debate. Regrettably, policy makers choose to stay silent.

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[1]The following are links to relevant resources:

OECD's Women Studying STEM:
https://www.facebook.com/OECDPublications/photos/a.371495076263018.90215.366003796812146/1670522396360273/?type=3&theater

Gender disparities in skills:
https://www.facebook.com/OECDEduSkills/photos/a.509378035785821.1073741828.508986735824951/1723542441036035/?type=3&theater

OECD comparing ability of boys and girls:
https://www.facebook.com/OECDEduSkills/photos/a.509378035785821.1073741828.508986735824951/1723622947694651/?type=3&theater

▲ Both boys and girls should be given ample opportunities to explore STEM-related careers. A team of S.3 students visiting a world-renowned architect, Mr. James Law, who designed the OPod Tube Housing.

Reviewing the STEM education discourse

OECD's *The ABC of Gender Equality in Education: Aptitude, Behaviour, Confidence*:
http://dx.doi.org/10.1787/9789264229945-en

OECD's The Future of Work for Women:
http://www.oecd.org/employment/future-of-work/Going-Digital-the-Future-of-Work-for-Women.pdf

OECD's *PISA 2015 Results on Excellence and Equity in Education*:
http://dx.doi.org/10.1787/9789264266490-en

The Hong Kong Component of Trends in International Mathematics and Science Study (TIMSS) in 2015:
http://web.edu.hku.hk/f/page/3932/TIMSS-2015-Presentation-for-Press-Conference.pdf

Use the simple and interactive tool to find out how HK 15-year olds differ from their counterparts in OECD countries in Science and Math ability across genders: https://www.compareyourcountry.org/pisa?cr=oecd&lg=en&utm_content=buffer08d63&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer

It is generally believed that Chinese, in comparison to the Caucasian who are more inclined to the democratic values, lag behind in dealing with gender-stereotypes in society.

Report on Promotion of STEM Education - Unleashing Potential in Innovation (Education Bureau, 2016) is the key official policy text on STEM education initiative in Hong Kong, stipulated by the Curriculum Development Institute of the Education Bureau. The document spells out the missions and strategies of STEM education development in primary and secondary schools.

Vocationalism discourse dominates the rationale in promotion of STEM education, in which the development of STEM education is regarded as a response to the challenges arising from the changes in the development of technology, economy and science in the 21st century, and thus as a means to maintain the competitiveness of HK in a global scale and to complement China's development (One Belt One Road Initiative). Among 6 major strategies on curricular reform and learning activities, none of them, in principle and content, address the gender issue and make reference to any existing data on gender disparities in STEM learning and performance.

STEM Education (http://stem.edb.hkedcity.net/en/home) is supposed to be one of the key web platforms on STEM education resources for educators, developed by the EdCity which is sponsored by the Education Bureau. Very limited information or resources relevant to gender issues are available on the website.

Staying "gender neutral" is not an excuse

Voices of gender are silent in STEM education policy text - to stay "gender neutral" in language. For critical feminists, it is a way to rationalize the gender division with an ill-informed and narrow view of equality (Mooney, 2011; Blackmore, 1997).

Avoidance of addressing the problem of gender stereotypes and lack of affirmative actions to resist perpetuation of the bias not only reinforce the gap, but may even widen it given the unique nature of STEM-related disciplines. STEM education may even be a tool in alliance with the "make under-achievement" rhetoric being increasingly popular among the public and educators.

▲ S.1 & 2 girls learn to integrate coding, engineering and fashion design in the TWF's Girls-Go-Tech Programme. A S.1 girl is showcasing her design in our GGT Catwalk Show cum Presentation.

Action

Gender awareness is the first step of social transformation

Unlike Hong Kong, UK actively addresses the issue with reference to statistics, action planning and mobilization of different sectors to actualize educational initiatives for girls (Department of Education & Department for Employment and Learning, 2009). Gender imbalance with women under-represented in STEM subjects was discussed with evidence; nature and nurture are both cited as factors of influence with gender bias appearing to start at an early age. Additional support to girls is evidenced by initiatives aiming at fighting gender bias through the involvement of business in partnership with schools, colleges and universities, particularly in areas like physical sciences and engineering. The UK's model illustrates how the gender awareness has been consciously incorporated in the policy text and agenda, with sustained effort as accessible actions (programmes, resources, news, public discussion and media initiatives on websites) and the deliberate involvement of female voices to construct career identities (stories shared by female engineers and scientists).

Girls learn and understand STEM better when they are given opportunities to apply knowledge in daily life. A team of four S.2 girls utilized IoT to design a practical device to save energy in the Cisco Innovation Challenge - they grabbed the second runner-up. ▼▶

Recommendations

Bringing in the career perspective in the discussion and actions!

In no way is STEMs a "neutral" discipline because of the traditional biased representation of male in both educational and workforce settings. Liberal feminism asserts that access to education is fundamental to the development of women's potential; radical feminism challenges the oppressive and exploitative relation due to male domination in the workplace and education settings, including curriculum formulation; poststructural or postmodern feminism emphasizes the new discourse formation by transforming the way we understand and making sense of female's experiences (Weiner, 1997; Arnot & Dillabough, 2006).

Counter-balance actions, in various forms including policy advocacy and provision of tailored programs addressing diversity and differentiated aptitude of girls in STEM, thus become really crucial. The followings are some possible options:

1. **Challenging and Fighting Gender Stereotypes in Occupational and Career Choices in Basic Education.** Examples:
   - Diversity starts in schools (https://amp.theguardian.com/science/occams-corner/2018/jan/26/children-can-only-aspire-to-the-roles-visible-to-them-time-to-get-into-the-classroom)
   - Inspiring girls with real-life examples and role models - Inspiring Women China (https://www.youtube.com/watch?v=cE2VhzSGiSU&sns=fb)
   - Launching campaigns to promote gender awareness in career choices and options through educational programmes and mentoring - Inspiring Women in the UK (https://inspiringwomencampaign.org)
2. **Promoting and launching STEM educational programmes that cater for aptitudes and interests of girls in schools.** Example:
   - A community-initiated Girls Go Tech Programme (GGT): A successful programme on STEM education for junior secondary school girls. It aims at encouraging the junior females from secondary schools and also disadvantaged backgrounds to explore STEM-related subjects to expand the possibilities of girls' career choices. (https://twfhk.org/; https://www.facebook.com/TWF-Girls-Go-Tech-110850482648004)
3. **Promoting gender awareness in education, among parents, educators and students, through solid evidence-based research and policy advocacy.** Example:
   - To STEM or Not To STEM? Factors Influencing Adolescent Girls' Choice of STEM Subjects Final Report (https://twfhk.org/research/girls-and-stem-education-hong-kong/summary)

Conclusion

The policy rhetoric on STEM education in Hong Kong is a "double omission" – deficiency in both gender sensitivity and career connectedness. The former has been discussed in detail, which possibly intensifies the gender bias on female's engagement in study and occupational choices. Nevertheless, the lack of career connectedness in actively bridging STEM to diversified career choices and options, if any, could be problematic for both male and female students.

"STEM for ALL" is a mission shared by many educators in Hong Kong; for HKACMGM, we also advocate "STEM for the FUTURE".

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For whatever reason, I didn't succumb to the stereotype that science wasn't for girls. I got encouragement from my parents. I never ran into a teacher or a counselor who told me that science was for boys. A lot of my friends did.

Sally Ride
(The first American woman in space)