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Gender Stereotypes and Bias as Depicted in STEM Textbooks of School Education: Insight from Systematic Literature Review

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ABSTRACT
STEM education is vital for fostering creativity and critical thinking among students. Researching gender bias in STEM textbooks is crucial as these materials significantly influence students' perceptions of gender roles, career aspirations, and cultural beliefs, potentially perpetuating inequalities in STEM fields. This review paper examines five aspects of gender portrayal in STEM textbooks: (i) language and terminology, (ii) visual representation, (iii) professional and occupational roles, (iv) games and leisure activities, and (v) cultural and regional differences. Employing a Systematic Literature Review (SLR) methodology, the study analyzed 39 selected papers from databases like Web of Science, Scopus, Springer Link, Google Scholar, Semantic Scholar, and ERIC, spanning 2004 to 2024. The findings highlight a dominant male presence in leadership roles and adventurous activities, while females are underrepresented or confined to passive and domestic settings. Female achievements are often minimized across cultures and regions. These insights offer valuable guidance for textbook developers, authors, and educators to design gender-sensitive curricula and educational materials. Future research could explore the long-term impact of such biases on students' career choices and societal attitudes.

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INTRODUCTION

Textbooks are indispensable educational materials that provide essential knowledge and significantly influence students' thoughts, shaping individual and societal behavior (Xenofontos, 2024; Subedi, 2021). The content and messages conveyed in textbooks can impact children's cognitive, affective, and social development through implicit or explicit images and written narratives (Nurlu, 2021). A particularly critical area is the depiction of gender stereotypes and biases in STEM textbooks, which can influence students' perceptions of gender roles in science, technology, engineering, and mathematics (STEM) fields (Papadakis, 2018; Lindsey & Jones, 2013; Barker & Aspray, 2006). Textbooks have the potential to shape learners' cultural heritage and contribute to the formation of their gender identity, while also impacting gender stereotypes and social power dynamics (Karama, 2020; Ullah et al., 2017). The reinforcement of traditional gender roles in educational materials often leads to a significant underrepresentation of women in STEM professions, perpetuating the gender gap (Nielsen & Matheson, 2017; Smith & Wilson, 2014; Walker & Huang, 2021). School education, particularly at the primary level, is crucial in molding attitudes, imparting knowledge, and

combating gender biases (Java & Parcon, 2016). Textbooks are integral to this process, contributing to instilling desirable attitudes in children and reinforcing or challenging gender models for boys and girls (Guichot-Reina & De la Torre-Sierra, 2023). Addressing gender stereotypes in STEM textbooks is essential for promoting gender equality in education and ensuring that all students, regardless of gender, are encouraged to engage in STEM subjects (Gardiner, 2011; Davis & Hall, 2020). By critically analyzing the content of these textbooks, researchers can identify and challenge stereotypes that hinder progress toward gender parity, creating educational resources that promote an inclusive environment where all students can see themselves represented in STEM roles (Papadakis, 2018; Nielsen & Matheson, 2017; Walker & Huang, 2021).

Conducting a systematic literature review on gender bias and stereotypes in STEM textbooks is crucial for several reasons. This review study provides a comprehensive examination of existing literature, shedding light on the pervasive issue of gender inequality in STEM educational resources. By identifying, analyzing, and interpreting relevant studies, the research reveals how gender bias is represented in educational materials, influencing young learners' perceptions and attitudes toward gender roles and career aspirations. This perpetuation of existing inequalities in STEM fields underscores the need for more equitable and inclusive teaching resources (Yang & Zhou, 2023; Murray et al., 2022; Kerkhoven et al., 2016; Wambugu et al., 2017). A systematic review allows researchers to identify recurring patterns of bias and assess the effectiveness of current strategies aimed at addressing these issues, providing a comprehensive assessment of how gender stereotypes are portrayed across various STEM textbooks and educational contexts (Wang et al., 2023; Whiteley, 1996; Aivelo et al., 2024; Lodge & Reiss, 2021). The findings of this study can inform educators, policymakers, and curriculum developers about the critical need to address and rectify gender disparities in educational materials, thereby promoting a more inclusive and equitable STEM learning environment (Sunar, 2012; Gumilar et al., 2022; Elgar, 2004; Gumilar & Amalia, 2020). Additionally, this review can highlight gaps in the literature and provide recommendations for future research, contributing to the broader goal of achieving gender equity in education (Parkin & Mackenzie, 2017).

Despite growing awareness of gender disparities in STEM education, limited research comprehensively explores how gender stereotypes and biases are portrayed in STEM textbooks at the school level. Existing studies often focus on isolated aspects without integrating these findings into a holistic framework. This systematic review aims to address the gaps in understanding how gender stereotypes and biases are portrayed in STEM textbooks at the school level by synthesizing existing research. It seeks to integrate isolated findings into a cohesive framework and identify areas requiring further investigation to guide the development of gender-sensitive educational materials.

The objective of this study was to identify the gender stereotypes and biases in STEM in school textbooks based on ten studies in the last ten years. The researcher has examined three aspects, namely (1) the methodology used, (2) the data source and sample, and (3) the main findings of the study.

METHODS

The current study adopts a Systematic Literature Review (SLR) methodology to examine gender stereotypes and bias in STEM textbooks used in school education. This approach involves analyzing numerous previously published studies, positioning the research as a comprehensive review. A literature review, particularly when systematic, provides a clear and impartial synthesis of existing perspectives without introducing new experimental data. It follows established guidelines to ensure transparency, reproducibility, and minimize bias, thus offering reliable findings that inform conclusions and support decision-making (Moher et al., 2009; Snyder, 2019; Tranfield et al., 2003). By systematically gathering and synthesizing past research, this study provides a concise summary of the most relevant sources on key research questions, contributing to a deeper understanding of the subject matter (Gulpinar & Guclu, 2013; Baumeister & Leary, 1997; Webster & Watson, 2002).

Data Sources

To ensure the quality and relevance of previous research on gender stereotypes and bias in STEM textbooks used in school education, both in India and internationally, high-quality publications were prioritized (Hsu, 2012; Hwang & Tsai, 2011). The primary databases selected for this study included Scopus, Web of Science, Semantic Scholar, Springer Link, Taylor & Francis Online, Google Scholar, and ERIC. These databases were chosen for their comprehensive coverage of peer-reviewed journals, conference proceedings, and scholarly articles, which align with the study's objective to analyze global and regional trends in gender representation in STEM textbooks. The search terms used-"gender stereotypes in textbooks," "gender bias in educational materials," "mathematics textbooks gender representation," "gender equality in school science textbooks," and "gender stereotypes in engineering and technology textbooks"-were carefully selected to encompass key themes relevant to the portrayal of gender in STEM education. These terms ensured a broad yet targeted exploration of the literature, facilitating the identification of publications that met the established criteria and were ultimately included in the review.

Publication selection and Screening

The authors compiled the selected information into a spreadsheet. Initially, they manually checked the titles and abstracts of the papers before proceeding to read the full texts. This process helped determine if the papers met the criteria for the review. They ensured that the chosen papers were relevant to the main topic and selected them carefully.

Exclusion and Inclusion criteria

The authors selected documents and data for the review by focusing on papers that formally investigated gender stereotypes and bias in school STEM textbooks, including those based on consultations. They examined studies from organizations, institutions, Departments of School Education, and government sources. The research needed to cover themes such as gender stereotypes and bias in school STEM textbooks, bias in images, gender issues in the curriculum, and the extent of gender bias in STEM textbook literature.

Table 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Studies published between 2003 and 2024.	Studies not directly related to gender stereotypes or biases in STEM textbooks.
Peer-reviewed journal articles, conference papers, and reports.	Non-peer-reviewed articles, editorials, and opinion pieces.
Studies focusing on gender representation in school STEM textbooks, particularly science textbooks, mathematics textbooks, and engineering and technology textbooks	Articles not available in full text.
Articles available in English.	

Data management, assessment, and extraction

The authors systematically collected information from the selected papers by examining key aspects such as the topic, year of publication, publisher, focus, outcomes, and keywords. Each paper's topic and outcomes were reviewed separately, and the data was organized meticulously. To ensure efficient retrieval and analysis, the research database was carefully structured and stored in a spreadsheet. This database includes several essential fields designed to document and categorize the collected data accurately. By organizing the research data in this structured manner, the team ensured that the data remained accessible, transparent, and consistent throughout the research process, facilitating effective data management and meaningful analysis. Below is a detailed overview of the fields included in the research database:

A. Author(s): This field captures the name(s) of the author(s) associated with each entry in the database.
B. Year: The publication year of each work is noted to provide chronological context and track the evolution of the research.
C. Title of Work: The titles of the research works are recorded here for clear identification and reference.
D. Journal or Publisher: For published works, the journal or publisher is recorded to acknowledge the source and provide additional context.
E. DOI (Digital Object Identifier): The DOI of each work is recorded to provide a unique and permanent link, ensuring easy access and reliable citation.
F. Bibliographic Data in APA Style: This section displays the bibliographic details of each work, formatted according to APA style guidelines, to maintain consistency and accuracy in references.
G. Type of Document: This field categorizes the document type, differentiating between research articles, systematic reviews, meta-analyses, conference papers, and other relevant formats.
H. Country of the Authors: The country or countries affiliated with the authors are documented to identify geographical trends and distributions.
I. Institutions or Organizations: This field lists the institutions or organizations with which the authors are affiliated, highlighting collaborative efforts and institutional contributions.
J. Language: The language of each work is specified to accommodate language preferences and support language-based analysis.
K. Keywords: Keywords related to each work are documented to enhance searchability and help with categorization based on relevant topics and themes.

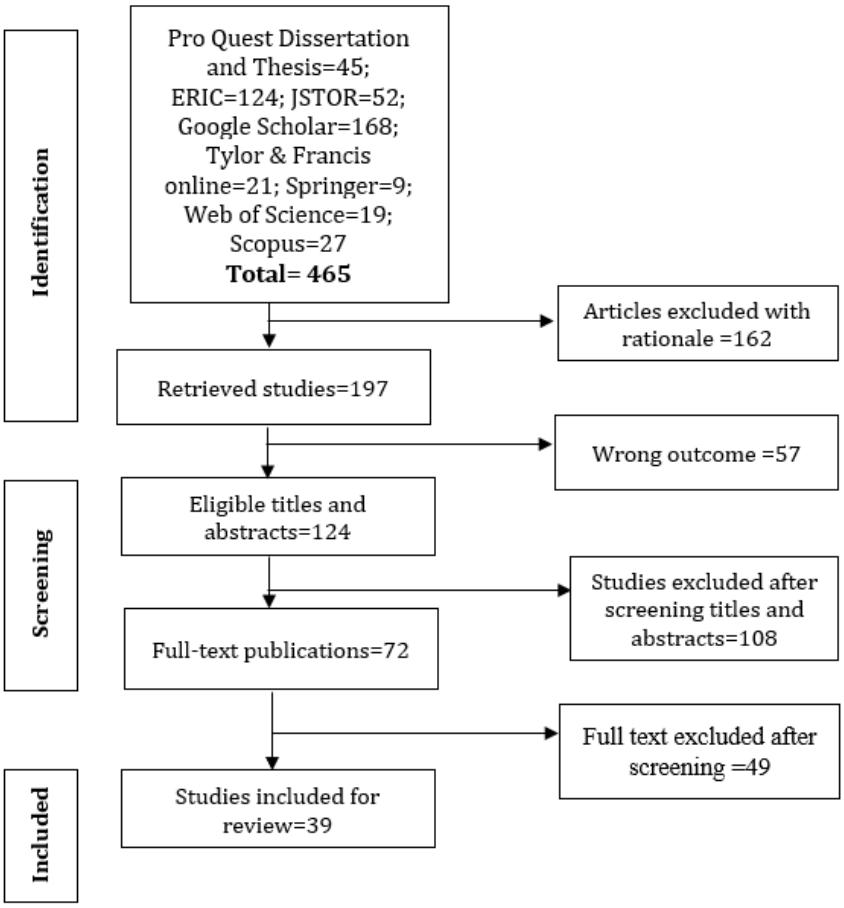

Figure 1 PRISMA flowchart for the selection of studies included in the review

Analysis Method

The PRISMA approach (Page et al., 2020) was selected for the analysis. This approach includes identifying and selecting scientific papers, eliminating duplicates, and applying criteria for inclusion, exclusion, and quality assessment. Relevant abstracts were reviewed to assess their appropriateness for both quantitative and qualitative analyses. The final step classified the theme into different categories.

RESULTS

Tables 2, 3, and 4 present a compilation of research articles examining gender stereotypes and bias in STEM textbooks used in school education, which have been systematically analyzed to address the predefined research questions.

1) What is the research methodology used in the research on gender stereotypes and biases in STEM textbooks?
2) What are the data sources or samples utilized in the research on gender stereotypes and biases in STEM textbooks?
3) What are the main findings of the research on gender stereotypes and biases in STEM textbooks?
4) What is the pattern of showing gender stereotypes and biases in STEM textbooks?

Table 2. Selected articles on gender stereotypes and bias in science textbooks

Author's Name	Year	Title	Journal/Publisher details
Yang and Zhou	2023	"A social semiotic analysis of gender representations in biology textbooks for upper secondary schools in China"	"Education as Change, vol. 27, pp. 1-21"
Murray, et al.	2022	"Representations of women and men in popular chemistry textbooks in the United Kingdom and Republic of Ireland"	"Chemistry Education Research and Practice, vol. 23, no. 3, pp. 373-384"
Kerkhoven et al.	2016	"Gender stereotypes in science education resources: A visual content analysis"	"PLoS ONE, vol. 11, no. 11, pp.1-13"
Wambugu, Ngatia and Wanyoike	2017	"Analysis of illustrations used in secondary schools physics textbooks"	"International Journal of Humanities Social Sciences and Education, vol.4, no. 4, pp.99-103"
Wang et al.	2023	"If images could speak: A social semiotics analysis of gender representation in science textbook images"	"Journal of Curriculum Studies, vol. 55, no.4, pp. 471-488"
Whiteley	1996	"The 'gender fairness' of integrated science textbooks used in Jamaican high schools"	"International Journal of Science Education, vol. 18, no. 8, pp. 969-976"
Aivelo, Neffling and Karala	2024	"Representation for whom? Transformation of sex/gender discussion from stereotypes to silence in Finnish biology textbooks from the 20th to 21st century"	"Journal of Biological Education, vol. 58, no. 2, pp. 297-311"
Lodge and Reiss	2021	"Visual representations of women in a Jamaican science textbook: Perpetuating an outdated, sexist ideology"	"International Journal of Science Education, vol. 1, no. 16."
Sunar	2012	"Analysis of science textbooks for A-levels in the UK: Issues of gender representation"	"Proceedings of the ESERA 2011 Conference: Science

			Learning and Citizenship"
Gumilar	2022	"The portrayal of women in Indonesian national physics textbooks: A textual analysis"	"International Journal of Science Education, vol. 44, no. 3, pp. 416-433"
Elgar	2004	"Science textbooks for lower secondary schools in Brunei: issues of gender equity"	"International Journal of Science Education, vol. 26, no. 7, pp.875-894"
Gumilar and Amalia	2020	"The representation of gender neutrality in Indonesian physics textbooks: A critical discourse analysis"	"Jurnal Keguruan dan Ilmu Tarbiyah, vol. 5, no. 2, pp. 205-214"
Parkin and Mackenzie	2017	"Is there gender bias in Key Stage 3 textbooks?: Content analysis using the Gender Bias 14 (GB14) measurement tool"	"Advanced Journal of Professional Practice, vol. 1, no. 1, pp. 23-40"

Table 3. Selected articles on gender stereotypes and bias in engineering and technology textbooks

Author's Name	Year	Title	Journal/Publisher details
Papadakis	2018	"Gender stereotypes in Greek computer science school textbooks"	"International Journal of Teaching and Case Studies, vol. 9, no.1, 48-pp. 71"
Lindsey and Jones	2013	"Examining gender stereotypes in engineering textbooks: A critical visual analysis"	"Science Education Review, vol. 12, no. 4, pp. 212-223"
Barker and Aspray	2006	"Gender differences in computer science textbooks: An analysis of visual and textual representations"	"Journal of Women and Minorities in Science and Engineering, vol. 12 no.3, pp.233-247"
Nielsen and Matheson	2017	"The representation of gender in engineering education materials: A visual study"	"Journal of Engineering Education, vol. 106, no. 4, pp.593-611"
Smith and Wilson	2024	"Uncovering gender bias in engineering textbooks through visual analysis"	"Gender and Education, vol. 26, no. 2, pp. 167-183"
Walker and Huang	2021	"Gender portrayal in engineering education: A visual study of textbooks and media"	"Engineering Education Journal, vol. 33, no. 1, pp.75-90"
Gardiner	2011	"Visual representations of gender in vocational education materials: A comparative study"	"International Journal of Educational Research, vol. 50, no.1-2, pp.1-11"
Davis and Hall	2020	"Analyzing gender representation in computer science educational materials: A visual and thematic approach"	"Journal of Educational Technology & Society, vol. 23, no. 2, pp.142-156"
Perry and Brown	2016	"Visual gender representation in engineering textbooks: An intersectional analysis"	"International Journal of Engineering Education, vol. 32, no. 6, pp. 2337-2350"

Table 4. Selected articles on gender stereotypes and bias in mathematics textbooks

Author's Name	Year	Title	Journal/Publisher details
Nurulu	2021	"Analysis of gender fairness of primary school mathematics textbooks in Turkey"	"International Journal of Psychology and Educational Studies, vol. 8, no. 4, pp. 78-95"
Ullah et al.	2017	"Gender bias in school mathematics textbooks from grade 1 to 12 in Palestine"	"Journal of International Women's Studies, vol. 21 no. 1, pp. 162-171"
Guichot-Reina and Torre-Sierra	2023	"The representation of gender stereotypes in Spanish mathematics textbooks for elementary education"	"Journal of Mathematics Education, vol. 3, no. 2, pp. 106-114"
Tang, Chen, and Zhang	2010	"Gender issues in mathematical textbooks of primary schools	"Journal of Mathematics Education, vol. 3, no. 2, pp. 106-114"
Java and Parcon	2016	Gendered illustrations in Philippine textbooks"	"ASIA Pacific Higher Education Research Journal, vol. 3, no.1, pp.34-51"
Incikabi and Ulusoy	2024	"Gender bias and stereotypes in Australian, Singaporean and Turkish mathematics textbooks"	"Turkish Journal of Education, 8 (4), 298-317"
Neto and Pinheiro	2021	"The problematic issue of gender in mathematics textbooks: A comparative analysis between Brazil and the USA"	"Investigacao e Divulgacao em Educacao Matematica, vol. 5, no. 1, pp.1-20"
Ustun and Uzuner	2023	"Gender equality in math-themed picture books: The example of Math matters"	"International Journal of Progressive Education, vol. 19, no. 5, pp. 225-249"
Sah Chuh and Nkwetisama	2022	"Gender representation in mathematics textbooks for Cameroon primary and secondary schools"	"IQ Research Journal, vol. 1, no. 10, pp. 01-21"
Iriaji and Pujiyanto	2016	"Gender stereotype portrayed in the illustrations of elementary school textbooks for early level students"	"Asian Journal of Management Sciences & Education, vol. 5, no.2, pp. 28-35"
Yuden and Chuki	2021	"Gender sensitivity in textbooks in secondary education in Bhutan"	"European Journal of Educational Technology, vol.4, no. 1, pp. 14-30"
Yasin et al	2012	"Linguistic sexism in Qatari primary mathematics textbooks"	"GEMA Online Journal of Language Studies, vol.12, no.1, pp.53-68"
Casalan, Delgado and Espino-Paller	2024	"Counting boys and girls in pages: A critical discourse analysis of gender representations in science and mathematics textbooks"	"The Asian ESP Journal Research Articles, vol. 17, no. 6.1, pp.127-150"
Rasool and Asif	2019	"Gender representation in the primary level mathematics textbooks of Punjab"	"Pakistan Journal of Languages and Translation Studies, UOG,

			vol.2, pp. 4-25"
Ladd	2011	"A study on gendered portrayals in children's picture books with mathematical content"	"International Journal of Knowledge Content Development & Technology, vol.1, no. 2, pp. 5-14"
Xenofontos	2024	"Gender representations in school mathematics: A study of primary textbooks in the Republic of Cyprus"	"International Journal of Mathematical Education in Science and Technology"
Subedi	2021	"Studies in mathematics education: Curriculum analysis from Indigenous knowledge and gender perspective"	"Interdisciplinary Research in Education, vol. 6, no. 1, pp. 99-114"

Year-wise distribution of studies

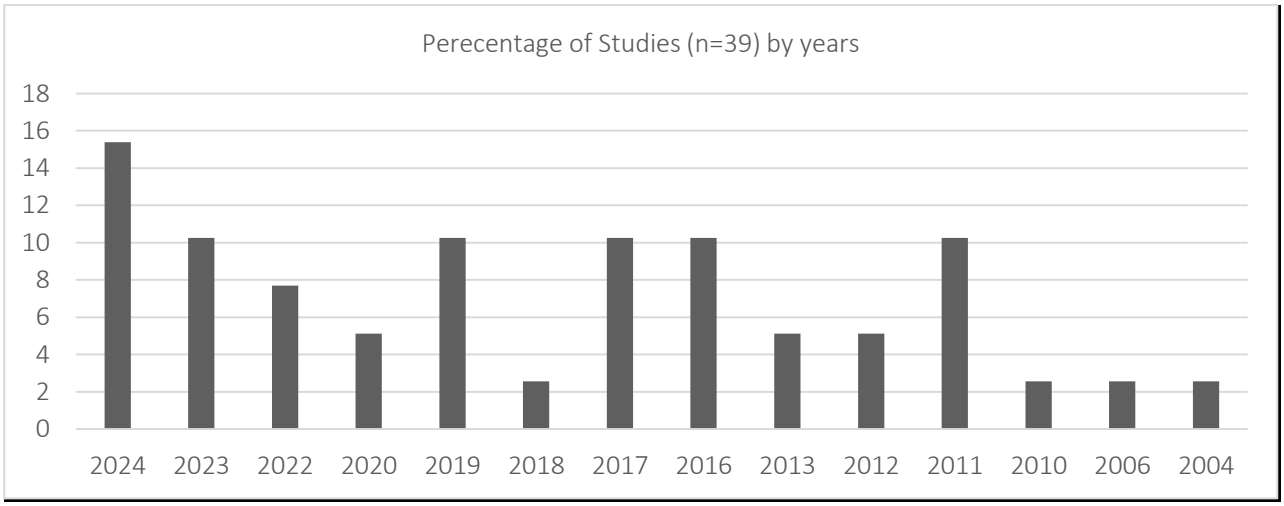

Figure 2 Year-by-year distribution of selected research work

The above figure 2 shows that of the 39 selected papers, most were published in the year 2024 has the highest number of publications, with 6 papers accounting for 15.38% of the total. The years 2017, 2019, 2016, and 2023 also show significant contributions, with each year having 4 papers, contributing 10.25% each. In contrast, the years 2004, 2006, 2010, and 2018 have the lowest number of publications, with just 1 paper each, accounting for 2.56% of the total.

Country-wise distribution of studies

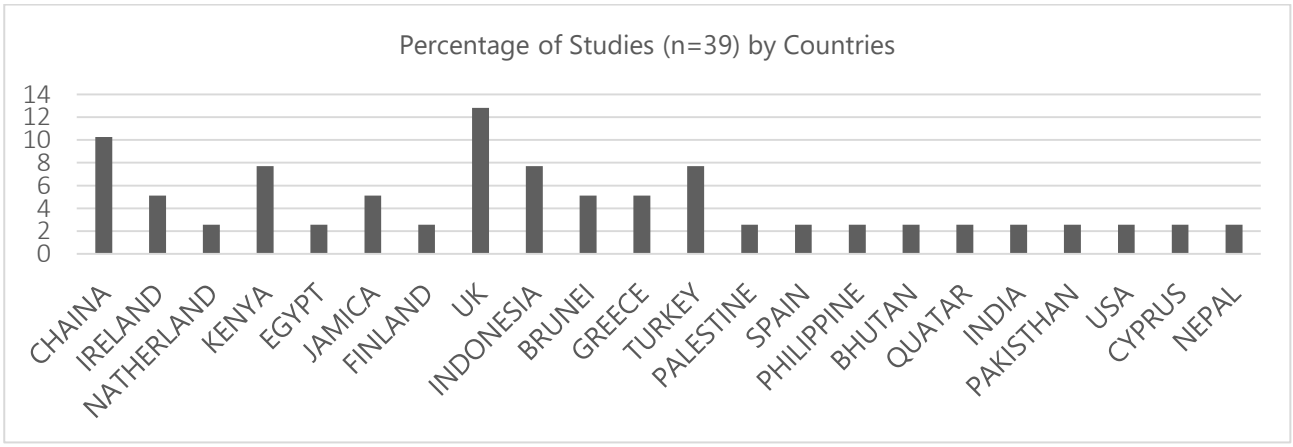

Figure 3 Country-wise distribution of selected research work

Figure 3 shows that the 39 selected research works across different countries. UK, accounting for 12.82% of the total, with 5 papers. China follows with 10.25% and 4 papers. Kenya and Indonesia each contributed 3 papers, representing 7.69% of the total. Ireland, Jamaica, Brunei, Turkey, and Cyprus each contributed 2 papers, making up 5.12% each. Meanwhile, the Netherlands, Egypt, Finland, Greece, Palestine, Spain, the Philippines, Bhutan, Qatar, India, Pakistan, the USA, and Nepal each contributed 1 paper, representing 2.56% of the total.

Methodology-wise distribution of studies

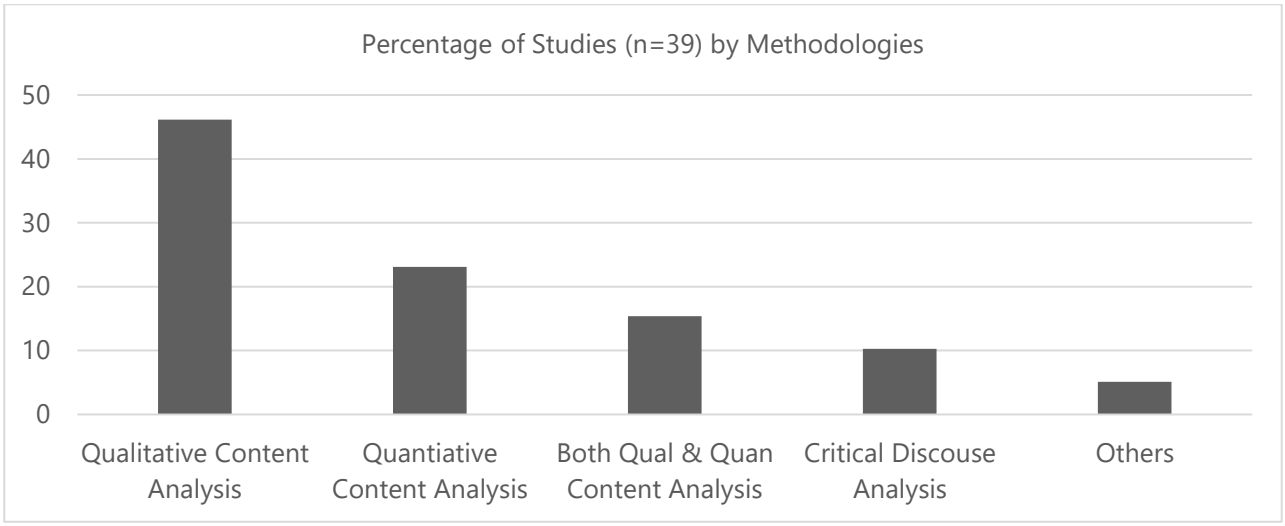

Figure 4 Methodology-wise distribution of selected research work

Figure 4 shows that the 39 selected research works illustrate different methodologies used. Quantitative content analysis was utilized in 23.07% (9 papers), while a combination of both qualitative and quantitative content analysis was found in 15.38% (6 papers). Critical discourse analysis was used in 10.25% (4 papers), and other methodologies accounted for 5.12% (2 papers).

Database-wise distribution of studies

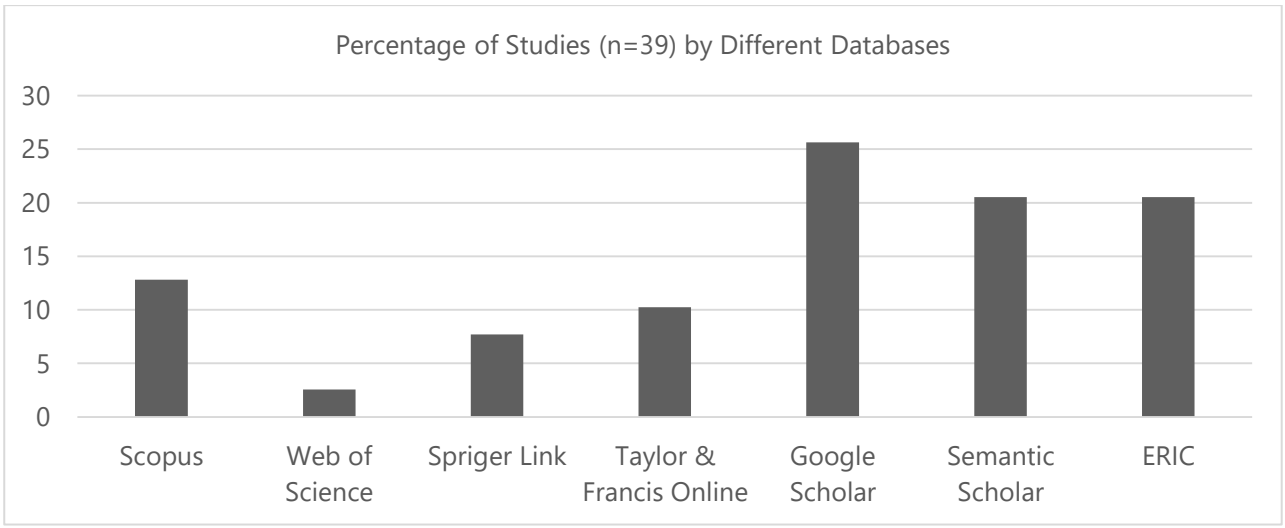

Figure 5 Database-wise distribution of selected research work

The above figure 5 shows that the 39 selected research works across various databases. Scopus, Google Scholar, and Semantic Scholar collectively account for over 70% of the papers, with 25.64%, 20.51%, and 20.51% respectively. Following closely is ERIC and Taylor & Francis Online with 20.51% and 10.25% shares. Springer Link contributes 7.69%, while Web of Science holds a smaller share of 2.56%.

Keyword-wise distribution of studies

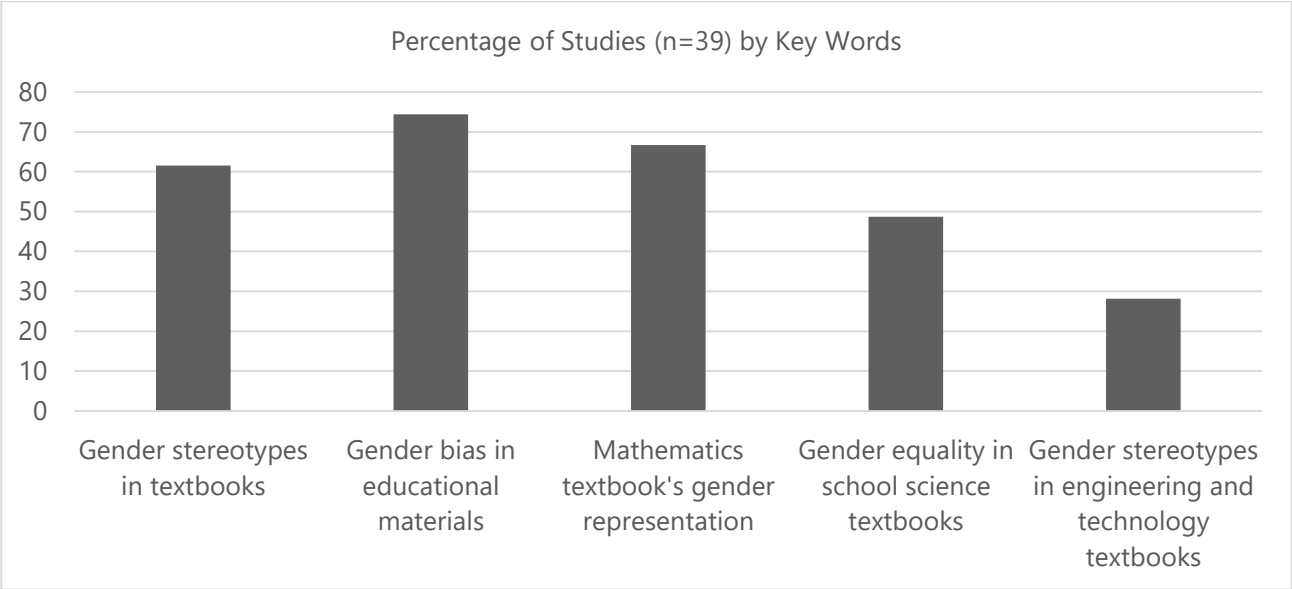

Figure 6 Keyword-wise distribution of selected research work

The above figure 6 shows that the 39 selected research works across different keywords. A total of 24 papers (61.53%) discuss "Gender Stereotypes in Textbooks", and "Gender Bias in Educational Materials" is explored in 29 papers (74.35%). The "representation of gender in mathematics textbooks" is analyzed in 26 papers (66.66%), Meanwhile, "Gender Equality in School Science Textbooks" is examined in 19 papers (48.71%), Finally, 11 papers (28.2%) focuses on "Gender Stereotypes in Engineering and Technology Textbooks.

School level-wise distribution of studies

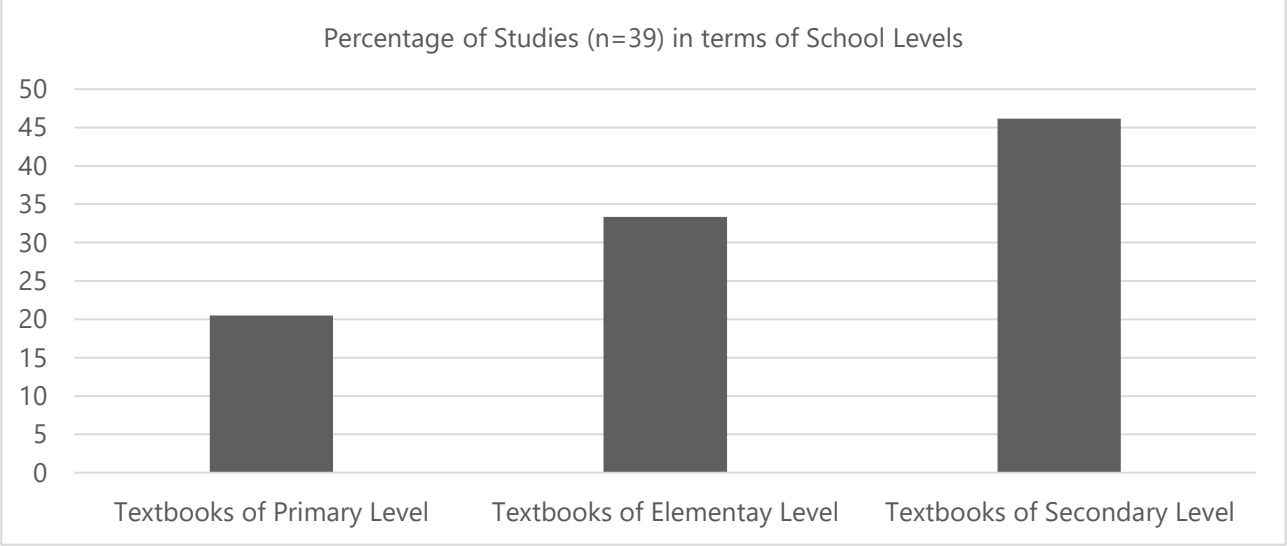

Figure 7 Textbooks of different school level -wise distribution of studies

The above figure 7 shows that the 39 selected research works across different school levels textbooks. At the primary level, 20.51% of the studies (8 out of 39) are dedicated to understanding textbooks. This focus increases at the elementary level, where 33.33% of the studies (13 out of 39) are concentrated. The most significant emphasis, however, is placed on secondary-level textbooks, which account for 46.15% of the studies (18 out of 39).

Different STEM Subject-wise distribution of studies

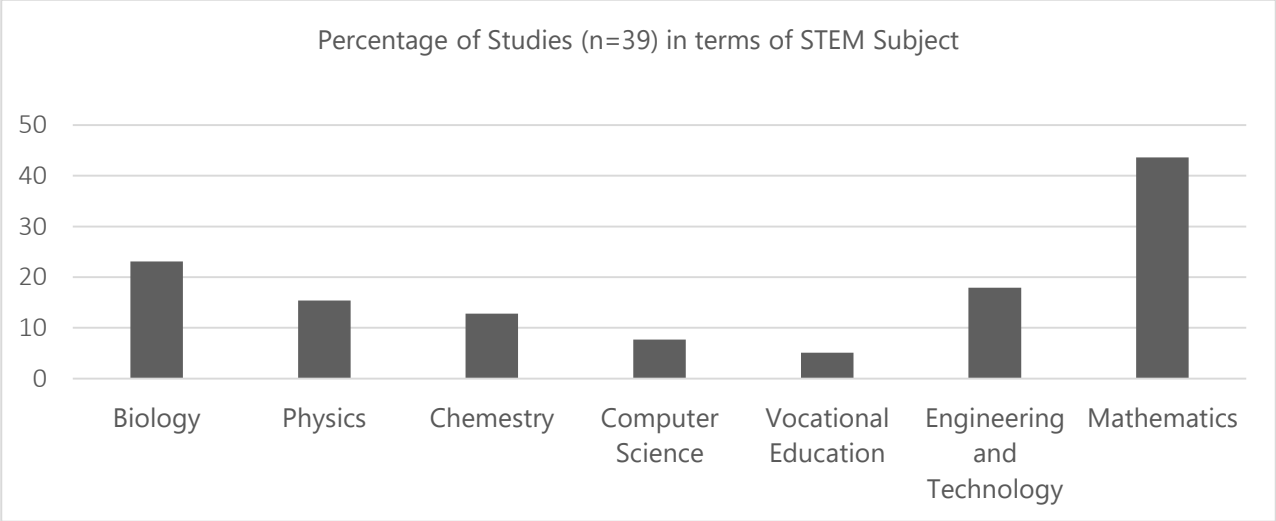

Figure 8 Different STEM Subject-wise distribution of studies

Figure 8 illustrates the distribution of 39 selected research works across various STEM subjects. Mathematics has the highest representation with 43.58% (17 studies). Engineering and Technology follows with 17.94% (7 studies). Biology is next with 23.07% (9 studies). Physics and Chemistry account for 15.38% (6 studies) and 12.82% (5 studies) respectively. Computer Science and Vocational Education have the least representation, with only 7.69% (3 studies) and 5.12% (2 studies), respectively.

Table 05: Summary of themes and selected research work for review

Category of theme	Gender stereotypes and bias in science textbooks	Gender stereotypes and bias in engineering and technology textbooks	Gender stereotypes and bias in mathematics textbooks
Portrayal of gender in language and terminological aspects	E1, E4, E7, E9, E12, E15, E18, E21	E1, E4, E11, E15, E22, E27, E35	E17, E22, E26, E29, E32, E35, E37, E38, E39
Portrayal of gender in visual representation	E2, E3, E6, E10, E14, E19, E23, E25	E2, E5, E8, E17, E21, E25, E31	E10, E15, E18, E23, E27, E31, E34, E36
Portrayal of gender in professional, occupational, and working roles representation	E5, E8, E11, E16, E20, E24, E27	E3, E9, E14, E18, E23, E29	E4, E5, E11, E12, E20, E25, E28
Portrayal of gender in games and leisure time activities	E13, E17, E22, E26, E28, E31, E34, E36	E6, E10, E13, E19, E28, E34, E37	E1, E6, E9, E16, E21, E24, E30, E33
Cultural and regional differences in the portrayal of gender in textbooks	E29, E30, E32, E33, E35, E37, E38, E39	E7, E12, E16, E20, E24, E26, E30, E32, E33, E36, E38, E39	E2, E3, E7, E8, E13, E14, E19

Note: "E" is a code used to categorize each of the research work included in the review.

The above table 5 shows that out of the 39 publications, 24 (61.53 %) discussed the Portrayal of gender in language and terminological aspects. 23 (58.97 %) of the published research focused on the

Portrayal of gender in visual representation, while 20 (51.28 %) addressed the Portrayal of gender in professional, occupational, and working roles representation. Additionally, 27 (69.23 %) of the publications examined the Portrayal of gender in games and leisure time activities. Finally, 8 (17.7 %) of the research works discussed Cultural and regional differences in the portrayal of gender in textbooks.

The objective of the Studies Examined

Table 6. Objectives of the studies (n=39) reviewed

Study	Purpose of the study
E01	To study the egalitarian gender biological science textbooks for upper secondary schools in China.
E02	The study examined the names of scientists and other individuals referenced in four widely used textbooks across the three education systems in the UK and the Republic of Ireland.
E03	This study aimed to assess whether primary school science educational materials included gender-biased imagery.
E04	This study aims to analyze the illustrations in physics textbooks that are commonly used in Kenyan secondary.
E05	To examine the underlying messages conveyed by images regarding gender representation in Chinese and Egyptian science textbooks.
E06	Assessed to evaluate gender equity in science textbooks used in the lower grades of secondary schools in Jamaica.
E07	To comprehend the evolution of sex/gender representations in biology education.
E08	To examine visual representations in a widely used school science textbook reinforce or ameliorate gender stereotypes.
E09	To study gender representation in science books for A-levels in the UK.
E10	To address the gap by examining how women are portrayed in three Indonesian physics textbooks, providing empirical evidence in contrast to the prevalent portrayals of men
E11	To examine issues affecting equity in science education for girls and boys.
E12	To study the representation of gender neutrality in Indonesian physics textbooks.
E13	To measure overall gender bias, or genderless, within Key Stage 3 textbooks.
E14	To evaluate the gender fairness of mathematics textbooks used in primary schools in Turkey for grades 1 to 4.
E15	To examine gender bias in mathematics textbooks from first grade to 12th grade in Palestine.
E16	To examine the disparity in the portrayal of women and men in the elementary mathematics textbooks currently utilized in Spain.
E17	To study the gender bias in mathematical textbooks of primary schools published by Beijing Normal University Press.
E18	To study the portal of sexes in 10th-grade mathematics textbooks.
E19	To investigate gender biases and stereotypes present in elementary mathematics textbooks from

	Australia, Singapore, and Turkey.
E20	To compare 6th-grade mathematics textbooks in Brazil and the USA to unveil the ways gender subjects were presented.
E21	The aim of this study is to assess how well illustrated children's books with a math focus represent gender equality.
E22	To analyze how gender is represented in mathematics textbooks employed in primary and secondary schools across Cameroon.
E23	This study focuses on examining gender disparities depicted in the illustrations found in textbooks for young learners at the elementary level.
E24	This study was carried out to understand gender stereotypes in mathematics textbooks of secondary schools in Bhutan.
E25	To study the linguistic sexism in Qatari primary mathematics textbooks.
E26	To study various gender representations in Grade Five science and mathematics textbooks in both public and private schools.
E27	To study the differential representation of genders in primary-level textbooks based on Single National Curriculum 2020.
E28	To analyze sexism in children's picture books that incorporate mathematical problems.
E29	The study focused on the upper-primary mathematics textbooks of the Republic of Cyprus.
E30	Aimed to analyze the curriculum of the course 'Studies in Mathematics Education (Math Ed. 539)' from indigenous and gender perspectives.
E31	To identify the elements of sexism and gender role stereotyping in Greek computer science textbook
E32	The study aims to explore how gender roles and identities are portrayed in visual representations.
E33	To assess the balance and fairness of gender representation.
E34	To evaluate the visual depiction of gender roles in engineering education materials.
E35	The study aims to assess how gender is represented in these visual elements Engineering Textbooks.
E36	To critically analyze and assess how gender roles and identities are depicted in engineering textbooks
E37	To identify any existing gender biases or stereotypes in vocational education materials.
E38	To examine how gender is represented in computer science textbooks.
E39	The study aims to identify potential biases, stereotypes, and imbalances in the visual content of computer science textbooks.

Note: "E" is a code used to categorize each of the research work included in the review.

What is the research methodology used in the research on gender stereotypes and biases in STEM textbooks?

Based on the study's analysis, the researchers employed a qualitative approach, specifically using documentary analysis methods through content analysis techniques.

Figure 4 shows that the 39 selected research works illustrate different methodologies used. Quantitative content analysis was utilized in 23.07% (9 papers), while a combination of both qualitative and quantitative content analysis was found in 15.38% (6 papers). Critical discourse analysis was used in 10.25% (4 papers), and other methodologies accounted for 5.12% (2 papers).

What are the data sources or samples utilized in the research on gender stereotypes and biases in STEM textbooks?

Table 7. Data sources used in studies

Author's and Year	Title	Data Sources/Sample
Yang and Zhou (2023)	"A social semiotic analysis of gender representations in biology textbooks for upper secondary schools in China"	Biological science textbooks
Murray, et al. (2022)	"Representations of women and men in popular chemistry textbooks in the United Kingdom and Republic of Ireland"	Chemistry textbooks
Kerkhoven et al. (2016)	"Gender stereotypes in science education resources: A visual content analysis"	Biology, chemistry, geology, mathematics, physics, and technology textbook
Wambugu, Ngatia and Wanyoike (2017)	"Analysis of illustrations used in secondary schools physics textbooks"	Physics textbooks
Wang et al. (2023)	"If images could speak: A social semiotics analysis of gender representation in science textbook images"	Science textbooks
Whiteley (1996)	"The 'gender fairness' of integrated science textbooks used in Jamaican high schools"	Science textbooks
Aivelo, Neffling and Karala (2024)	"Representation for whom? Transformation of sex/gender discussion from stereotypes to silence in Finnish biology textbooks from the 20th to 21st century"	Biology textbook
Lodge and Reiss (2021)	"Visual representations of women in a Jamaican science textbook: Perpetuating an outdated, sexist ideology"	Science textbooks
Sunar (2012)	"Analysis of science textbooks for A-levels in the UK: Issues of gender representation"	Chemistry Student Book
Gumilar (2022)	"The portrayal of women in Indonesian national physics textbooks: A textual analysis"	Physics Textbooks
Elgar (2004)	"Science textbooks for lower secondary schools in Brunei: issues of gender equity"	Science textbook
Gumilar and Amalia (2020)	"The representation of gender neutrality in Indonesian physics textbooks: A critical discourse analysis"	Physics textbooks

Parkin and Mackenzie (2017)	"Is there gender bias in Key Stage 3 textbooks?: Content analysis using the Gender Bias 14 (GB14) measurement tool"	Chemistry Book

Table 08: Data sources used in studies

Author's and Year	Title	Data Sources/Sample
Papadakis (2018)	"Gender stereotypes in Greek computer science school textbooks"	Computer science textbooks
Lindsey and Jones (2013)	"Examining gender stereotypes in engineering textbooks: A critical visual analysis"	Engineering textbooks
Barker and Aspray (2006)	"Gender differences in computer science textbooks: An analysis of visual and textual representations"	Computer science textbooks
Nielsen and Matheson (2017)	"The representation of gender in engineering education materials: A visual study"	Engineering textbooks
Smith and Wilson (2024)	"Uncovering gender bias in engineering textbooks through visual analysis"	Engineering textbooks
Walker and Huang (2021)	"Gender portrayal in engineering education: A visual study of textbooks and media"	Engineering textbooks
Gardiner (2011)	"Visual representations of gender in vocational education materials: A comparative study"	Vocational education Textbook
Davis and Hall (2020)	"Analyzing gender representation in computer science educational materials: A visual and thematic approach"	Computer science textbooks
Perry and Brown (2016)	"Visual gender representation in engineering textbooks: An intersectional analysis"	Engineering textbooks

Table 09: Data sources used in studies

Author's and Year	Title	Data Sources/Sample
Nurulu (2021)	"Analysis of gender fairness of primary school mathematics textbooks in Turkey"	Mathematics textbook
Ullah et al. (2017)	"Gender bias in school mathematics textbooks from grade 1 to 12 in Palestine"	Mathematics textbook
Guichot-Reina and Torre-Sierra (2023)	"The representation of gender stereotypes in Spanish mathematics textbooks for elementary education"	Mathematics textbook
Tang, Chen, and Zhang (2023)	"Gender issues in mathematical textbooks of primary schools"	Mathematics textbook

Java and Parcon (2016)	"Gendered illustrations in Philippine textbooks"	Mathematics textbook
Incikabi and Ulusoy (2024)	"Gender bias and stereotypes in Australian, Singaporean and Turkish mathematics textbooks"	Mathematics textbook
Neto and Pinheiro (2021)	"The problematic issue of gender in mathematics textbooks: A comparative analysis between Brazil and the USA"	Mathematics textbook
Ustun and Uzuner (2023)	"Gender equality in math-themed picture books: The example of Math matters"	Mathematics textbook
Sah Chuh and Nkwetisama (2022)	"Gender representation in mathematics textbooks for Cameroon primary and secondary schools"	Mathematics textbook
Iriaji and Pujiyanto (2016)	"Gender stereotype portrayed in the illustrations of elementary school textbooks for early level students"	Mathematics textbook
Yuden and Chuki (2021)	"Gender sensitivity in textbooks in secondary education in Bhutan"	Mathematics textbook
Yasin et al (2012)	"Linguistic sexism in Qatari primary mathematics textbooks"	Mathematics textbook
Casalan, Delgado and Espino-Paller (2024)	"Counting boys and girls in pages: A critical discourse analysis of gender representations in science and mathematics textbooks"	Mathematics textbook
Rasool and Asif (2019)	"Gender representation in the primary level mathematics textbooks of Punjab"	Mathematics textbook
Ladd (2011)	"A study on gendered portrayals in children's picture books with mathematical content"	Mathematics textbook
Xenofontos (2024)	"Gender representations in school mathematics: A study of primary textbooks in the Republic of Cyprus"	Mathematics textbook
Subedi (2021)	"Studies in mathematics education: Curriculum analysis from Indigenous knowledge and gender perspective"	Mathematics textbook

What are the main findings of the research on gender stereotypes and biases in STEM textbooks?

Findings of Studies on Gender Stereotypes and Bias in Science Textbooks

The issue of gender bias in science textbooks is not confined to any one region but varies across different cultural and educational contexts. For example, Murray et al. (2022) examined popular chemistry textbooks in the United Kingdom and the Republic of Ireland, finding that men were disproportionately represented as scientists and in leadership roles, while women were often shown in supportive or secondary positions. This finding aligns with research conducted by Elgar (2004) in Brunei, where science textbooks for lower secondary schools also demonstrated a clear gender bias, with men being more frequently depicted and associated with scientific achievement. In a study focusing on Indonesian physics textbooks, Gumilar et al. (2022) highlighted that women were portrayed in limited roles, often as observers or assistants rather than

as active participants in scientific endeavors. This reinforces traditional gender roles and perpetuates the stereotype that women are less capable in science, which can negatively impact girls' interest and performance in these subjects. The representation of gender in textbooks plays a crucial role in shaping students' perceptions of gender roles and their own potential in science. Sunar (2012), in an analysis of A-level science textbooks in the UK, found that the gender bias present in these materials could contribute to a lower self-concept and decreased motivation among female students to pursue careers in science. Similarly, Lodge and Reiss (2021) argued that the outdated and sexist ideologies perpetuated by visual representations in Jamaican science textbooks could discourage girls from engaging with science, thereby limiting their educational and professional opportunities. The persistence of gender stereotypes and bias in science textbooks is a significant barrier to achieving gender equity in education. While there have been efforts to address these issues, such as those highlighted by Aivelo et al. (2024) and Gumilar and Amalia (2020), much work remains to be done. Ensuring that science textbooks present a balanced and inclusive portrayal of both men and women is crucial for fostering an equitable learning environment and encouraging all students to pursue their interests in science. Continued research and critical analysis of educational materials are necessary to challenge and change the deep-seated gender biases that persist in science education.

Findings of Studies on Gender Stereotypes and Bias in Technology and Engineering Textbooks

The analysis of gender stereotypes and biases in technology and engineering textbooks reveals persistent gender imbalances across various educational materials. Papadakis (2018) identified that Greek computer science textbooks perpetuate traditional gender roles, with men predominantly depicted in active, technical roles, while women are often sidelined into supportive or non-technical positions. Lindsey and Jones (2013) corroborated these findings in engineering textbooks, where men were frequently shown as engineers, while women were underrepresented or portrayed in passive roles. Barker and Aspray (2006) highlighted similar disparities in computer science textbooks, noting a significant gender bias in both visual and textual content, often reinforcing male dominance in the field. Nielsen and Matheson (2017) extended this analysis to engineering education materials, revealing that visual representations overwhelmingly favored male students and professionals. Smith and Wilson (2014) further uncovered gender bias through visual analysis, emphasizing how these biases perpetuate stereotypes that discourage female participation in engineering. Walker and Huang (2021) demonstrated that gender portrayals in engineering education are not only skewed but also reflect broader societal biases, reinforcing existing gender norms. Gardiner (2011) provided comparative insights across vocational education materials, revealing consistent underrepresentation and stereotypical depictions of women. Davis and Hall (2020) focused on computer science, finding that educational materials often depicted men in active, problem-solving roles, while women were portrayed as passive learners. Perry and Brown (2016) emphasized the intersectional aspects of gender representation in engineering textbooks, showing how visual content perpetuates both gender and racial stereotypes. Collectively, these studies underscore the critical need for more inclusive and balanced representations in educational materials to challenge and dismantle persistent gender biases.

Findings of Studies on Gender Stereotypes and Bias in Mathematics Textbooks

Studies on gender stereotypes and bias in mathematics textbooks have revealed persistent inequalities across various regions. Xenofontos (2024) highlighted that Cypriot primary textbooks underrepresent females in mathematical contexts, reinforcing gender roles. Subedi (2021) identified a lack of gender inclusivity in the curriculum, influenced by indigenous knowledge perspectives in Nepal. Nurlu (2021) found that Turkish textbooks perpetuate gender stereotypes, favoring male characters in active roles. Similarly, Karama (2020) noted significant gender bias in Palestinian textbooks from grades 1 to 12, with males dominating both text and illustrations. Ullah et al. (2017) observed a skewed representation favoring males in textbooks in Azad Jammu & Kashmir. Guichot-Reina & De la Torre-Sierra (2023) reported that

Spanish textbooks continue to portray traditional gender roles, marginalizing female presence. Tang, Chen, & Zhang (2010) discussed the underrepresentation of girls in Chinese textbooks, limiting their engagement with mathematics. Incikabi & Ulusoy (2024) compared Australian, Singaporean, and Turkish textbooks, uncovering consistent gender bias across different cultures. Neto & Pinheiro (2021) emphasized the persistence of gender issues in Brazilian and American textbooks, with stereotypical portrayals limiting female participation. These studies underscore the need for reform in educational materials to promote gender equality.

What is the pattern of showing gender stereotypes and biases in STEM textbooks?

The pattern of gender stereotypes and biases in STEM textbooks often reflects traditional gender roles and discrepancies in representation. Yang and Zhou (2023) highlight that biology textbooks for upper secondary schools in China frequently depict males in scientific roles while relegating females to supportive or domestic positions. Similarly, Murray et al. (2022) reveal that popular chemistry textbooks in the UK and Ireland portray men as more active and competent in scientific contexts, while women are shown in less dynamic roles. Kerkhoven et al. (2016) and Wang et al. (2023) demonstrate that science education resources globally often reinforce outdated stereotypes by presenting women less frequently and in passive roles compared to their male counterparts. Wambugu et al. (2017) and Gumilar et al. (2022) further corroborate that physics and chemistry textbooks often underrepresent women, a trend that persists across various cultures and educational systems. Additionally, studies by Papadakis (2018) and Lindsey and Jones (2013) show that engineering and computer science textbooks perpetuate gender biases by underrepresenting women and emphasizing male dominance in technical fields. This consistent pattern across different textbooks and educational contexts underscores the need for more equitable gender representation in STEM educational materials.

Summary of the result

The result shows that most of the selected papers are from the year 2004 to 2024, also journal articles (100%), and literature reviews on gender stereotypes and bias in STEM textbooks were the most reviewed in the study. This indicates that the review was thoroughly conducted with current and relevant publications. However, most of the countries represented gender stereotypes and biases presented in STEM textbooks.

DISCUSSION

Portrayal of gender in language and terminological aspects of STEM textbooks

The portrayal of gender in the language and terminological aspects of STEM textbooks reveals significant patterns of bias and stereotyping. Yang and Zhou (2023) highlight how biology textbooks in China reinforce traditional gender roles through their linguistic and visual content, often depicting females in passive or supportive roles. Similarly, studies by Murray et al. (2022) and Kerkhoven et al. (2016) show that chemistry and other science textbooks in various countries, including the UK and Egypt, often marginalize women or place them in stereotypically feminine roles. Wambugu et al. (2017) and Wang et al. (2023) further support this by documenting how illustrations in physics and science textbooks tend to underrepresent women or present them in limited, often stereotypical contexts. Despite some progress, as noted by Aivelo et al. (2024) and Gumilar et al. (2022), the transformation of gender discussions in educational materials frequently remains superficial, oscillating between outdated stereotypes and muted representations. This indicates that while some textbooks are moving towards more equitable representations, substantial biases persist, affecting the portrayal of gender in STEM education globally.

Portrayal of gender in the visual representation of STEM textbooks

The portrayal of gender in STEM textbooks has been a subject of extensive research, revealing persistent biases in visual representations. Studies have highlighted that textbooks often perpetuate

traditional gender stereotypes, particularly in science and mathematics contexts. For instance, Yang and Zhou (2023) found that biology textbooks in China depict gender roles in ways that reinforce existing stereotypes, with limited representation of females in active scientific roles. Similarly, Murray et al. (2022) observed that chemistry textbooks in the UK and Ireland frequently present women in passive or supportive roles, contrasting with male characters who are shown in more dynamic positions. Kerkhoven et al. (2016) and Wambugu et al. (2017) further demonstrated that gender stereotypes are prevalent in science education resources, with visual content often reinforcing traditional notions of male dominance in STEM fields. In contrast, some studies, like those by Wang et al. (2023) and Aivelo et al. (2024), reveal efforts to challenge these stereotypes, though such representations remain inconsistent. This disparity underscores the need for continued efforts to address gender imbalances and ensure that STEM textbooks provide equitable and diverse portrayals of both genders in scientific roles.

Portrayal of gender in professional, occupational, and working roles representation of STEM textbooks

The portrayal of gender in professional, occupational, and working roles within STEM textbooks reveals persistent biases and disparities. Yang and Zhou (2023) highlight that upper secondary biology textbooks in China continue to perpetuate traditional gender roles, often marginalizing female representation in professional contexts. Similarly, Murray et al. (2022) found that UK and Irish chemistry textbooks exhibit imbalanced gender representation, with men being more prominently depicted in professional roles compared to women. Kerkhoven et al. (2016) emphasize that science education resources globally frequently reinforce gender stereotypes, portraying women in less active roles. Contrastingly, studies by Wang et al. (2023) and Sunar (2012) reveal some progress, with certain textbooks attempting to challenge these stereotypes by portraying women in more assertive and influential roles. However, these improvements are not uniform, as demonstrated by Wambugu et al. (2017) and Aivelo et al. (2024), who observe that while some textbooks have enhanced female representation, many still lag in depicting women equitably in STEM fields. Overall, despite gradual advancements, many STEM textbooks continue to reflect outdated gender biases, underscoring the need for ongoing efforts to achieve gender fairness and inclusivity in educational materials.

Portrayal of gender in games and leisure time activities of STEM textbooks

The portrayal of gender in games and leisure activities within STEM textbooks reflects significant disparities and stereotypes. Yang and Zhou (2023) highlight how gender roles are often depicted through a narrow lens, with females frequently shown in passive or supportive roles, which reinforces traditional gender norms. Similarly, Kerkhoven et al. (2016) reveal that such stereotypes are pervasive across educational resources, where men are more commonly associated with active and leadership roles in science and technology. Murray et al. (2022) and Wang et al. (2023) further emphasize that these representations are not limited to specific countries but are a broader issue affecting STEM education globally. The disparity in representation impacts how students perceive gender roles within STEM fields, potentially discouraging female participation and perpetuating existing biases. This issue is compounded by the lack of diverse role models and active roles for women in educational materials, as noted by Gumilar et al. (2022) and Aivelo et al. (2024). Addressing these biases is crucial for fostering a more inclusive and equitable environment in STEM education.

Cultural and regional differences in the portrayal of gender in textbooks of STEM textbooks

Cultural and regional variations significantly influence the portrayal of gender in STEM textbooks, reflecting diverse societal norms and values. For instance, Yang and Zhou (2023) highlight persistent gender stereotypes in Chinese biology textbooks, where females are often depicted in supportive roles, contrasting with more balanced or progressive representations in other regions. Murray et al. (2022) found that UK and Irish chemistry textbooks similarly exhibit gender imbalances, though often with less pronounced stereotypes

compared to those noted by Kerkhoven et al. (2016) in broader science education resources. In contrast, Wambugu et al. (2017) and Wang et al. (2023) reveal that Kenyan and Chinese physics textbooks feature more active portrayals of women, challenging traditional gender roles. However, the trend is not universal; Aivelo et al. (2024) observe that Finnish textbooks have transitioned from explicit gender stereotypes to a more neutral stance, while Whiteley (1996) and Lodge and Reiss (2021) critique Jamaican textbooks for perpetuating outdated gender biases. Similarly, Gumilar and Amalia (2020) note that Indonesian textbooks struggle with gender neutrality, reflecting regional educational and cultural constraints. These studies collectively underscore how regional educational materials mirror and reinforce local gender norms, suggesting that efforts to address gender bias in textbooks must be tailored to specific cultural contexts and educational traditions.

CONCLUSION

An extensive review of literature through a systematic literature review approach on gender stereotypes and biases in STEM textbooks reveals substantial gender imbalances within educational materials. Data shows a consistent under-representation of women, reinforcing long-standing gender roles and perpetuating stereotypes. Research highlights that both language and illustrations in these textbooks contribute significantly to establishing gender-based expectations and boundaries, thus shaping students' perceptions of gender issues and influencing their engagement with STEM subjects. This issue underscores the need for educational resources that actively challenge and counteract gender norms rather than conform to them. Schools must reassess and update their STEM textbooks to include material that supports both male and female students equally. Incorporating content that breaks traditional gender biases and promotes gender equality can help dismantle stereotypes and present a more balanced view of roles and opportunities. By representing women and men equally and actively addressing gender biases, textbooks can foster a more inclusive and empowering educational environment for all students.

The study's scope, limited to research published between 2004 and 2024, may inadvertently exclude earlier works or emerging trends that could provide valuable insights. Although major databases like Scopus, Web of Science, and Springer Link were utilized to ensure high-quality sources, the exclusion of regional or less prominent databases might have resulted in the omission of culturally specific studies. Additionally, the focus on school-level STEM textbooks restricts the exploration of gender biases to a specific educational stage, leaving potential insights from higher education or informal learning resources unexplored. Furthermore, the predominance of English-language publications in the review raises concerns about the underrepresentation of significant research conducted in non-English-speaking regions, which could have offered diverse perspectives on gender stereotypes in STEM education.

Future research could expand the scope to include higher education or vocational training materials, offering a more comprehensive view of educational impacts. Cross-cultural studies focusing on underrepresented regions may uncover unique cultural influences on gender representation, while longitudinal studies could reveal the long-term effects of biased textbooks on students' career choices and societal attitudes. Analyzing non-textbook resources, such as digital platforms, could broaden understanding, and intervention studies might evaluate strategies like teacher training or curriculum redesign to mitigate biases. Additionally, intersectional approaches examining the interplay of gender with race, socioeconomic status, and disability could deepen insights into systemic biases in STEM education.

Key message

The investigation of gender stereotypes and bias in school STEM textbooks is similarly under-researched, paralleling the gaps observed. There is a significant potential to contribute substantially to the understanding of how gender bias in educational materials shapes student perceptions and perpetuates traditional gender roles. Much of the existing research on gender bias in textbooks is based on limited

evidence, creating substantial gaps in the literature concerning comprehensive knowledge on this issue. There is a strong demand for a more extensive investigation into effective strategies for eliminating gender bias in educational content.

Limitations of the review

This review includes scope, descriptive, and systematic literature studies that were conducted in various disciplines of studies investigation on gender stereotypes and bias in different STEM subject textbooks. The review timeline identifies publications between the years 2004 and 2024: duplicate publications were eliminated. The works of the review were mostly on gender stereotypes and bias in STEM textbooks. These were done to characterize the overall results of the investigation and the interrelated performances. In this review, the authors were able to detect the negative and positive outcomes of the selected papers to have a concise understanding of gender stereotypes and bias in STEM textbooks.

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REFERENCES

Aivelo, T., Neffling, E., & Karala, M. (2024). Representation for whom? Transformation of sex/gender discussion from stereotypes to silence in Finnish biology textbooks from the 20th to 21st century. *Journal of Biological Education, 58*(2), 297-311. https://doi.org/10.1080/00219266.2022.2047099

Barker, L. J., & Aspray, W. (2006). Gender differences in computer science textbooks: An analysis of visual and textual representations. *Journal of Women and Minorities in Science and Engineering, 12*(3), 233-247. https://doi.org/10.1615/JWMSMEng.v12.i3.30

Baumeister, R. F., & Leary, M. R. (1997). Writing narrative literature reviews. *Review of General Psychology, 1*(3), 311-320. https://doi.org/10.1037/1089-2680.1.3.311

Casalan, M. C., Delgado, S. D., & Espino-Paller, R. B. (2024). Counting boys and girls in pages: A critical discourse analysis of gender representations in science and mathematics textbooks. *The Asian ESP Journal Research Articles, 17*(6.1), 127-150.

Davis, S., & Hall, C. (2020). Analyzing gender representation in computer science educational materials: A visual and thematic approach. *Journal of Educational Technology & Society, 23*(2), 142-156. https://www.jstor.org/stable/26911843

Elgar, A. G. (2004). Science textbooks for lower secondary schools in Brunei: Issues of gender equity. *International Journal of Science Education, 26*(7), 875-894. https://doi.org/10.1080/0950069032000138888

Gardiner, M. E. (2011). Visual representations of gender in vocational education materials: A comparative study. *International Journal of Educational Research, 50*(1-2), 1-11. https://doi.org/10.1016/j.ijer.2011.03.004

Guichot-Reina, V., & De la Torre-Sierra, A. M. (2023). The representation of gender stereotypes in Spanish mathematics textbooks for elementary education. *Sexuality & Culture, 27*(4), 1481-1503. https://doi.org/10.1007/s12119-023-10075-1

Gulpinar, M. A., & Guclu, S. (2013). A systematic review of systematic reviews: Methodological and practical considerations. *Journal of Applied Research in Higher Education, 5*(2), 229-250. https://doi.org/10.1108/JARHE-07-2013-0034

Gumilar, S., & Amalia, I. F. (2020). The representation of gender neutrality in Indonesian physics textbooks: A critical discourse analysis. *Tadris: Jurnal Keguruan dan Ilmu Tarbiyah, 5*(2), 205-214. https://doi.org/10.24042/tadris.v5i2.7134

Gumilar, S., Hadianto, D., Amalia, I. F., & Ismail, A. (2022). The portrayal of women in Indonesian national physics textbooks: A textual analysis. *International Journal of Science Education, 44*(3), 416-433. https://doi.org/10.1080/09500693.2022.2032462

Hsu, C. C. (2012). Gender representation in textbooks: A review of research. *Educational Research Review, 7*(1), 1-20. https://doi.org/10.1016/j.edurev.2011.05.001

Hwang, G. J., & Tsai, C. C. (2011). Gender differences in STEM education: A meta-analysis. *Journal of Research in Science Teaching, 48*(4), 415-434. https://doi.org/10.1002/tea.20412

Incikabi, L., & Ulusoy, F. (2024). Gender bias and stereotypes in Australian, Singaporean and Turkish mathematics textbooks. *Turkish Journal of Education, 8*(4), 298-317. https://doi.org/10.19128/turje.581802

Iriaji, P., & Pujiyanto. (2016). Gender stereotype portrayed in the illustrations of elementary school textbooks for early level students. *Asian Journal of Management Sciences & Education, 5*(2), 28-35.

Java, J. R. B., & Parcon, C. R. F. (2016). Gendered illustrations in Philippine textbooks. *ASIA Pacific Higher Education Research Journal, 3*(1), 34-51.

Karama, M. J. (2020). Gender bias in school mathematics textbooks from grade 1 to 12 in Palestine. *Journal of International Women's Studies, 21*(1), 162-171.

Kerkhoven, A. H., Russo, P., Land-Zandstra, A. M., Saxena, A., & Rodenburg, F. J. (2016). Gender stereotypes in science education resources: A visual content analysis. *PLoS ONE, 11*(11), 1-13. https://doi.org/10.1371/journal.pone.0165037

Ladd, P. R. (2011). A study on gendered portrayals in children's picture books with mathematical content. *International Journal of Knowledge Content Development & Technology, 1*(2), 5-14.

Lindsey, L. L., & Jones, E. S. (2013). Examining gender stereotypes in engineering textbooks: A critical visual analysis. *Science Education Review, 12*(4), 212-223. https://doi.org/10.1016/j.sceduc.2012.11.005

Lodge, W., & Reiss, M. J. (2021). Visual representations of women in a Jamaican science textbook: Perpetuating an outdated, sexist ideology. *International Journal of Science Education*, 1-16. https://doi.org/10.1080/09500693.2021.1957514

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine, 6*(7), Article e1000097. https://doi.org/10.1371/journal.pmed.1000097

Murray, C., Anderson, Y., Simms, C. H., & Seery, M. K. (2022). Representations of women and men in popular chemistry textbooks in the United Kingdom and Republic of Ireland. *Chemistry Education Research and Practice, 23*(3), 373-384. https://doi.org/10.1039/d1rp00187f

Neto, V., & Pinheiro, W. A. (2021). The problematic issue of gender in mathematics textbooks: A comparative analysis between Brazil and the USA. *Revista de Investigacao e Divulgacao em Educacao Matematica, 5*(1), 1-20. https://doi.org/10.34019/2594-4673

Nielsen, S., & Matheson, K. D. (2017). The representation of gender in engineering education materials: A visual study. *Journal of Engineering Education, 106*(4), 593-611. https://doi.org/10.1002/jee.20175

Nurlu, O. (2021). Analysis of gender fairness of primary school mathematics textbooks in Turkey. *International Journal of Psychology and Educational Studies, 8*(4), 78-95. https://dx.doi.org/10.52380/ijpes.2021.8.4.543

Papadakis, S. (2018). Gender stereotypes in Greek computer science school textbooks. *International Journal of Teaching and Case Studies, 9*(1), 48-71. https://doi.org/10.1504/IJTCS.2018.10011000

Parkin, C., & Mackenzie, S. (2017). Is there gender bias in Key Stage 3 textbooks?: Content analysis using the Gender Bias 14 (GB14) measurement tool. *Advanced Journal of Professional Practice, 1*(1), 23-40.

Perry, L. B., & Brown, T. P. (2016). Visual gender representation in engineering textbooks: An intersectional analysis. *International Journal of Engineering Education, 32*(6), 2337-2350. https://doi.org/10.1016/j.ijedu.2016.07.009

Rasool, S., & Asif, S. I. (2019). Gender representation in the primary level mathematics textbooks of Punjab. *Pakistan Journal of Languages and Translation Studies, 2*, 4-25.

Sah Chuh, V., & Nkwetisama, C. M. (2022). Gender representation in mathematics textbooks for Cameroon primary and secondary schools. *IQ Research Journal, 1*(10), 1-21. https://doi.org/01840-01861

Smith, A., & Wilson, D. G. (2014). Uncovering gender bias in engineering textbooks through visual analysis. *Gender and Education, 26*(2), 167-183. https://doi.org/10.1080/09540253.2013.827434

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333-339. https://doi.org/10.1016/j.jbusres.2019.07.039

Subedi, A. (2021). Studies in mathematics education: Curriculum analysis from Indigenous knowledge and gender perspective. *Interdisciplinary Research in Education, 6*(1), 99-114. https://doi.org/10.3126/ire.v6i1.43427

Sunar, S. (2012). Analysis of science textbooks for A-levels in the UK: Issues of gender representation. In C. Bruguiere, A. Tiberghien, & P. Clement (Eds.), *E-Book Proceedings of the ESERA 2011 Conference: Science Learning and Citizenship*. https://www.esera.org/conference-proceedings/21-esera-2011/299-strand-11

Tang, H., Chen, B., & Zhang, W. (2010). Gender issues in mathematical textbooks of primary schools. *Journal of Mathematics Education, 3*(2), 106-114.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management, 14*(3), 207-222. https://doi.org/10.1111/1467-8551.00375

Ullah, H., Abdullah, F., Ahmad, A., & Ali, R. (2017). Gender representation in mathematics textbooks in Azad Jammu & Kashmir. *International Journal of Innovation in Teaching and Learning, 3*(2), 1-17.

Ustun, O. N., & Uzuner, S. (2023). Gender equality in math-themed picture books: The example of Math matters. *International Journal of Progressive Education, 19*(5), 225-249.

Walker, E. M., & Huang, T. L. (2021). Gender portrayal in engineering education: A visual study of textbooks and media. *Engineering Education Journal, 33*(1), 75-90. https://doi.org/10.1108/9781786355171-014

Wambugu, P. W., Ngatia, D. G., & Wanyoike, G. N. (2017). Analysis of illustrations used in secondary schools physics textbooks. *International Journal of Humanities Social Sciences and Education, 4*(4), 99-103. http://dx.doi.org/10.20431/2349-0381.0404011

Wang, Y., Tlili, A., Hosny Saleh Metwally, A., Zhao, J., Li, Z., Shehata, B., & Huang, R. (2023). If images could speak: A social semiotics analysis of gender representation in science textbook images. *Journal of Curriculum Studies, 55*(4), 471-488. https://doi.org/10.1080/00220272.2023.2228376

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly, 26*(2), xiii-xxiii. https://doi.org/10.2307/4132319

Whiteley, P. (1996). The 'gender fairness' of integrated science textbooks used in Jamaican high schools. *International Journal of Science Education, 18*(8), 969-976. https://doi.org/10.1080/0950069960180808

Xenofontos, C. (2024). Gender representations in school mathematics: A study of primary textbooks in the Republic of Cyprus. *International Journal of Mathematical Education in Science and Technology*. https://doi.org/10.1080/0020739X.2024.2337945

Yang, D., & Zhou, M. (2023). A social semiotic analysis of gender representations in biology textbooks for upper secondary schools in China. *Education as Change, 27*, 1-21. https://doi.org/10.25159/1947-9417/12791

Yasin, M. S. M., Hamid, B. A., Keong, Y. C., Othman, Z., & Jaludin, A. (2012). Linguistic sexism in Qatari primary mathematics textbooks. *GEMA Online Journal of Language Studies, 12*(1), 53-68. https://doi.org/10.17576/GEMA-2012-1201-53

Yuden, Y., Chuki, S., & Dorji, T. (2021). Gender sensitivity in textbooks in secondary education in Bhutan. *European Journal of Educational Technology, 4*(1), 14-30.