
Mapping the Integrated Research Landscape on Gender and Teamwork in Higher Education: 2000-2016

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CONTEXT

Employers and education researchers alike increasingly advocate teamwork as a means of developing skills that engineering graduates need, and accreditation bodies consider the ability to both lead and function on teams as an important outcome for engineering graduates. At the same time, we know that teamwork can be a site for the manifestation of gender biases. The literature is full of conflicting findings on how teamwork can promote and/or hinder diversity in education, and those conflicting findings need to be made sense of so that best practices can be implemented. To that end, we are conducting an integrated literature review of higher education research on gender and teamwork. This paper builds on and advances other meso-level analyses of gender in engineering education research that have been published over the past decade.

PURPOSE

The purpose of this paper is to analyse the higher education research landscape related to gender and teamwork with the aim of identifying how it should inform engineering educators' practices, and how it should inform future engineering education research.

APPROACH

This paper is a meso-level analyses of higher education journal articles published between 2000 and 2016. An international dataset of 54 articles about gender and teamwork, primarily from engineering and business fields, was analysed. As a first step in mapping that body of literature, this paper presents findings on geographic and disciplinary origins, methods utilized, topics studied, and gaps that future research should address.

RESULTS

The leading topics investigated were: effects of team composition; student perceptions and/or experiences; self and/or peer evaluation; and learning styles. Across the board, findings were mixed, such that it is hard to draw conclusions related to any facet of teamwork based on this integrated, multidisciplinary dataset. Similar to prior meso-level analyses in engineering education, we found that almost all articles utilized quantitative methods and very few engaged gender theories.

CONCLUSIONS

Several limitations of the research landscape are important to highlight: 1) dominant research designs and questions may not be the best for capturing the experiences of minority groups or understanding gender in teamwork; 2) important findings from books and conference papers are not yet reflected in the articles; and 3) use of ill-supported concepts, such as learning styles and Myers-Briggs, instead of gender theories is problematic, and future research should more deeply engage gender theories. If possible, a systematic metaanalysis of this dataset would be useful, and, given the mixed results present in the dataset, researchers should be cautious about claiming teamwork is inherently good for diversity.

KEYWORDS

Gender, teamwork, PBL

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Introduction

Teamwork is increasingly seen as an important component of engineering education programs (Borrego, Karlin, McNair, & Beddoes, 2013; Male, Bush, & Chapman, 2010, 2011; Paretti, Cross, & Matusovich, 2014; Purzer, 2011). Employers and education researchers alike advocate teamwork as a means of developing skills that engineering graduates need (Purzer, 2011), and Engineers Australia considers the ability to lead and function on teams as an important outcome for engineering graduates (Engineers Australia, 2016). However, “despite the clear emphasis on teamwork in engineering and the increasing use of student team projects, our understanding of how best to cultivate and assess these learning outcomes in engineering students is sorely underdeveloped (McGourty et al., 2002; Shuman, Besterfield-Sacre, & McGourty, 2005)” (Borrego, Karlin, McNair, Beddoes, 2013, p. 473).

One aspect in which this is particularly true is understanding how to best cultivate and assess the inclusivity of teamwork, and understanding the ways in which teamwork does and does not support diversity in engineering. In order to advance discussions on those topics and synthesize the dispersed body of research on gender and teamwork in higher education, we are conducting a meso-level literature review of articles published between 2000 and 2016. This paper is a first step in mapping that body of literature. Where does it come from? What methods are being used to answer what questions? What kinds of questions and topics are being explored and which are not? What theories are being engaged? What gaps can be identified? By providing an integrated analysis of the higher education research landscape, this paper joins other meso-level analyses of the gender and engineering education research and responds to calls for more such analyses (Beddoes, Borrego, & Jesiek, 2009; Jesiek & Beddoes, 2013; Pawley, Schimpf, & Nelson, 2016.) Meso-level analyses are midway between purely quantitative and purely qualitative publication analyses, combining aspects of both.

Methods

EBSCO host, which includes multiple databases such as Academic Search Premier, Educational Research Complete and ERIC, was searched for articles about gender and teamwork. Most engineering education journals and higher education journals were all found within EBSCO host, though often the most recent one to one and a half years of articles were unavailable. With that in mind, *European Journal of Engineering Education (EJEE)*, *Journal of Engineering Education (JEE)*, *Journal of Higher Education*, *Studies in Higher Education*, and *Research in Higher Education* were individually searched for any missing articles from recent years. Originally, only publications that referred to engineering were included, but due to the limited amount of research found in engineering, the scope was expanded to STEM contexts, and subsequently even further to all post-secondary contexts. Expanding the search to all post-secondary contexts was done in order to provide readers with a comprehensive review of relevant issues. An extensive list of search words and word combinations was utilized, including the terms *gender*, *female*, *women*, *education*, *STEM*, *team work*, *group work*, and *sex*. The combinations of terms are specified in Table 1 and Table 2. In order to yield a manageable dataset of the most relevant journal articles, the scope was limited to articles published between 2000 and 2016 and to research articles directly related to higher education contexts. Limiting the search to traditional higher

education contexts excluded articles related to health care professionals, primary education (K-12) contexts, and online courses (due to their different considerations). Our search also excluded certain types of publications that were not strictly research articles (e.g., panel summaries, teacher reflections, and descriptions of implementation activities).

Table 1. EBSCO host search

Terms	Combined with
Education, gender and	<ul style="list-style-type: none"> • Team/s • Teamwork/team work • Groupwork/group work • PBL
Education, women and	
Education, female and	
Education, gender, STEM and	
Education, women, STEM and	
Education, female, STEM and	

Table 2. Individual journal searches

Terms	Combined with
Team/teamwork/team work and	<ul style="list-style-type: none"> • Gender • Sex • Women
Group/Groupwork/group work and	
PBL and	

After the exclusion criteria were applied, the dataset yielded 54 articles for analysis. Fifty-one of those are accounted for in the Findings below. The remaining three will be included in our systematic literature review, but are of a different sort than the rest of the dataset, e.g. a metaanalysis or report. As with any dataset, there are limitations to note. In order to scope a manageable dataset, we were not able to include non-English language articles, books, or conference papers.

Findings and Discussion

Our first research question concerned the origins of the research, both in the geographic and disciplinary sense. Table 3 presents the geographic origins of the dataset, showing that the vast majority came from the United States, with Europe and Australia contributing the second and third highest numbers, respectively. There was only one international collaboration present in the dataset; it was between Qatar and the United States.

Table 3. Geographic origins

Country	Number
United States	24
Australia	5
United Kingdom	4
Denmark	2
The Netherlands	2
Turkey	2
Qatar and United States	1
Belgium, Canada, China, France, India, Malaysia, Norway, South Africa, South Korea, Spain, United Arab Emirates	1 each

Table 4 presents the disciplinary origins of the dataset. Discipline was assigned based on the setting in which the study was conducted, not necessarily the researchers' fields. *Business* includes business, economics, organizational behaviour and management articles. *Sciences* includes physical and health sciences. *Multiple disciplines* included articles with more than four disciplines represented, usually with engineering and business among them.

Table 4. Disciplinary origins

Discipline	Number
Engineering	17
Business	11
Sciences	5
Multiple disciplines	5
Computer science and information systems	3
Science and Engineering	2
Education	2
Psychology	2
Education and Marketing	1
Hospitality, Geography, Music	1 each

As summarized in Table 5, the vast majority (80%) of the dataset was quantitative studies, either purely quantitative data or quantification of qualitative data. Even in the mixed methods studies, the quantitative data was prioritized, with qualitative data being secondary. This finding further confirms the dominance of quantitative research documented in other studies of gender research in engineering education (Beddoes, 2012; Pawley, Schimpf & Nelson, 2016). The quantitative data was primarily from student surveys. Self and peer evaluations, or, to a lesser extent, student surveys combined with course marks/grades. Over the course of 16 years, only 4 qualitative articles were found. That is striking and important to note because quantitative methods, and student surveys in particular, may not be the ways to identify and explore problems. Indeed, recent research shows that engineering professors recognize that peer evaluations are not likely to capture instances of gender bias or discrimination if they occur (Beddoes & Panther, 2017).

Table 5. Methods utilized

Methods	Number
Quantitative	38
Mixed quantitative and qualitative	6
Qualitative	4
Quantification of qualitative data	3

The leading topics being investigated in the dataset were students' perceptions, experiences, and attitudes related to teamwork; the effects of different team compositions; self and/or peer evaluations, and learning styles. Other topics included evaluation of women's contributions and expertise and comparison of lecture to teamwork. Across the board, findings on these topics were mixed, and often contradictory, such that it is hard to draw conclusions related to any facet of teamwork based on this integrated, multidisciplinary dataset. The research in the dataset does not build on prior work or present a trajectory of comprehensive development in any way. This lack of systematic development limits the ability to draw conclusions or make recommendations for best practices because there is not sufficient research on any one topic. For example, the "team composition" category included studies that examined the effects of team composition on: motivation, team quality, cognitive complexity, class performance, final report, interactions, satisfaction, diversity management skills, self-efficacy, learning, idea variety, and innovation, to name just a few. Thus, there are a small number of studies on a larger number of topics, rather than systematic development of knowledge related to a core set of questions.

In addition to the systematic lack of development, the lack of engagement with gender studies or theories was striking. Although there were several notable exceptions, instead of engagement with gender studies research, it was more common to see authors utilizing ill-supported concepts, such as learning styles and Myers-Briggs, to frame their studies.

Conclusion and Next Steps

This meso-level analysis identified several limitations of the higher education research landscape related to gender and teamwork. First, the dominant research designs and approaches may not be the best for capturing the experiences of minority groups or understanding gender in teamwork. Similar to prior meso-level analyses in engineering education, we found that almost all articles utilized quantitative methods. Second, important findings on gender biases in teamwork from books and conference papers are not being built upon. While this may be understandable in the case of some conference papers which have come out in recent years (see Meiksins et al., 2016 and 2017), it is a problem in the case of books such as *On The Outskirts of Engineering*, which was published in 2007 (Tonso, 2007). Third, the use of ill-supported concepts, such as learning styles and Myers-Briggs, instead of gender theories is problematic, and future research should more deeply engage with gender theories. Fourth, the lack of consensus in the dataset, combined with the lack of systematic development, makes it difficult to draw conclusions or make recommendations. What can be recommended is that researchers should stop making unqualified claims that teamwork necessarily or automatically supports diversity or helps women. Many studies in the dataset (as well as others not in the dataset) do not support such claims. Those interested in advocating teamwork should equally account for the studies that do not support their aims. Otherwise, we risk implementing pedagogical practices that perpetuate the very problem they were intended to solve. By including our dataset as an appendix at the end of this paper, we hope to make that more feasible for others.

In sum, much more research is needed, and that research will be most useful if a research agenda for gender and teamwork in higher education was developed and followed. If the community developed a list of questions and then set about to systematically investigate them, instead of one or two articles about 35 different topics, we could begin to systematically develop evidence across contexts that would eventually allow a sufficient body of knowledge upon which to make claims and draw recommendations. With or without such an agenda, future research should include greater use of qualitative methods, feminist methodologies, and gender theories.

For our part, our next steps, we will be adding 2017 articles to the dataset, analysing in greater depth the theory and findings in the dataset, and writing a systematic literature review.

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Appendix: Dataset

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