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Gender Bias in School Mathematics Textbooks from Grade 1 to 12 in Palestine

By Muneer Jebreel Karama[1]

Abstract

This study examines one of the most important social concepts and perspectives in mathematics textbooks from first grade to12thgrade in Palestine, which is gender bias. To achieve the goal of this study, the researcher conducted a quantitative and qualitative content analysis of an interval sample of these textbooks. Content analysis is considered an important method for revealing the strengths and weaknesses of curriculum components. The content analysis addressed the use of gender in names, verbs (actions), pictures, pronouns, and professions. The result confirms a male bias in all aspects of the analysis. The same result was confirmed by the qualitative analysis of profession types mentioned in mathematics textbooks for both females and males. In light of these results, the researcher strongly recommends that the curriculum be reformed to improve the gender balance.

Keywords: Math education, content analysis, gender balance, gender bias, curriculum reforms, Palestine, gender and education

Introduction

Gender inequality is an old and contemporary humanitarian social issue (Piatek-Jimenez, K., Madison, M., & Przybyla-Kuchek, J., 2014, Swim, J. K., Aikin, K. J., Hall, W. S., & Hunter, B. A., 1995). It affects many aspects of life; for example, the Gender Inequality Index (GII) ranks Iceland the highest in the world; its GII is (0.874), which indicates that women make $874 per month for every $1000 made by men. Yemen has the lowest income ranking (0.516); women there make $516 per month while men make $1000 (http://reports.weforum.org/global-gender-gap-report-2016/rankings/). Similar gender inequality can also be found in politics, health, etc. Gender balance in school curriculums is considered one of the most powerful tools for social growth and development for both females and males. It is also considered one of the most important aspects of modern curriculums because it affects students' self-esteem and self-assertiveness (Clark, A., 1995, Grogan, M., 1999, Kagawa, F., 2007, Wiesner, M. E., 2000).

Many studies have revealed hidden gender issues in school curriculums, including Piatek-Jimenez, K., Madison, M., &Przybyla-Kuchek, J., 2014, Holba, A.,2015, Bejerano, A. R., &Bartosh, T. M., 2015, Tang, H., Chen, B., & Zhang, W., 2010, DAWAR, T., &ANAND, D. S, Zakka, Z.M., &Zanzali, N. A. A.,2015,Gharbavi, A., & Mousavi, S. A.,2012, Forgasz, H., & Rivera, F., 2012, Brandell, G., Leder, G. & Nystrom, P., 2007). The majority of these studies showed a male bias. Other international institutions, such as National Council of Teachers of Mathematics NCTM (2000), pointed out a gender imbalance in terms of equity principles in school mathematics from

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1st to 12th grade. Gender balance should be the norm; it is a basic human right that should be considered in mathematics textbooks (Karama, MJ, 2012) because there is no difference between females and males, who are equal in life. The gender imbalances described above were confirmed by the UN General Assembly (1979) "Convention on the Elimination of All Forms of Discrimination against Women", i.e., the CEDAW, http://www.un.org/womenwatch/daw/cedaw/. Textbooks have important and high status in schools for many reasons; approximately 80% of classroom time is spent interacting with textbooks (Blumberg, R. L. 2008). Students read more than 32,000 pages of textbooks from first grade to 12th grade (Bahiyah et al., 2008), and textbooks play a critical role in presenting gender ideologies (Ariyanto, S., 2018).

Palestinian School Mathematics Textbooks (PSMTBs) from first grade to 12th grade, are designed, authorized, and distributed by the Ministry of Education to all public and private schools in the West Bank and Gaza Strip. Teachers of mathematics are required to utilize these PSMTBs during their daily lessons. Moreover, students' mathematical knowledge is tested according to the PSMTB method.

PSMTBs were recently reformed in 2018 and amended by the Ministry of Education to place students at the center of the learning process through an emphasis on active learning and problem solving. Like any global mathematics curriculum, PSMTBs address conceptual knowledge, procedural knowledge and problem solving. PSMTB daily lessons are structured as follows: lesson title, examples (from 2 to 4), activities (3-5), definitions, theorems (if any), exercises and problem solving (5-7). To meet the PSMTB authors' goals of associating mathematics with real life, PSMTBs include many human factors such as names, actions, pictures, and professions. Therefore, it is important to know how this information is oriented.

No studies have examined gender issues in PSMTBs. Because it is necessary to know the exact orientations of PSMTBs due to their inclusion of gender dimension (names, verbs (actions), pictures, pronouns, and professions), this research attempts to answer the following question: How is the Palestinian mathematics curriculum oriented toward gender in terms of names, verbs (actions), pictures, pronouns, and professions?

Research on gender in school mathematics textbooks

In the introduction, we stated the importance of gender issues in school mathematics textbooks for different grades. Many studies have examined gender issues in school mathematics textbooks; Zakka, Z. M., & Zanzali, N. A. B. A. (2015) examined gender bias in school mathematics textbooks for fifth and sixth grades in Nigeria. They found that there was a male bias. Dawar, T., &Anand, D. S. (2017) conducted an analysis of school textbooks for English, Language and Environmental Studies in seventh grade in India. They observed that females were underrepresented and found a male bias. Tang, H., Chen, B., & Zhang, W. (2010) explored gender issues in mathematics textbooks for first, third, and sixth grades in China and found gender inequality and some stereotypes. Gharbavi, A., & Mousavi, S. A. (2012) conducted a content analysis of high school English textbooks in Iran and found significant differences between representations of males and females due to favoritism and bias towards males. Ariyanto, S. (2018) confirmed that textbooks for junior high school students depicted gender bias and stereotypes. Linn, M. C., & Hyde, J. S. (1989) conducted a study of gender in mathematics and science; they found a male bias, with males gaining greater access to science and greater earning potential than females. Zittleman, K., &Sadker, D. (2002) conducted content analysis of23 education textbooks; they found that only 7% of the contents were oriented toward females. Elgar, A. G. (2004)

conducted a content analysis of science textbooks for secondary schools in Brunei and found gender inequality in these textbooks. Alayan, S., & Al-Khalidi, N. (2010) analyzed gender issues in school textbooks for history, civics, and national education in Jordan and Palestine for 7th, 8th, 9th, 10th, 11th, and 12th grades. They found that the representations in the textbooks indicated that males were superior, productive, and creative, while females were weak, inferior, and controlled and their roles were limited to being mothers and staying at home.

Such findings about general education policy in Palestine were confirmed by Blumberg, R. L. (2015) in her report "Education for All", which was included in UNESCO's "Eliminating gender bias in textbooks: Pushing for policy reforms that promote gender equity in education." However, no studies have examined gender issues in PSMTBs. Thus, this study examines gender issues in PSMTBs to describe gender representation in the curriculum developed by the authors and policy makers of PSMTBs.

Methodology

Mathematics textbooks are published by the Ministry of Education and were reformed in 2018. This study aims to analyze a sample of these textbooks according to determine how whether genders are represented equally. Thus, the researcher chose the sample of mathematics textbooks according to the interval sampling method, as indicated in the following table (1).

Table1. Interval sampling of PSMTBs

Gender	1	2	3	4	5	6	7	8	9	10	11	12
Textbook	×			×			×			×		

The sample contained four textbooks, which were analyzed according to gender dimensions. The content analysis framework used in this study consisted of many methods that were used in previous studies (Tang, H., Chen, B., & Zhang, W., 2010, DAWAR, T., & ANAND, D. S.,Zakka, Z.M., &Zanzali, N. A. B. A., 2015, Gharbavi, A., &Mousavi, S. A., 2012).The first method applied was a general content analysis considering overall masculine and feminine representations. This was followed by more detailed analysis of names, pictures, etc. The researcher developed the framework to achieve the study goals of analyzing the content according to important variables that may relate to gender, such as names, verbs (actions), pictures, pronouns, and professions.

To achieve the aim of this study, the researcher collected data by the procedure used by Cohen & Manion (1992, p. 49) in comparable studies, such as the selection of sample PSMTBs, as mentioned above, critical readings of the sample PSMTBs, and determination of gender dimensions such as names, verbs (actions), pictures, pronouns, and professions. Frequencies were calculated for each dimension in each textbook.

After the data was collected, the researcher used descriptive statistics tables containing the number of cases and their percentages and whether gender equality was present (i.e., if there were no differences in the number of female and male names used or if pictures of both genders were used). The chi-square test was used to determine the presence of significant differences between females and males.

Results and Discussions

This section shows the results of the study and presents discussions of each of the following: names, verbs (actions), pictures, pronouns, and professions.

The result for names in PSMTBs

Table (2) presents the frequencies and percentages of occurrences of female and male names in four PSMTBs.

Table 2. **Frequency of occurrence of female and male names in the texts of all four PSMTBs**

Book title	Female		Male		total	
	frequency	percentage	frequency	percentage	frequency	percentage
Mathematics 1st grade	33	37%	57	63%	90	100%
Mathematics 4th grade	52	36%	92	64%	144	100%
Mathematics 7th grade	28	39%	44	61%	72	100%
Mathematics 10^{th}grade	15	11%	122	89%	137	100%
Total	128	29%	315	71%	443	100%

As shown in table (2), female names were used less often than male names. There was a total of128 female names and 315 male names in the four textbooks. In addition, the researcher found 85 names that could be used for both genders; however, these names were excluded from the tables of frequency to focus only on names that are gender-specific.

Table (3) presents the significant differences using the chi-square test.

Table 3. Chi-square test of name distribution in PSMTBs

Gender	Observed frequency (O)	Expected frequency (E)	O-E	(O-E)^2	(O-E)^2/E
Female	128	221.5	-93.5	8742.25	39.46
Male	315	221.5	93.5	8742.25	39.46
Chi-square value					78.92*

* 78.92 is greater than 3.84 in the chi-square table at significance level $\alpha = 0.05$

In Table (3), it is clear that male names dominated in the PSMTBs; for example, readers can easily find the name "Ali" mentioned in many examples and exercises, while "Alia" rarely appears.

This result was confirmed by Ortigão, M. I. R., dos Santos, J. R. V., & Dalto, J. O. (2018),Cvencek, D., Meltzoff, A. N., & Greenwald, A. G. (2011); Sleeter, C. E., & Grant, C. A. (2017); Zakka, Z. M., &Zanzali, N. A. B. A.(2015);Macintyre, T., & Hamilton, S. (2010); and Piatek-Jimenez, K., Madison, M., &Przybyla-Kuchek, J. (2014). This orientation of the PSMTBs indicated that their authors maintain an outdated point of view and have not benefited from gender

research or from the CEDAW. Accordingly, it is necessary to hold training workshops for educational policy makers and the authors of PSMTBs regarding gender issues.

Verbs in PSMTBs

Table (4) presents the frequencies and percentages of female and male verbs in the four PSMTBs.

Table 4. Frequency of female and male verbs in the text of all four PSMTBs

Book title	Female		Male		total	
	frequency	percentage	frequency	percentage	frequency	percentage
Mathematics 1st grade	11	31%	24	69%	35	100%
Mathematics 4th grade	1	17%	5	83%	6	100%
Mathematics 7th grade	11	28%	28	72%	39	100%
Mathematics 10th grade	0	0%	58	100%	58	100%
total	23	17%	115	83%	138	100%

Table (4) indicates gender discrimination in the actions or verbs used in the PSMTBs to present mathematical activities and problems. Despite the PSMTB authors' efforts to use actions and verbs applicable to both genders, of which there are 1034 common verbs and actions, they failed consider the differences in feminine and masculine verb use, as shown in the table. For example, there were many greetings that assumed that only males were engaged in activities, such as “dear boys” or “dear guys”, while there were few greetings of females in activities or problems.

To confirm the results presented in table (4), the researcher conducted a chi-square test, as shown in table (5).

Table 5. Chi-square test of verb (or action) distribution in the PSMTBs

Gender	observed frequency	expected frequency	O-E	(O-E)^2	(O-E)^2/E
Female	23	69	-46	2116	30.66
Male	115	69	46	2116	30.66
Chi-square value					61.32*

* 61.32 is greater than 3.84 in the chi-square table at a significance level of $\alpha = 0.05$.

In table (5), it is clear, that there is a huge gap between verbs that address females and males. The majority, of these verbs are directed toward males. Similar results were obtained by Alayan, S., & Al-Khalidi, N. (2010), Iseke-Barnes, J. M. (2000), and Elgar, A. G. (2004). These results are related to our study and they show the same trends for PSMTBs. Accordingly, the researcher strongly recommends an urgent reform of PSMTBs to avoid biasing students’ beliefs about gender (Piatek-Jimenez, K., Madison, M., & Przybyla-Kuchek, J. 2014).

Pictures in PSMTBs

Table (6) presents the frequencies and percentages of pictures of females and males in the four PSMTBs.

Table 6. Frequency of pictures of females and males in the text of all four PSMTBs

Book title	Female		Male		Total	
	frequency	percentage	frequency	percentage	frequency	percentage
Mathematics 1st grade	6	27%	16	73%	22	100%
Mathematics 4th grade	8	27%	22	73%	30	100%
Mathematics 7th grade	2	40%	3	60%	5	100%
Mathematics 10th grade	0	0%	7	100%	7	100%
total	16	25%	48	75%	64	100%

Table (6) indicates the bias towards males in pictures, despite the authors' attempts to avoid bias by including approximately seven common pictures that include both females and males. However, this research focuses only on pictures depicting females and males separately.

Table (7) confirms the significant differences between the numbers of pictures of females and males based on the chi-square test.

Table 7. Chi-square test of the distribution of images of females and males in PSMTBs

Gender	observed frequency	expected frequency	O-E	(O-E)^2	(O-E)^2/E
Female	16	32	-16	256	8
Male	48	32	16	576	8
Chi-square value					16*

*16is greater than 3.84 in the chi-square table at a significance level of $\alpha = 0.05$.

The chi-square test confirms the male bias despite the use of seven pictures that contain females and males together. The analysis reveals that the majority of the images depict males and that images of females are missing from one-fifth of the books. The same results were found by Sleeter C. E., & Grant, C. A. (2017) for mathematics textbooks and by Potter, E. F., & Rosser, S. V. (1992) for science textbooks.

Pronouns in PSMTBs

Table (8) presents the frequencies and percentages of feminine and masculine pronouns in four PSMTBs.

Table 8. Frequency of feminine and masculine pronoun use in the text of all four PSMTBs.

Book title	Female		Male		total	
	frequency	percentage	frequency	percentage	frequency	percentage
Mathematics 1st grade	5	45%	6	55%	11	100%
Mathematics 4th grade	5	45%	6	55%	11	100%
Mathematics 7th grade	0	0%	4	100%	4	100%
Mathematics 10th grade	1	8%	12	92%	13	100%
total	11		28	72%	39	100%

Table 8 shows that a total of 11 pronouns related to females were used compared with 28 pronouns related to males, which implies the dominance of male pronouns in PSMTBs. A chi-square test was conducted to confirm this result, as shown in table 9.

Table 9. Chi-square test of the distribution of feminine and masculine pronouns in PSMTBs

Gender	observed frequency	expected frequency	O-E	(O-E)^2	(O-E)^2/E
Female	11	25	-14	196	7.84
Male	39	25	14	196	7.84
Chi-square value					15.68*

*15.68 is greater than 3.84 in the chi-square table at a significance level of α =0.05.

The chi-square tests in table 9proves the presence of a male bias. The use of a majority of masculine pronouns suggests that the books are directed only toward males and ignores females. This result is similar to the findings of Yasin, M. S. M., Hamid, B. A., Keong, Y. C., Othman, Z., & Jaludin, A. (2012), Kahveci, A. (2010), and Sadker, M. P., & Sadker, D. M. (1979).

Professions in PSMTBs

The data were analyzed two ways: First, a quantitative analysis was used, as described above; this was followed by a qualitative analysis to determine the different types of occupations represented. Table 10 shows the results of the quantitative analysis of professions mentioned in PSMTBs for females and males.

Table 10. Frequency of female and male professions in the text of all four PSMTB.

Book title	Females		Males		total	
	frequency	percentage	frequency	percentage	frequency	percentage
Mathematics 1st grade	0	0%	6	100%	6	100%
Mathematics 4th grade	5	33%	10	67%	15	100%
Mathematics 7th grade	3	33%	6	67%	9	100%
Mathematics 10th grade	0	0%	27	100%	27	100%
total	8		49	86%	57	100%

Table 10 shows that females were represented in 8 professions, while males were represented in59 professions. From this table, we can see that females were represented in zero professions in the PSMTBs for grades 1 and 10.

Table 11 indicates the large gap in and differences between gender representation in professions using the chi-square test.

Table 11. Chi-square test of the distribution of females and males among professions in PSMTBs

Gender	Observed frequency	Expected frequency	O-E	(O-E)^2	(O-E)^2/E
Female	8	28.5	-20.5	420.25	14.74
Male	49	28.5	20.5	420.25	14.74
Chi-square value					29.48*

*29.48 was greater than 3.84 in the chi-square table at a significance level of α =0.05.

Table 11 confirms the significant difference in the professional representation of females and males. The same result was reported by Clark Blickenstaff, J. (2005), and Gharbavi, A., & Mousavi, S. A. (2012).

Qualitative analysis of professions

This section presents the different types of professions mentioned in PSMTBs for both females and males. The represented female professions included making cakes, cooking, sewing, baking, raising children and harvesting fruits and vegetables.

In contrast, males were shown in the following professions: Trader, carpenter, painter, driver, construction worker, engineer, shop owner, math teacher, dentist, scientist, farm owner, football player, designer, accountant, president, scholar, researcher, and manager. This qualitative analysis shows that males were presented in the highest status professions, while females were represented as having limited occupations in society and as staying at home, cooking and cleaning.

Conclusion

The research shows that PSMTBs are subject to stereotypes due to gender issues. Moreover, females are unlikely be represented in the names, verbs (actions), pictures, pronouns, and professions shown in the PSMTBs. The PSMTBs present a male bias and neglect the representation of females as social partners.

Recommendation

In light of the results, it is important to reconsider PSMTBs and reform them to ensure gender balance in names, verbs (actions), pictures, pronouns, and professions.

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