Gender and Diversity in a Problem and Project Based Learning Environment: A Book Review

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Abstract
"Gender and Diversity in a Problem and Project Based Learning Environment" by Xiangyun Du is a pioneering exploration of the intersection between pedagogical innovation and gender diversity in engineering education. This book expertly navigates the challenges of achieving gender inclusivity in male-dominated disciplines while showcasing the transformative potential of Problem-Based Learning (PBL) methodologies. Through insightful case studies, critical analyses, and a rich synthesis of research findings, Du presents a compelling argument for the effectiveness of PBL as a catalyst for fostering diversity and equity in engineering education. Her work not only informs but also inspires positive change, making it an indispensable resource for educators, researchers, and policymakers striving to create more inclusive and equitable engineering education.

Keywords: diversity, gender equality, inclusivity, pedagogy, women empowerment.

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Introduction

Gender and Diversity in a Problem and Project Based Learning Environment is authored by Xiangyun Du, Professor from the Department of Learning and Philosophy; and also, a Director at UNESCO Centre for Problem and Project-based Learning, Aalborg University, Denmark. Having earned her academic degrees in engineering education (master's degrees at Linköping University, Sweden, and Roskilde University, Denmark, and a PhD degree at Aalborg University, Denmark), she has been committed to research in educational transformation through pedagogical change using Problem-Based and Project-Based Learning methodology) – in diverse social, cultural, and educational contexts. Having worked in fields of development ranging from engineering, STEM, teaching preparation, language teaching, business to health (medicine, dental, and public health sciences) education, etc.), her research topics included change from an inter/cross-cultural perspective, curriculum and pedagogy development, faculty/staff/ teacher development, intercultural learning and teaching, and gender studies.

Based on her expertise in PBL, in this book, Du's main argument revolves around the pivotal question of whether PBL can serve as a viable solution to the prevalent issue of a dearth of university students pursuing engineering and technology studies, particularly focusing on the underrepresentation of women in these fields. At the core of her book is the exploration of how the PBL environment, implemented in engineering education, can foster gender diversity and inclusivity. Through a comprehensive examination of learning experiences among engineering students in Denmark, Du delves into the intricate interplay between PBL methodologies and their potential to create a more welcoming and supportive space for diverse groups, with a particular emphasis on women.

The larger point of this book extends beyond a mere exploration of pedagogical techniques; it seeks to shed light on the broader implications of gender diversity in engineering education. By analyzing the various dimensions of PBL, Du aims to contribute valuable insights into transforming not only teaching methodologies but also the overall culture within engineering disciplines. The book underscores the importance of creating an environment that accommodates diverse learning styles and perspectives, ultimately making a compelling case for the integration of PBL as a means to address the gender disparity prevalent in engineering and technology fields.

Readers should care about this book because it offers a nuanced perspective on a critical issue within higher education. In an era where diversity and inclusion are paramount, Du's work serves as a guide for educators, policymakers, and anyone interested in fostering equitable opportunities in STEM fields. The comprehensive research and ethnographical study

presented in the book provide practical insights and evidence-based strategies for creating an educational landscape that not only attracts but also nurtures a diverse cohort of engineering students. Ultimately, Du invites readers to contemplate the transformative potential of PBL in shaping the future of engineering education by breaking down barriers and encouraging participation from individuals of all backgrounds and genders.

This book has 326 pages and contains 10 chapters consisting of Introduction; PBL Environment for Gender Diversity in Engineering Education; Understanding Learning; Gender Understanding; Gendered Ways of Learning in Engineering Education; Research on Gender Diversity in Engineering Education; Studying Electrical and Electronics Engineering; Studying Architecture and Design Engineering; Gender and Learning in Engineering Education; and Conclusion: Is PBL a Recipe to Gender Diversity?

Summary and opinions

The book unfolds a series of key arguments that collectively lead to its overarching view. Du begins by positioning PBL as a potential pedagogical solution to the prevalent issue of low enrolment in engineering and technology programs. She intricately examines the dynamics of learning within the PBL framework, shedding light on how this methodology influences students' engagement and understanding in engineering education. The exploration of gender understanding and the identification of gendered ways of learning contribute to a deeper understanding of diversity within this educational context. Building upon existing research on gender diversity in engineering education, Du conducts an ethnographical study of engineering students in Denmark, providing rich qualitative data as evidence. Furthermore, specific case studies in electrical and electronics engineering, and architecture and design engineering offer nuanced insights into how gender dynamics manifest in these disciplines. The evidence supporting these arguments ranges from statistical data on enrolment trends to interviews and surveys capturing diverse perspectives. The concluding chapter weaves these threads together, culminating in the central question: Is PBL a recipe for gender diversity in engineering education? In essence, the book presents a comprehensive and well-supported exploration of the transformative potential of PBL in addressing the broader issue of gender representation in engineering fields.

In the first chapter of this book, readers gain the idea which sets the stage for the book's central inquiry and the context in which the research was conducted. The second chapter, PBL Environment for Gender Diversity in Engineering Education, is instrumental in setting the stage for the book's central theme and exploring the implications of PBL for promoting gender diversity in engineering education. It outlines the key principles and characteristics of PBL and establishes its relevance in addressing issues of gender diversity within engineering programs. The chapter defines PBL as an instructional approach that centers on students' active engagement in solving real-world problems. Students work collaboratively, applying their knowledge and critical thinking skills to address complex, authentic challenges. The PBL environment is characterized by its emphasis on student-centered learning and problem-solving (Hmelo-Silver, 2004).

The chapter also acknowledges the persistent gender gap in engineering and technology fields. It recognizes that women and other underrepresented groups are often underrepresented in engineering programs, and this lack of diversity has implications for both the workforce and societal equity.

The highlighted key themes:

- Collaborative Learning: The chapter underscores how PBL encourages collaborative learning, where students work together in small groups to tackle complex problems. This collaborative approach can promote diversity and inclusivity by valuing the contributions of all students and fostering a sense of belonging (Peña & de les Valls, 2023).
- Active Learning: PBL places a strong emphasis on active, hands-on learning. This can be particularly empowering for female students, as it allows them to engage with the subject matter directly and build confidence in their problem-solving abilities (Felder & Brent, 2007).
- Real-World Relevance: PBL often involves real-world, authentic problems. By connecting learning to practical applications, it can make engineering education more appealing and relevant to a diverse range of students (Chen et al., 2023).
- Student-Centered Approach: The student-centered nature of PBL acknowledges and values the individual experiences and perspectives of learners. This approach can help address implicit biases and create an equitable learning environment (Gray, 2023).

The third and fourth chapter, Understanding Learning and Gender Understanding explores the foundations of learning theory and its application in PBL settings, provides a critical theoretical foundation for the book's exploration of gender diversity in engineering education within the context of PBL. By examining established learning theories and their applicability to PBL, the chapter highlights the potential for PBL to create an inclusive and equitable learning environment. This understanding is vital in addressing the gender gap in engineering education and ensuring that all students have equal opportunities for success. By its nature, PBL challenges traditional teaching methods and stereotypes associated with gender roles. Female students, as well as their male counterparts, are given equal opportunities to take on

various roles within the problem-solving process, challenging preconceived notions about gender-specific capabilities in engineering (Bellamy, 2023). The chapter starts by defining and discussing various learning theories, including behaviourism, constructivism, and socio-cultural theories. These theories provide the foundation for understanding how individuals acquire knowledge, skills, and attitudes (Crawley, 2014). The chapter sets the stage for later discussions by demonstrating how an understanding of learning theories can inform the design of PBL activities that are sensitive to gender differences in learning styles. It hints at the potential for tailored PBL experiences that can engage and support all students, regardless of their gender.

Chapter 5, 6 and 9 explores the existing literature and research findings regarding gender differences in learning styles and preferences; and investigates how gender can influence learning approaches and behaviours within the engineering context; and highlighting the gaps and challenges. It examines how societal expectations and stereotypes can shape students' approaches to learning, particularly in male-dominated fields like engineering. The chapter delves into the cultural and social factors that contribute to gendered ways of learning. It considers how societal norms and expectations, as well as the prevailing engineering culture, can influence the learning experiences of female students. By investigating how gender influences learning approaches, the chapter uncovers both the challenges that female students may face in engineering education and the opportunities to create more inclusive learning environments. It discusses strategies to address these challenges and promote diversity.

Chapter 7 and 8 present case studies on Electrical and Electronics Engineering; and Architecture and Design Engineering where it shows how PBL can be tailored to meet the needs of students in different engineering subfields, offering insights that can be applied in various educational settings. The chapters underline the adaptability and efficacy of PBL and Project based learning (PjBL) in promoting gender diversity and inclusivity within engineering, including traditionally male-dominated subfields. Architecture and design fields emphasize creativity, collaboration, and problem-solving. The chapter explores how these aspects can create an inclusive environment and align with PBL principles. It also showcases practical applications of PBL in architecture and design engineering programs, illustrating how these methodologies can foster a more diverse and inclusive cohort of students. Moreover, the chapter addresses the unique challenges that female students may face in these creative fields and the opportunities for innovation and pedagogical change.

Final chapter, Conclusion: Is PBL a Recipe to Gender Diversity?, has the shortest pages among the rest. It wraps up the book's core arguments and addresses the pivotal question of whether PBL can facilitate gender diversity in engineering and technology education. The chapter revisits the key arguments and themes explored throughout the book, including the role of PBL in promoting gender diversity, the impact of gender on learning approaches, and the practical applications of these concepts in specific engineering subfields. It synthesizes the research insights and findings presented in earlier chapters, emphasizing the contributions of PBL to creating more inclusive and equitable learning environments. The chapter critically evaluates the evidence presented and considers the strengths and limitations of PBL as a strategy for achieving gender diversity. It acknowledges the complexities and nuances involved in addressing this issue. While drawing conclusions, the chapter looks forward and considers the future of gender diversity in engineering and technology education. It may offer recommendations for future research, policy, and pedagogical practices.

This book has left an indelible impact on me, primarily owing to its compelling exploration of the transformative role of PBL in addressing gender diversity in engineering education. Du's adept ability to seamlessly blend theoretical concepts with real-world applications was a standout feature, creating a narrative that marries academic rigor with practical insights. The depth of her ethnographical study, centered on engineering students in Denmark, not only illuminated the challenges within the PBL framework but also offered a nuanced understanding of the opportunities it presents. Du's examination of gendered ways of learning presented a revolutionary argument that challenges conventional perspectives, suggesting that innovative pedagogical approaches can effectively break down gender barriers in STEM fields (Duo, 2023). The inclusion of specific case studies, statistical data, and interviews enhanced the overall persuasiveness of her overarching argument, making it more convincing and applicable. Despite these strengths, it is worth noting that a more explicit acknowledgment of potential limitations or alternative viewpoints could have added nuance to the narrative. Nevertheless, Du's work emerges as an innovative and thought-provoking contribution to the discourse on gender diversity in STEM, offering tangible solutions and inspiring hope for a more inclusive future in engineering education.

Conclusion

This book holds significant implications for educational researchers, policymakers, and educators. This comprehensive work successfully combines two vital areas of educational research and practice: the application of PBL and the promotion of gender diversity within engineering and technology education. Throughout the book, Du meticulously explores the intersection of pedagogical methods and gender inclusivity. She addresses the central question

of whether PBL can serve as a recipe for achieving gender diversity in engineering education. Through well-researched chapters, Du not only presents a strong theoretical foundation but also offers practical insights and case studies from specific engineering subfields. The book takes an interdisciplinary approach, drawing from the fields of education, gender studies, and engineering, to provide a well-rounded perspective. It identifies the challenges and barriers that female students often face in male-dominated disciplines and emphasizes the importance of creating an inclusive learning environment. The book serves as a valuable resource for educators, researchers, and policymakers seeking to enhance gender diversity in engineering education. It offers practical strategies and recommendations for implementing PBL methodologies and tailoring them to address the unique needs of diverse student populations.

In conclusion, "Gender and Diversity in a Problem and Project Based Learning Environment" is a well-structured and informative book that tackles an important issue in engineering education. By examining the potential of PBL to bridge the gender gap in engineering and technology fields, Du's work not only informs but also inspires positive change. This book is an essential read for anyone dedicated to fostering diversity and inclusivity in engineering education and serves as a beacon of hope for a more equitable future in these critical fields.

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