Drivers of Women's Participation in STEM in The Academy

Shysta Sehgal

University of Toronto

Author Note

Thank you to the Laidlaw Foundation for granting a research funding of $5000, which made this research project possible. Thank you to Dr. Caroline Manion at the Ontario Institute for Studies in Education for supervising this project, reviewing the draft, and providing research guidance whenever required.

Correspondence concerning this article should be emailed to shysta.sehgal@mail.utoronto.ca.

Abstract

This research explored the enabling and constraining factors for women's participation in tertiary STEM education. A literature review of 19 peer-reviewed articles was conducted to explore these factors. Theories like cognitive consistency theory, social role theory, spotlighting theory, gender-equality education paradox, and learning styles theory were considered to explain the findings. Active instruction, community and support, and role models and a higher percentage of women in STEM in a university were the enabling factors for women's participation and persistence in STEM majors. Negative gender stereotypes and the gendered ideologies in affluent societies and globalised areas were found to dissuade women from pursuing STEM.

Keywords: Women's participation, Higher Education, STEM, factors

Drivers of Women's Participation in STEM in The Academy

The lack of gender equity in tertiary STEM education remains a serious concern because more girls are capable of enrolling in STEM majors than the number of girls that actually do (Stoet & Geary, 2019). Moreover, society is deprived of the diversity and innovations that this underrepresented group can bring in the STEM workforce, especially when shortages are predicted in these jobs (Xue & Larson, 2015). Since fewer women pursue STEM majors, they also end up being deprived of the higher-paying jobs that they can attain after pursuing a degree in STEM.

Recently, a study by Stoet and Geary (2019) found that even as national gender equality increases, the STEM graduation gap does not decrease. This perplexing finding invites further critical discussion as to the reasons why women choose STEM and why this gap has been particularly hard to close, even in more gender-equal countries. Some articles aim to understand this gap through the feminist standpoint theory, which places women at the centre of discussion, to elaborate the thought processes of women and the motivational factors they have encountered when they chose STEM and persisted in it. Other articles take an implicit social cognition approach to understand how career choices arise and differ between men and women. Some articles also take an intersectional approach where they recognise the effects of intersecting social categories like class, race, and gender on career opportunities and experiences. By studying and realising how different complex identities are shaped (i.e. going beyond the dichotomous categorisation as being a man or a woman) and identifying the unique challenges faced by certain people (like black women), this approach provides a better perspective on the challenges faced by certain marginalised communities in STEM.

However, there is a lack of articles that synthesise the findings and insights from these different approaches to understand the complex reasons why some women choose a STEM path, whereas some women don’t. To address this gap, this article aims to understand the enabling and constraining factors for women pursuing tertiary STEM education from diverse perspectives in order to suggest different policies that can help reduce the gender stereotypes in STEM education and address the gender gap in STEM enrollment and persistence. This article has an international focus, as it studies the literature on this topic in the USA and Cambodia and also looks at the data on different countries (more than 60) used in the Stoet and Geary (2019) study.

Research Question

The specific research question that this article aims to answer is:

What are the enabling and constraining factors for women while choosing to pursue (or not pursue) tertiary STEM education?

This question is of utmost importance to inform future policies and curricula in STEM. This article aims to answer this multifaceted question by looking at gender differences in learning styles, career aspirations, intraindividual strengths in STEM, along with sexism and gender stereotypes, which make the STEM graduation gap between men and women particularly resistant to change.

Methodology

This qualitative study, conducted over a span of six weeks, is a desk-based conceptual study involving secondary analysis and synthesis of existing data to answer the specific research question posed in this article.

For the purposes of this study, 19 peer-reviewed scholarly publications in the disciplines of psychology, sociology, gender studies, and education were selected to review the existing literature on women’s participation in higher STEM education in different countries. In addition to different theories represented in the literature reviewed, it also was a multi-disciplinary dataset that was reviewed.

Many articles were quantitative, with the others being qualitative that focused on interviewing women. The articles were found using the University of Toronto Libraries and the ProQuest database. All the articles used for answering the research question were published after 2000. This was done to ensure the findings of these articles are still applicable to some extent even in 2021; however, there is no absolute way of knowing this without replicating the results of the study, which is not the aim of this article. Some keywords that were used to find the articles are “women participation” AND “factors” AND “STEM majors”. A lot of the existing literature used in this study is specific to the USA; however, some of the articles have a cross-country focus. One article looked at the case of Cambodia, and the insights of this article were helpful to observe how the participation of women in tertiary STEM education in a low-income country differs from that in a high-income country like the USA. Some articles recognized that women are not underrepresented in all STEM fields, particularly biological sciences, and focused on physical sciences, computer science, computer and electrical engineering, or just more math-intensive majors. Most of the articles studied the experiences of women and factors that affect their participation in STEM majors in different years of college. However, some articles also studied the gender differences in motivations, strengths, and interests in adolescence to understand factors that affect the decision-making process in the transition phase from high school to university.

The findings and important insights from the articles were thematically arranged on an Excel spreadsheet, which contained different headers like “Push factors”, “Pull factors”, “Implications”, and “Recommendations/suggestions.” Along with that, a more detailed summary of each article was maintained on a Google Doc corresponding to each article. Recurring patterns and themes were also noted on another Google Doc.

Theory

Several theories have been proposed that attempt to explain the gender gap in tertiary STEM education. This article aims to synthesise the perspectives from the gender-equality education paradox (Stoet & Geary, 2019), social role theory (Eagly, 1987), balanced identity theory, a derivative of the cognitive consistency theory, (Greenwald et al., 2002; Nosek & Smyth, 2011; Smyth & Nosek, 2015), learning styles theory (Kulturel-Konak et al., 2011), and spotlighting theory (McLoughlin, 2005) to understand the encouraging and discouraging factors for women when they decide to pursue (or not pursue) STEM majors.

Gender-Equality Education Paradox

The phenomenon of less gender-equal countries having more women engagement in STEM education as compared to more gender-equal countries has been termed as the gender-equality education paradox (Stoet & Geary, 2019). The authors of the theory explained that this phenomenon could be because women get engaged in STEM degrees in less gender-equal countries to a more considerable extent than more gender-equal countries because of less life-quality pressures and little financial hardships.

Cognitive Consistency Theory

According to the American Psychological Association, cognitive consistency theory combines several theories on attitude to posit that attitude change stems from a desire to maintain consistency among different elements in the cognitive system. There are several sub-theories within the cognitive consistency theory; however, for this article, the focus will be on the balanced identity theory, introduced in the next section.

Balanced identity theory. A derivative of the cognitive consistency theory, balanced identity theory explains the mechanism behind the strengthening of different associations in the cognitive system. One principle of the balanced identity theory is that if there are no connections between two "nodes" and these two are connected to the same third node, then the association between these two nodes should strengthen. For example, if someone strongly associates their identity with the male gender and the male gender with mathematics, then the association between their identity and mathematics would strengthen. (Cvencek et al., 2012)

Social Role Theory

The social role theory aims to explain the gendered imbalance in career interests and choices. This theory proposes that women are more inclined to "people-oriented" jobs and men are more inclined to "things-oriented" jobs. This difference arises from the way households have been organised historically: women usually had to take up the role of a nurturer and a caregiver whereas men held more positions of power, which leads them to pursue more competitive and analytical jobs. (Eagly, 1987)

Learning Styles Theory

While there is some debate on the true definition of learning styles, the definition used by Kulturel-Konak et al. (2011) is that the individual's learning styles are his/her preferred method for perceiving and transforming the information they receive (Mainemelis, Boyatzis, and Kolb, 2001, 2002). For example, women prefer more creative thinking materials and brainstorming as part of the course material, as compared to men (Kulturel-Konak et al., 2011).

Spotlighting Theory

The spotlighting theory aims to explain the reasons women are dissuaded from pursuing STEM majors. Broadly, spotlighting means "the signalling out of women based on gender in ways that make them uncomfortable" (McLoughlin, 2005, p. 374). The intent behind spotlighting might not always be malicious; however, the effects are.

Findings

This study discusses constraining and enabling factors for women in tertiary STEM education, with recommendations identified in the discussion section, drawn from the findings.

Enabling Factors

Active instruction. There are several positive factors that can boost women's participation and persistence in STEM fields. Women prefer classrooms that advocate for active learning environments instead of lecture-based teaching (Kulturel-Konak et al., 2011; Rainey et al., 2019). These active methods of teaching may involve collaborative group work with peers in the classroom, or instructors that follow a "transmission" model of teaching instead of assuming an expert role in the classroom (Barrett, 2005). The studies that researched women's preferences for classroom environments and teaching styles observed and interviewed the student's perception of the teaching methods. Therefore, there might actually be a difference between what type of instruction was used and what the students perceived. Most of the women who dropped STEM majors reported the least levels of active instruction (Rainey et al., 2019). This is a very insightful finding for informing future policies and course changes because the study conducted by Rainey et al. (2019) also found that students perceive more active instruction in the biological sciences as compared to the physical sciences, and women are comparatively well-represented in the biological sciences than the physical sciences. Therefore, women's representation in the physical sciences might be improved if the professors tried to incorporate more active instruction to be more inclusive of different learning styles.

A study by Cohoon (2002) found that women who chose computer science (CS) felt that it offered them the chance to be creative. More women than men prefer course materials that involve creative thinking (Kulturel-Konak et al., 2011). Therefore, it might be worthwhile to explore whether this finding extends to other STEM domains apart from CS. To increase the representation within CS, instructors should discontinue unilateral teaching styles and incorporate assignments involving more opportunities to demonstrate and develop creative thinking skills to encourage more women to pursue STEM.

Importance of community. Most STEM institutional texts in universities place an emphasis on individualism (Parson & Ozaki, 2017). However, most women who persisted in these STEM environments found a community with the faculty and their peers where they felt elements of care (Parson & Ozaki, 2017). These findings can be explained by considering the elements of social role theory. According to this theory, women are more interested in people rather than things. If women feel that STEM is people-centred just like the other majors that they typically pursue and there are elements of community-building and support, they feel more motivated to persist and enrol in these majors. This belongingness factor has also been emphasised to be useful for women for boosting academic achievement and retention in STEM in a study by Rattan et al. (2015) as cited by Kricorian et al. (2020).

Number of women and role models. Role models at different levels (college seniors, faculty members, industry professionals) generally have a positive impact on women. A study by Griffith (2010) found that a higher percentage of females enrolled in STEM field graduate programs in the universities positively impacts the persistence of women in undergraduate STEM majors and also encourages more women to switch into STEM majors. This can be explained by the cognitive consistency theory. As women see other women succeeding in STEM, they might form a strengthening of the association between STEM and females.

Similarly, the same reasoning can be applied to discuss the findings of role model research. In a study that focused on engineering majors, an area of extreme gender disparity within STEM, conducted by Dennehy and Dasgupta (2017), the exposure to successful in-group members (in this case, women) was found to be highly effective to enhance motivation and persistence.

Constraining Factors

Negative stereotypes. There are several prejudices and stereotypes that still exist in STEM institutions pertaining to the interests and capabilities of men and women. Such stereotypes, coupled with tacit and overt sexism, can negatively impact women’s decision to pursue STEM. In a study cited by O'Brien et al. (2020), there was evidence for negative stereotypes harming women’s performance and grades in STEM courses because of social identity threat (Danaher & Crandall, 2008). This can be linked back to the spotlighting theory where women might feel that they have been put in the “spotlight” in their STEM courses because of the lack of numerical representation, thus making them think that the gender stereotypes about STEM might actually be true, which impacts their confidence and performance (Murphy et al., 2007). Not only this, but *the fear of confirmation* of this negative gender stereotype about their capabilities also *affects women’s test performance* in science and math courses (Beilock et al., 2007; Spencer et al., 1999). Rigid curriculum entrenched in stereotypical male environments also dissuades women from choosing engineering and makes it harder for them to persist in engineering (Potvin et al., 2018). These findings can be explained by cognitive consistency theory because women might unknowingly change their implicit perception of their capabilities according to gender stereotypes, and this gets reflected explicitly in their performance on the tests.

Particularly for computer science, women feel that the typical notion of CS majors conflicts with their gender identity. They feel that the "nerdy" behaviour associated with these majors and lack of social interaction does not align with their gender identities, so they do not pursue these majors despite having the abilities (Cross & Madson, 1997; Markus & Kitayama, 1991). Women's perceptions and interests in computing majors might again be reshaped to maintain "balance" with the ideas of their "self" and their academic goals, as explained by the balanced identity theory.

Role of globalisation and development. Perhaps the most surprising of the findings about women's engagement in STEM is that as national gender equality increases, the participation of women in STEM decreases (Stoet and Geary, 2019). A study conducted in Cambodia also found that there was more women engagement in STEM in less developed parts of the country as compared to the urbanised areas (Perez-Felkner et al., 2020). One way that the study aims to explain this finding is that globalisation and the ideologies it brings along with it reach the urban and more developed areas first as compared to the rural areas. Thus, globalisation ends up bringing gendered ideologies, which take an effect on how women choose their majors. However, according to Stoet and Geary (2019), women tend to engage in STEM in less developed areas more because of economic hardships and due to the awareness of the higher salaries that STEM jobs can help them attain. When they do not face these financial constraints in more developed areas, they choose majors that interest them more and suit their academic strengths. However, several findings about this study were contested, and the use of the Global Gender Gap Index (GGGI) was debated because it measures only gender parity and not how that parity was achieved (Thomson, 2017; Richardson et al., 2020). Further, Richardson et al. (2020) also could not replicate some of the findings of the study. Stoet and Geary (2020) defended their use of GGGI as being in many psychological and social sciences studies, as it is the only gender-gap index that is reported annually. Moreover, some studies have also reported that gender stereotypes in STEM and career-based decisions are stronger in more affluent countries (Cheryan & Plaut, 2010; Spencer et al., 1999). This needs a lot of extensive research to understand how this happens and how to prevent this "surface-level" of equality in these countries (and establish gender equality at the grassroots). To conclude, the gender equality education paradox needs more research about its existence and needs better measures that academia can agree upon to validate the findings.

Discussion

This study has explored the enabling and constraining factors for women's participation in tertiary STEM education. Moreover, these factors have been explored from the lens of different theories and perspectives to understand the complex dynamics of women's decision-making process around their majors and career choices. One common theme that emerges across enabling and constraining factors is women's desire for community in STEM majors. As mentioned above, women have persisted in STEM majors when they felt supported and found an inclusive space; however, women switched out of these majors when they felt the lack of active instruction and support in the STEM departments. Another common theme across enabling and constraining factors is that women experienced social identity threat in STEM settings because of negative gender stereotypes; however, in the institutions that had a higher female representation in STEM, more undergraduate women also enrolled in STEM. Along with these factors, the study also explored how women's participation differs in more gender-equal vs less gender-equal countries, and there seem to be more gendered ideals entrenched in more developed countries as compared to less developed countries. However, further research is needed to confirm this because of the debated findings.

These are several tried and tested recommendations that can help in increasing women’s participation and confidence in their STEM abilities. Actively encouraging women to participate in internships and teaching assistantships can bolster their confidence (Beyer et al., 2003). Moreover, value affirmation can be particularly beneficial for women. In this intervention, students note what values are important to them, and this method has been found to help women who endorse negative gender stereotypes the most (Miyake et al., 2010). Spotlighting also needs to be handled in order to reduce the barriers that dissuade women from choosing STEM. While there need to be institutional policies for tacit and overt sexism, there is another form of spotlighting that affects women. Programs designed to help women, like “Women in STEM”, while often helpful, end up reinforcing the stereotype that women are not as capable as men and need extra help to succeed in STEM (McLoughlin, 2005). The benefits of these programs should be retained and be available to whoever needs help, instead of spotlighting women. Lastly, universities need to take into account how their STEM curricula are gendered and how they are promoting a masculine environment by not supporting all forms of learning styles. Acknowledging this and framing appropriate policies can help more women be more open to the possibility of getting a career in STEM.

There are several limitations to this research study. Because of the short duration of the project and the qualitative nature of the study, an extensive literature review could not be conducted and findings could not be replicated. Moreover, the literature reviewed in this study studies women’s participation in STEM in the US mostly, and, therefore, the findings can not be generalised.

Future research should look at the factors for women’s participation in other countries, particularly developing countries to understand cross-national differences that arise in various countries. Also, the gender-equality education paradox needs to be studied extensively in future research in this area to understand if it exists or not. Future projects should also look at the mechanism of implicit social cognition that gives rise to changes in women’s perceptions of their STEM identities and how to intervene to prevent it from happening.

References

Barrett, K. R. (2005). Gender and differences in online teaching styles. *Encyclopedia of Gender and Information Technology*, 372–377. https://doi.org/10.4018/978-1-59140-815-4.ch058

Beilock, S. L., Rydell, R. J., & McConnell, A. R. (2007). Stereotype threat and working memory: Mechanisms, alleviation, and spillover. *Journal of Experimental Psychology: General*, *136*(2), 256–276. https://doi.org/10.1037/0096-3445.136.2.256

Beilock, S. L., Rydell, R. J., & McConnell, A. R. (2007). Stereotype threat and working memory: Mechanisms, alleviation, and spillover. *Journal of Experimental Psychology: General*, *136*(2), 256–276. https://doi.org/10.1037/0096-3445.136.2.256

Beyer, S., Rynes, K., Perrault, J., Hay, K., & Haller, S. (2003). Gender differences in computer science students. *ACM SIGCSE Bulletin*, *35*(1), 49–53. https://doi.org/10.1145/792548.611930

Cheryan, S., & Plaut, V. C. (2010). Explaining underrepresentation: A theory of precluded interest. *Sex Roles*, *63*(7-8), 475–488. https://doi.org/10.1007/s11199-010-9835-x

Cohoon, J. M. G. (2002). Recruiting and retaining women in undergraduate computing majors. *ACM SIGCSE Bulletin*, *34*(2), 48–52. https://doi.org/10.1145/543812.543829

Cross, S. E., & Madson, L. (1997). Elaboration of models of the Self: Reply to Baumeister and Sommer (1997) and Martin AND Ruble (1997). *Psychological Bulletin*, *122*(1), 51–55. https://doi.org/10.1037/0033-2909.122.1.51

Cvencek, D., Greenwald, A. G., & Meltzoff, A. N. (2012). Balanced identity theory Review of Evidence for Implicit Consistency in Social Cognition. In B. Gawronski & F. Strack (Eds.), *Cognitive consistency a fundamental principle in social cognition* (pp. 157–177). story, Guilford Press.

Danaher, K., & Crandall, C. S. (2008). Stereotype threat in applied Settings re-examined. *Journal of Applied Social Psychology*, *38*(6), 1639–1655. https://doi.org/10.1111/j.1559-1816.2008.00362.x

Dennehy, T. C., & Dasgupta, N. (2017). Female peer mentors early in college increase women's positive academic experiences and retention in engineering. *Proceedings of the National Academy of Sciences*, *114*(23), 5964–5969. https://doi.org/10.1073/pnas.1613117114

Eagly, A. H. (1987). Sex differences in social behavior. *L. Erlbaum Associates*. https://doi.org/10.4324/9780203781906

Greenwald, A. G., Banaji, M. R., Rudman, L. A., Farnham, S. D., Nosek, B. A., & Mellott, D. S. (2002). A unified theory of implicit attitudes, stereotypes, self-esteem, and self-concept. *Psychological Review*, *109*(1), 3–25. https://doi.org/10.1037/0033-295x.109.1.3

Kolb, D. A., Boyatzis, R. E., & Mainemelis, C. (2001). Experiential Learning Theory: Previous research and New Directions. *Perspectives on Thinking, Learning, and Cognitive Styles*, 227–248. https://doi.org/10.4324/9781410605986-9

Kricorian, K., Seu, M., Lopez, D., Ureta, E., & Equils, O. (2020). Factors influencing participation of underrepresented students in stem fields: Matched mentors and mindsets.*International Journal of STEM Education*, *7*(1). https://doi.org/10.1186/s40594-020-00219-2

Kulturel-Konak, S., D'Allegro, M. L., & Dickinson, S. (2011). Review of gender differences in learning STYLES: Suggestions for STEM Education. *Contemporary Issues in Education Research (CIER)*, *4*(3), 9–18. https://doi.org/10.19030/cier.v4i3.4116

Mainemelis, C., Boyatzis, R. E., & Kolb, D. A. (2002). Learning styles and adaptive flexibility. *Management Learning*, *33*(1), 5–33. https://doi.org/10.1177/1350507602331001

Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review*, *98*(2), 224–253. https://doi.org/10.1037/0033-295x.98.2.224

McLoughlin, L. A. (2005). Spotlighting: Emergent gender bias in undergraduate engineering education. *Journal of Engineering Education*, *94*(4), 373–381. https://doi.org/10.1002/j.2168-9830.2005.tb00865.x

Miyake, A., Kost-Smith, L. E., Finkelstein, N. D., Pollock, S. J., Cohen, G. L., & Ito, T. A. (2010). Reducing the gender achievement gap in college science: A classroom study of values affirmation. *Science*, *330*(6008), 1234–1237. https://doi.org/10.1126/science.1195996

Murphy, M. C., Steele, C. M., & Gross, J. J. (2007). Signaling Threat How Situational Cues Affect Women in Math, Science, and Engineering Settings. *Psychological Science*, *18*(10), 879–885. https://doi.org/10.1111/j.1467-9280.2007.01995.x

Nosek, B. A., & Smyth, F. L. (2011). Implicit social cognitions predict sex differences in math engagement and achievement. *American Educational Research Journal*, *48*(5), 1125–1156. https://doi.org/10.3102/0002831211410683

O'Brien, L. T., Garcia, D. M., Blodorn, A., Adams, G., Hammer, E., & Gravelin, C. (2020). An educational intervention to improve women's academic stem outcomes: Divergent effects on well-represented vs. underrepresented minority women. *Cultural Diversity and Ethnic Minority Psychology*, *26*(2), 163–168. https://doi.org/10.1037/cdp0000289

Parson, L., & Ozaki, C. C. (2017). Gendered student ideals in stem in higher education. *NASPA Journal About Women in Higher Education*, *11*(2), 171–190. https://doi.org/10.1080/19407882.2017.1392323

Perez-Felkner, L., Felkner, J. S., Nix, S., & Magalhães, M. (2020). The puzzling relationship between international development and gender equity: The case of STEM postsecondary education in Cambodia. *International Journal of Educational Development*, *72*, 102102. https://doi.org/10.1016/j.ijedudev.2019.102102

Potvin, G., McGough, C., Benson, L., Boone, H. J., Doyle, J., Godwin, A., Kirn, A., Ma, B., Rohde, J., Ross, M., & Verdin, D. (2018). Gendered interests in electrical, computer, and Biomedical Engineering: Intersections with career Outcome expectations. *IEEE Transactions on Education*, *61*(4), 298–304. https://doi.org/10.1109/te.2018.2859825

Rainey, K., Dancy, M., Mickelson, R., Stearns, E., & Moller, S. (2019). A descriptive study of race and gender differences in how instructional style and perceived professor care influence decisions to major in stem. *International Journal of STEM Education*, *6*(1). https://doi.org/10.1186/s40594-019-0159-2

Richardson, S. S., Reiches, M. W., Bruch, J., Boulicault, M., Noll, N. E., & Shattuck-Heidorn, H. (2020). Is there a GENDER-EQUALITY paradox in science, technology, engineering, and Math (STEM)? Commentary on the study BY STOET and Geary (2018). *Psychological Science*, *31*(3), 338–341. https://doi.org/10.1177/0956797619872762

Smyth, F. L., & Nosek, B. A. (2015). On the gender–science stereotypes held by scientists: Explicit accord with gender-ratios, implicit accord with scientific identity. *Frontiers in Psychology*, *6*. https://doi.org/10.3389/fpsyg.2015.00415

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. https://doi.org/10.1006/jesp.1998.1373

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. https://doi.org/10.1006/jesp.1998.1373

Stoet, G., & Geary, D. C. (2019). Corrigendum: The gender-equality paradox in science, technology, engineering, and mathematics education. *Psychological Science*, *31*(1), 110–111. https://doi.org/10.1177/0956797619892892

Thomson, S. *How Rwanda beats the United States and France in gender equality*. World Economic Forum. Retrieved September 14, 2021, from https://www.weforum.org/agenda/2017/05/how-rwanda-beats-almost-every-other-country-in-gender-equality/.

Xue, Y., & Larson, R. (2015). Stem crisis or stem surplus? Yes and yes. *Monthly Labor Review*. https://doi.org/10.21916/mlr.2015.14