

If Not in Science, Then Where Are the Women? A Content Analysis of School Textbooks

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Abstract

This article analyses the representation of femininity in school textbooks in search of elements that discourage girls from taking up scientific educational paths. Quantitative content analysis and elements of the constant comparison method were used to examine the content of 75 Polish textbooks. Significant differences were identified in the number of male and female characters, their ages, financial resources, occupations, family roles and mental characteristics. Interestingly, the authors of the analysed textbooks are mostly women, which seems to indicate a manifestation of self-discrimination. These results indicate the existence of mechanisms discouraging females from a scientific career and are discussed in light of Hofstede's masculinity-femininity theory.

Keywords: femininity; masculinity; education; content analysis

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Introduction

Ruth Watts begins her book *Women in Science: A Social and Cultural History* with the view that science and women do not come together in colloquial speech (Watts 2007). It is difficult to disagree with this view given that science has been associated with masculinity for centuries, and until recently it was extremely rare for women to participate in this field (Rossi 1965). The twenty-first century has brought constant changes, a striving for innovation and an increasing need for creativity, which entails the need to involve the greatest possible human resources. Therefore, it seems that the marginalisation of women in science should be less and less noticeable. Unfortunately, this is not the case, as researchers in both Poland (Młodożeniec and Knapińska 2013), Europe (Busolt and Kugele 2009) and the United States (Handelsman et al. 2005; Mendick 2006) have noted.

It is essential to address this deeply rooted cultural imbalance for the future development of humanity because, despite their interest, half of the population is systematically excluded from science (Cheryan et al. 2017). Meanwhile, equal opportunities for women and men in choosing career paths would be profitable and beneficial from the perspective of countries and their economies (Maceira 2017). In the search for the mechanisms that inhibit women's scientific career paths, researchers have focused on socialisation in the family (Eccles et al. 2000), peer groups (Witt 2000), media coverage (Signorielli 1990), or the content of education and the hidden curriculum (Hernández et al. 2013; Lamas 1996). Part of the problem lies in elementary and secondary schooling, when choices are made about learning or extracurricular activities according to the student's gender (Eder and Parker 1987). Many years of favouring boys in science classes (Gilbert 2001), while encouraging girls to choose art or humanities subjects, remain relevant (Basow 2004). This allows children to develop only a narrow range of skills and may have a significant impact on future educational and career path choices (Knapp, Kelly-Reid, and Whitmore 2006). School textbooks presenting specific patterns of femininity and masculinity are also important because in addition to the substantive, educational aspect, they also include an ideological message because they reflect social reality and the relationships of the participants (Good et al. 2010). Textbooks provide implicit confirmation of the validity of the roles in which girls and boys function, strengthening their internalised beliefs about their own potential and place in the social world (Koch 2003), which may involve choosing a career path (Basow 2004). The traditional division of what is exclusively appropriate for females or males is slowly evolving and may vary depending on the culture or society (An and Kim 2007). In highly masculine cultures (Hofstede 1996; Hofstede Insights 2020) with a clear division between male and female spheres, this division may also be reflected in the teaching content. The question arises as to how femininity is currently portrayed in school textbooks in a masculine culture (in this case, Polish) and whether this image may partially discourage girls from taking up a scientific education and career path. In this article, we try to answer this question.

Individualism, Femininity and the Economy

According to Geert Hofstede's cultural dimensions theory of classifying cultures (Hofstede 2001, 2011), one of the dimensions is the division into *individual* and *collective* cultures. In societies closer to collectivism, the members adapt to the rules prevailing in the social group; they rarely reveal their opinions or needs (Rudowicz 2003), and they are perceived as an inherent correlate of a specific group. Moreover, the successes and innovations of the entire group are seen as more important than the independent actions of an individual (Markus and Kitayama 1991). In individualistic cultures, the needs of the individual prevail, non-conformism is valued, and successes are attributed to specific people and creators, and are not attributed to the whole group (Lubart 2010). Poland is a former socialist country that experienced a strong influence of collectivist values for almost half a century under the influence of the Union of Soviet Socialist Republics (USSR) (Oyserman, Coon, and Kimmelmeier 2002). Poland started to introduce Western values after the fall of communism in the 1980s (Boski 2006). This ultimately resulted in a slight advantage of individualistic values, with a current score of 60 points out of 100 on the individualism scale (Hofstede Insights 2022).

This systematic shift is not observed in the second dimension: *masculinity* and *femininity*. Masculinity illustrates the intensity of diversity between gender roles and refers to social norms that define these roles (Hofstede 2001). Although men and women are different from each other, these natural differences are often exaggerated in cultures and this intensifies the gender gap. This phenomenon was described by Sandra Bem (1993) as gender polarisation, which favours the construction of social roles (that is, activities and behaviours that are considered to only be appropriate for women or men). In masculine societies, a large gender gap exists and socialisation revolves around traditional gender roles. Such societies propose that a man should focus on material success and be efficient, strong and assertive, while women should focus on quality of life and be delicate, modest and rather passive. There is also a clearer division between what femininity and masculinity mean, and what activities and features are associated with them (Runge et al. 1981). In feminine societies gender roles overlap; both women and men care about relationships and a high quality of life, while the distinction between genders (for example in terms of household duties, occupational positions, earnings or access to educational paths) is less pronounced (Hofstede 2001). With a score of 64 (out of a possible 100), Poland is in the upper half of this scale and is described as a masculine society.

Apart from the lack of gender equality, the masculinisation of society can have tangible economic effects. Data from the Central Statistical Office (GUS) shows that men more often than women attain the highest academic degrees. In 2017, 753 women, compared to 922 men, obtained a postdoctoral degree, while the title of professor was awarded to 89 women, compared to 197 men (GUS 2020). The gender gap in tertiary education restricts career opportunities for women and this may limit the economic development of the entire country; for example, it may be one of the reasons for the difference in

gross domestic product (GDP) (Maceira 2017). In fact, Poland's gross domestic product (GDP) per capita is lower than the GDP of other individualist European countries where feminine values prevail, such as Finland or Norway (see World Bank 2020). In addition, the score of the Global Innovation Index (Dutta, Lavin, and Wunsch-Vincent 2020) and the Global Creativity Index (Florida, Mellander, and King 2015) for Poland are lower when compared to Finland and Norway.

The Image of Women in Textbooks

The significantly lower number of women than men in science (Blickenstaff 2005; Hill, Corbett, and St. Rose 2010) and technology-related professions (Cronin and Roger 1999) may be due to the lack of women's role models in scientific fields (Byrne 1993), the social pressure exerted on girls to adapt to traditional gender roles (Thorne 1993), and teaching content that mainly represents men in science (Walford 1981). In masculine societies, a clear division of roles is important and highly valued. It can be assumed that a reflection of the noticeable differences between femininity and masculinity would also be found in teaching content, which would allow the continuation of the adopted values.

Numerous European and international analyses confirm the traditional gender content, gender bias and polarisation in textbooks. For example, in Greek textbooks, women are presented as less able to deal with new technologies than men (Papadakis 2018). Gender-biased textbooks also glorify males through the frequency of reference to famous men, while famous women appear in them less frequently (Gouvias and Alexopoulos 2018). In Russian-language textbooks, it was found that men argue and women agree, and men talk mainly about themselves while women's questions mostly concern men (Rifkin 1998). In Singaporean textbooks, there is a strong advantage for men in both the number and quantity of the characters' statements, and the importance of masculinity increases with the successive levels of linguistic knowledge (Gupta and Yin 1990). Similar examples of gender polarisation and male primacy in textbooks can be found (among others) in three European masculine societies: Germany (Moser and Hannover 2014), the United Kingdom (Musty 2015) and Italy (Biemmi 2015). They can also be found in Macedonia (Toçi and Aliu 2013), Iran (Gharbavi and Mousavi 2012), China (Tang, Chen, and Zhang 2010), Japan (Lee 2014) and Pakistan (Ullah and Skelton 2013). Analyses of Polish textbooks also indicate a strengthening of gender polarisation. Textbooks published between 1977 and 1982 mentioned the profession of mothers four times less often than that of fathers; the woman was seen as the guardian of the home, while the man provided entertainment and was the source of general knowledge (Szacka 1997). Similarly, the contents of the textbooks in force until 1989 were dominated by androcentrism, a clear division of tasks by gender and stereotyping of mental traits (Pankowska 2005). Male characters predominate in one of the most recent studies (Chmura-Rutkowska et al. 2016). Women more often took care of the household and family, while men earned more and they more regularly held managerial positions. However, it is difficult to clearly state how often and with what intensity traditional

gender roles are presented in textbooks. This is due to the fact that the majority of these analyses are qualitative in nature, showing a certain fragment of reality, and indicating and exploring the existence of a phenomenon in a narrow area (Rahman 2017).

Considering that this type of research on the content of textbooks is rare, we decided to choose a quantitative method of analysis. This research approach can introduce new information on the frequency of occurrence of certain terms or elements, which cannot be achieved using qualitative analyses (McLaughlin and Marascuilo 1990). Textbooks for the two last grades of elementary school were selected for analysis because, to the authors' knowledge, there has been no previous research on the content of this group of textbooks. The decision to choose Polish-language and mathematics textbooks was dictated by the fact that these are the subjects with the largest number of hours in the weekly schedule, and consequently the students use these textbooks most often. Compulsory school reading, as an element of work during Polish-language lessons, was also included in our analyses. The aim of this study was to ascertain how the content of textbooks and school readings represents gender polarisation, femininity, masculinity and the distribution of social gender roles, looking for possible reasons to explain why girls are discouraged from science. No research hypotheses were formulated because this study was exploratory in nature.

Method

Sample and Data Collection

A total of 75 book items for the 7th and 8th grades of elementary school were included in the quantitative analysis: 32 Polish-language textbooks and workbooks (16 for Grade 7 and 16 for Grade 8) 19 school readings (for Grades 7 and 8 combined) and 24 mathematics textbooks and workbooks (12 for Grade 7 and 12 for Grade 8). This represents 100% of the textbooks, workbooks and school reading for Grades 7 and 8 that were approved by the Polish Ministry of National Education in 2017. The selection of books was made using the list of textbooks available on the website of the Ministry of National Education (MNE 2017). Data collection was based on a textual analysis of the content of the textbooks. This consists of understanding the language, symbols and graphics that are present in the analysed text. This type of analysis provides us with information on how people communicate their understanding of life and life experiences (Allen 2017).

Quantitative Content Analysis

Content analysis facilitates the description of open and hidden content of the message and allows us to measure the frequency, intensity or order of occurrence of terms or words. Typically, a content analysis research method includes the following steps: (1) selecting the unit of analysis, (2) defining categories, (3) testing defined categories, (4) assessing reliability and validity, (5) data coding, and (6) reassessment of reliability and validity (Krippendorff 1980; Weber 1985). Focusing on the gender aspects of a textbook, we examined the types of character activity, power distribution, and patterns

of perception and being perceived (including verbal labelling) (Kabira and Masinjila 1997). The final analytical criteria illustrating the sociocultural definition and valuation of both genders were built on this basis (Table 1). The unit of analysis was individual or collective human character (for example, a group of girls, a group of men) appearing in a selected fragment of the textbook that forms a logical unit (that is, thematic or structural). The main texts, source texts and footnotes, as well as illustrations and infographics, were analysed. In the case of mathematical problems, a single task was examined. The set of categories that we used for coding were the objective characteristics of the individuals (for example, mother, student, and doctor) and the conceptual characteristics (for example, aggression, emotional expression or wisdom), which were only coded for unambiguous content. In the case of doubts or ambiguities within the category (for example, a lack of information on the profession or financial resources of the character), the content was not included in the analysis. Encoding was performed by 10 qualified coders who were teachers of mathematics and Polish language and members of non-governmental organisations dealing with equality education. Each coder used an Excel spreadsheet with the entered analytical categories and a common categorisation key for each textbook. In the next step, the data from the spreadsheets was entered into one database and subjected to further statistical analyses. Having coded the content of all the books, the codes were unified and adapted for introduction to SPSS Imago 25. To guarantee the reliability of the assessments, each book was coded independently by two coders. The coders' agreement was good and ranged from $\kappa=0.71$ to $\kappa=0.82$ (Weber 1985). In cases where the coders disagreed, the differences were discussed on an ongoing basis. In addition, the textbook authorship was coded, looking for differences in the numbers of male and female authors. The analysis covered 75 books for Polish language, school reading and mathematics. Data on 11 911 characters (8 105 male and 3 806 female) were entered into the database.

Table 1: The coding categories

| Category | Subcategory | Codes |
|----------------------------|--------------------------|--|
| Type of content | Subject | 1: Polish language; 2: mathematics; 3: school reading |
| | Type of analysed content | 1: Polish language task; 2: mathematics task; 3: text in textbook; 4: source text; 5: poetry; 6: prose; 7: illustration; 8: photograph; 9: art reproduction |
| Objective characteristics | Character gender | 1: female; 2: male |
| | Character age | 1: infant; 2: preschool and elementary school child; 3: teenager; 4: adult; 5: senior |
| | Family life—roles | 1: marriage; 2: parents; 3: children/grandchildren; 4: siblings; 5: relationship; 6: grandparents; 7: extended family members |
| | Social life—occupation | 1: learning/studying; 2: unemployed; 3: manual labour/farming; 4: qualified staff; 5: company owners/management staff; 6: trade and services; 7: office work/middle level; 8: intellectual work and self-employment; 9: sport |
| | Financial resources | 1: very low (homeless people, beggars); 2: low (difficulty meeting life needs, e.g., they cannot afford meals for children, clothes, and paying rent); 3: average (stable life, character has everyday appliances, makes purchases, arranges pocket money for children, etc.); 4: high (highly profitable job; a celebrity; surrounds him/herself with expensive things, invests, etc.); 5: very high (a monarch, king, emperor, princess, etc.) |
| Conceptual characteristics | Mental and moral traits | Mental and moral traits that describe the character in the unit of analysis, literally coded |
| Authorship | Textbook authorship | Gender of authors of textbooks, readings and units of analysis (if possible to determine them) |

Note: If the unit of analysis did not contain clear information about a character within the selected category, then the category for that character was not coded.

Results

Frequency of Gender Occurrence

The textbooks were found to be dominated by male characters (68%, $N=8105$), who are more than twice as numerous as female characters (32%, $N=3806$). More specifically, in Polish-language textbooks women constitute 31%, ($N=2517$) and men 69% ($N=5649$). In mathematics textbooks, women constitute 35% ($N=1228$) and men 65% ($N=2225$). In school readings, women are presented four times less often (21%, $N=61$) than men (79%, $N=231$). The differences between the results are statistically significant, with a low effect size ($\chi^2=40.032$; $p=.0001$; Cramer's $V=.058$; $p=.0001$).

Gender and Type of Analysed Content

The differences between the results in the three groups of textbooks are statistically significant. In Polish-language textbooks, the highest representation of women was noted in art reproductions. A slightly smaller percentage of female characters occurs in illustrations. The source texts reported almost half as many female characters as male. In other types of analysed content, the percentage of women in relation to men was found to be lower than half, that is, texts in the textbooks, Polish-language tasks and photographs ($\chi^2=20.682$; $p<.001$, Cramer's $V=.071$; $p<.001$). In the mathematics textbooks, in the case of mathematical tasks the female characters constituted slightly more than half in relation to the male characters. In the remaining categories (that is, illustrations, text in textbook and source text) the number of female characters did not exceed half the number of males, while in the photograph category no women were recorded ($\chi^2=28.551$; $p<.0001$, Cramer's $V=.112$; $p<.0001$). In school readings, the percentage of women did not exceed half the number of men in any of the categories. Moreover, none of the 24 pictures shows a female character ($\chi^2=9,720$; $p<.008$, Cramer's $V=.182$; $p<.008$). The gender of the characters in different types of analysed content is presented in Figures 1 to 3.

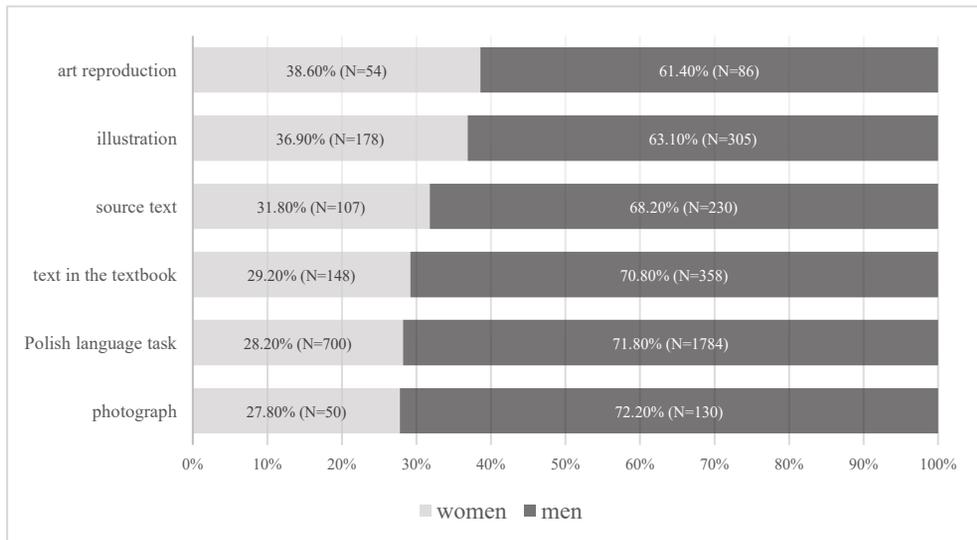


Figure 1: Gender of characters in different types of analysed content: Polish language

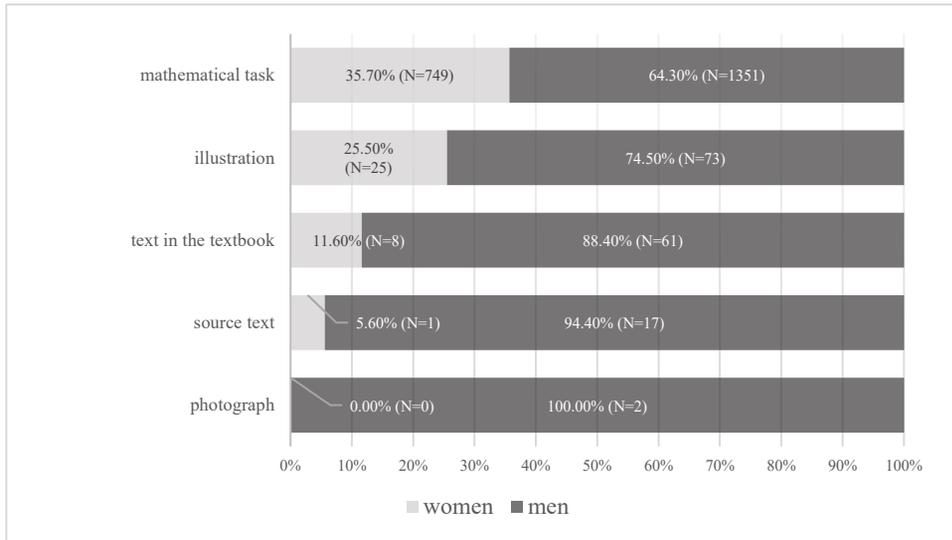


Figure 2: Gender of characters in different types of analysed content: mathematics

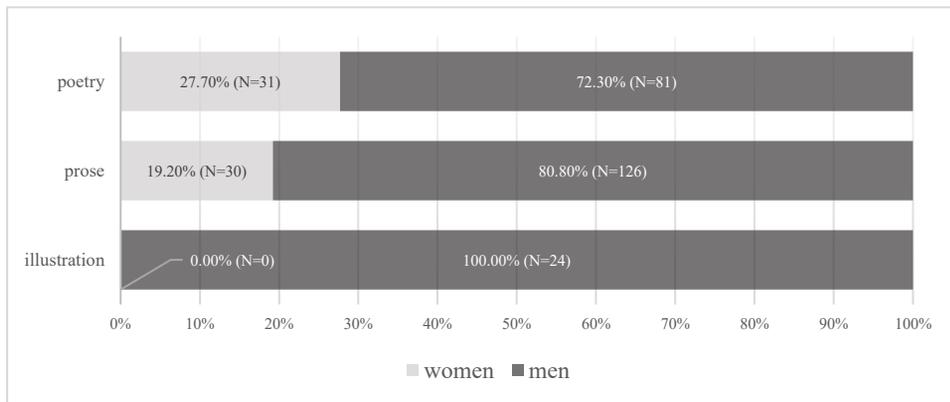


Figure 3: Gender of characters in different types of analysed content: school readings

Gender and Age

The female and male characters were found to differ significantly in terms of age ($p < .0001$). Indeed, in all groups of textbooks the female characters are significantly more frequently depicted as infants. Moreover, in Polish-language and mathematics textbooks, women are more often presented as preschool and early school children and teenagers, while male characters are more often depicted as adults. More female characters as seniors are also presented in Polish-language textbooks and school readings. Assuming that children and young people remain dependent, women are portrayed in these dependent roles more often than men. The gender and the ages of the analysed characters are presented in Table 2.

Table 2: Gender and ages of the analysed characters

| | | Polish language (32 books) | | Mathematics (24 books) | | School readings (19 books) | | All textbooks (75 books) | |
|-------------------|----------|---|-------|--|-------|---|-------|--|-------|
| | | Female | Male | Female | Male | Female | Male | Female | Male |
| Infant | <i>N</i> | 5 | 3 | 1 | 0 | 3 | 0 | 9 | 3 |
| | % | 0.3% | 0.1% | 0.2% | 0.0% | 7.1% | 0.0% | 0.4% | 0.1% |
| Pre-school/ | <i>N</i> | 96 | 110 | 66 | 84 | 1 | 21 | 163 | 215 |
| Elementary school | % | 6% | 3.1% | 13.2% | 8.7% | 2.4% | 11.4% | 7.6% | 4.6% |
| Teenager | <i>N</i> | 376 | 501 | 202 | 291 | 9 | 45 | 587 | 837 |
| | % | 23.4% | 14.1% | 40.5% | 30.0% | 21.4% | 24.5% | 27.3% | 17.8% |
| Adult | <i>N</i> | 1107 | 2840 | 214 | 579 | 29 | 102 | 1350 | 3521 |
| | % | 68.8% | 80.1% | 42.9% | 59.6% | 69.0% | 55.4% | 62.8% | 74.9% |
| Senior | <i>N</i> | 26 | 90 | 16 | 17 | 0 | 16 | 42 | 123 |
| | % | 1.6% | 2.5% | 3.2% | 1.8% | 0% | 8.7% | 2.0% | 2.6% |
| Overall | <i>N</i> | 1610 | 3544 | 499 | 971 | 42 | 184 | 2151 | 4699 |
| | % | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| | | $(\chi^2=104.474;$ $p<.0001;$ Cramer's $V=.142;$ $p<.0001)$ | | $(\chi^2=20.885;$ $p<.0001;$ Cramer's $V=.304;$ $p<.0001)$ | | $(\chi^2=20.000;$ $p<.0001;$ Cramer's $V=1.000; p<.0001)$ | | $(\chi^2=131,887;$ $p<.0001;$ Cramer's $V=0,139; p<.0001)$ | |

Gender and Financial Resources

Significant differences were identified in the financial resources of male and female characters in Polish-language textbooks and school readings. Women more often have low and average financial resources, while men more often have very low (in three groups of textbooks), high and very high (in mathematics and Polish-language textbooks) financial resources. The gender and financial resources of the analysed characters are presented in Table 3.

Table 3: Gender and financial resources of the analysed characters

| | | Polish language (32 books) | | Mathematics (24 books) | | School readings (19 books) | | All textbooks (75 books) | |
|-----------|---|--|-------|--|-------|---|-------|---|-------|
| | | Female | Male | Female | Male | Female | Male | Female | Male |
| Very low | N | 3 | 12 | 0 | 1 | 1 | 69 | 4 | 82 |
| | % | 2.1% | 2.7% | 0.0% | 1,0% | 5,3% | 61,1% | 2,1% | 12,4% |
| Low | N | 27 | 40 | 0 | 7 | 3 | 8 | 30 | 55 |
| | % | 18.6% | 8.8% | 0.0% | 7,1% | 15,8% | 7,1% | 15,4% | 8,3% |
| Average | N | 19 | 33 | 21 | 40 | 8 | 23 | 48 | 96 |
| | % | 13.1% | 7.3% | 67.7% | 40,8% | 42,1% | 20,4% | 24,6% | 14,5% |
| High | N | 87 | 323 | 9 | 38 | 7 | 12 | 103 | 373 |
| | % | 60% | 71.5% | 29% | 38,8% | 36,8% | 10,6% | 52,8% | 56,3% |
| Very high | N | 9 | 44 | 1 | 12 | 0 | 1 | 10 | 57 |
| | % | 6.2% | 9.7% | 3.2% | 12,2% | 0% | 0,9% | 5,1% | 8,6% |
| Overall | N | 145 | 452 | 31 | 98 | 19 | 113 | 195 | 663 |
| | % | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| | | $(\chi^2=17.371$; $p<.002$; Cramer's $V=.171$; $p<.002)$ | | $(\chi^2=8.656$; $p<.07$; Cramer's $V=.259$; $p<.07)$ | | $(\chi^2=22.245$; $p<.0001$; Cramer's $V=.411$; $p<.0001)$ | | $(\chi^2=35.511$; $p<.0001$; Cramer's $V=.203$; $p<.0001)$ | |

Gender and Occupation

Significant differences were also found in the frequency of the analysed characters' professions and genders in all groups of textbooks. Compared to male characters, the female characters are more than twice as often presented as learning and studying in Polish-language and mathematics textbooks. Moreover, in Polish-language textbooks, women are more frequently presented as unemployed or performing manual labour and working in agriculture. In other occupational groups, the share of men is greater than that of women. Major differences exist in all groups of textbooks in favour of men in three categories: intellectual work and self-employment (for example, scientist, lawyer, doctor, or IT specialist), sport, qualified employees and in Polish-language and mathematics textbooks as company owners/management staff. The gender and the occupations of the analysed characters are presented in Table 4.

Table 4: Gender and occupations of analysed characters

| | | Polish language (32 books) | | Mathematics (24 books) | | School readings (19 books) | | All textbooks (75 books) | |
|---|----------|--|-------|---|-------|--|-------|--|-----------|
| | | Female | Male | Female | Male | Female | Male | Female | Male |
| Scientist / inventor | <i>N</i> | 11 | 98 | 0 | 46 | 0 | 2 | 11 | 146 |
| | % | 1.8% | 4.5% | 0.0% | 5.9% | 0.0% | 2.7% | 1.3% | 4.8% |
| Intellectual work and self- employment | <i>N</i> | 303 | 1100 | 16 | 126 | 1 | 17 | 320 | 1243 |
| | % | 50.8% | 50.8% | 6.3% | 16.1% | 8.3% | 23.0% | 37.2% | 41.1 % |
| Company ownership/ management | <i>N</i> | 13 | 74 | 3 | 42 | 1 | 4 | 17 | 120 |
| | % | 2.2% | 3.4% | 1.2% | 5.4% | 8.3% | 5.4% | 2.0% | 4.0% |
| Qualified staff | <i>N</i> | 31 | 280 | 7 | 30 | 0 | 18 | 38 | 328 |
| | % | 5.2% | 12.9% | 2.8% | 3.8% | 0.0% | 24.3% | 4.4% | 10.9 % |
| Manual labour / agriculture | <i>N</i> | 23 | 106 | 6 | 70 | 4 | 11 | 33 | 187 |
| | % | 3.9% | 4.9% | 2.4% | 8.9% | 33.3% | 14.9% | 3.8% | 6.2% |
| Office work / middle level | <i>N</i> | 6 | 35 | 3 | 16 | 0 | 1 | 9 | 52 |
| | % | 1.0% | 1.6% | 1.2% | 2.0% | 0.0% | 1.4% | 1.0% | 1.7% |
| Sport | <i>N</i> | 13 | 118 | 26 | 101 | 0 | 1 | 39 | 220 |
| | % | 2.2% | 5.5% | 10.3% | 12.9% | 0.0% | 1.4% | 4.5% | 7.3% |
| Trade / services | <i>N</i> | 12 | 66 | 25 | 57 | 5 | 8 | 42 | 131 |
| | % | 2.0% | 3.0% | 9.9% | 7.3% | 41.7% | 10.8% | 4.9% | 4.3% |
| Unemployed | <i>N</i> | 4 | 5 | 0 | 1 | - | - | 4 | 6 |
| | % | 0.7% | 0.2% | 0.0% | 0.1% | - | - | 0.5% | 0.2% |
| Studying / learning | <i>N</i> | 180 | 283 | 167 | 294 | 1 | 12 | 348 | 589 |
| | % | 30.2% | 13.1% | 66.0% | 37.5% | 8.3% | 16.2% | 40.4% | 19.5 % |
| Overall | <i>N</i> | 596 | 2165 | 253 | 783 | 12 | 74 | 861 | 3022 |
| | % | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100 % |
| | | $(\chi^2=134.679$; $p<.0001$; Cramer's $V=.221$; $p<.002)$ | | $(\chi^2=86.315^b$; $p<.0001$; Cramer's $V=.289$; $p<.0001)$ | | $(\chi^2=13.724^c$; $p=.089$; Cramer's $V=.399$; $p=.089)$ | | $(\chi^2=200.613$; $p<.0001$; Cramer's $V=.227$; $p<.0001)$ | |

Gender and Family Life

Differences in the frequency of specific family roles between genders were found to be less spectacular but still statistically significant in Polish-language textbooks and school readings. Women are more often presented as mothers than men are presented as fathers. Women are also more often presented as married or being in a relationship. Meanwhile, men are more often portrayed as children and grandchildren (in Polish-language and

mathematics textbooks), siblings or extended family members (in all groups of textbooks). Moreover, women as grandmothers occur more frequently in Polish-language and mathematics textbooks. The gender and the family roles of the analysed characters are presented in Table 5.

Table 5: Gender and roles played in family life

| | | Polish language (32 books) | | Mathematics (24 books) | | School readings (19 books) | | All textbooks (75 books) | |
|-------------------------------|----------|--|-------|---|-------|--|-------|--|-------|
| | | Female | Male | Female | Male | Female | Male | Female | Male |
| Marriage | <i>N</i> | 78 | 65 | 9 | 7 | 5 | 4 | 92 | 76 |
| | % | 16.5% | 14.6% | 6.3% | 4.5% | 17.9% | 7.4% | 14.2% | 11.6% |
| Parents | <i>N</i> | 167 | 137 | 52 | 45 | 9 | 13 | 228 | 195 |
| | % | 35.2% | 30.7% | 36.1% | 28.8% | 32.1% | 24.1% | 35.3% | 29.7% |
| Children and grandchildren | <i>N</i> | 116 | 141 | 38 | 48 | 6 | 6 | 160 | 195 |
| | % | 24.5% | 31.6% | 26.4% | 30.8% | 21.4% | 11.1% | 24.8% | 29.7% |
| Siblings | <i>N</i> | 37 | 43 | 27 | 37 | 2 | 3 | 66 | 83 |
| | % | 7.8% | 9.6% | 18.8% | 23.7% | 7.1% | 5.6% | 10.2% | 12.7% |
| Relationship | <i>N</i> | 29 | 19 | - | - | 4 | 5 | 33 | 24 |
| | % | 6.1% | 4.3% | - | - | 14.3% | 9.3% | 5.1% | 3.7% |
| Grandparents | <i>N</i> | 29 | 17 | 11 | 10 | 0 | 18 | 40 | 45 |
| | % | 6.1% | 3.8% | 7.6% | 6.4% | 0.0% | 33.3% | 6.2% | 6.9% |
| Extended family | <i>N</i> | 18 | 24 | 7 | 9 | 2 | 5 | 27 | 38 |
| | % | 3.8% | 5.4% | 4.9% | 5.8% | 7.1% | 9.3% | 4.2% | 5.8% |
| Overall | <i>N</i> | 474 | 446 | 144 | 156 | 28 | 54 | 646 | 656 |
| | % | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| | | $(\chi^2=12.254;$ $p=.057;$ Cramer's $V=.115;$ $p=.057)$ | | $(\chi^2=3.303;$ $p=.653;$ Cramer's $V=.105;$ $p=.653)$ | | $(\chi^2=13.554;$ $p=.035;$ Cramer's $V=.407;$ $p=.035)$ | | $(\chi^2=12.989;$ $p=.043;$ Cramer's $V=.100;$ $p=.043)$ | |

Mental and Moral Characteristics

Coding of mental and moral characteristics was carried out based on the constant comparison method (Glaser and Strauss 1967; Strauss and Corbin 1990). Graphics were excluded from the analysis because of the inability to clearly identify the characters' traits. Only those features that were explicitly assigned to a character in the text were coded. In the first step, open coding was used when 425 different mental and moral characteristics attributed to male and female characters were coded by 10 coders. In the

second step, where axial coding was used, these terms were grouped into 18 categories by two competent judges trained in the coding procedure. The judges worked independently and any discrepancies were discussed on an ongoing basis. Table 6 presents the differences in the frequency of terms attributed to male and female characters, as well as examples of features classified into categories.

Of all of the terms attributed to female characters, the largest category comprises *prosocial traits*. In comparison, the same category of traits for male characters is more than a third lower. In contrast, the attributes most commonly attributed to male characters are fame and recognition; female characters demonstrating such attributes appear far less often. Anti-social traits, idealism and honour, wisdom, proactivity, positive strength, docility and submission, and avoidance and stagnation are also more often attributed to males. Delicacy, emotional expression, immaturity, sense of humour, professionalism, and promiscuity are more often attributed to female characters than to male characters. The frequencies of attributing low intelligence, nonconformity and aggression to female and male characters were all found to be comparable, with a slight predominance of low intelligence among women and the other two characteristics among men. The differences between the results are statistically significant, with a medium effect size ($\chi^2=76.30$; $p<.0001$; Cramer's $V=.27$; $p<.0001$).

Table 6: Mental and moral traits attributed to male and female characters

| | Main category | | Example of traits assigned to category | Female | Male | Overall |
|-----|----------------------|----------|---|---------------|-------------|----------------|
| 1. | Anti-social traits | <i>N</i> | greedy, self-centred, selfish | 33 | 91 | 124 |
| | | % | | 11.30% | 12.10% | 11.90% |
| 2. | Prosocial traits | <i>N</i> | selfless, conflict-free, cooperative | 50 | 85 | 135 |
| | | % | | 17.20% | 11.30% | 13.00% |
| 3. | Delicacy | <i>N</i> | delicate, gentle, graceful, sensitive | 30 | 26 | 56 |
| | | % | | 10.30% | 3.50% | 5.40% |
| 4. | Emotional expression | <i>N</i> | emotional, impulsive, moody | 18 | 21 | 39 |
| | | % | | 6.20% | 2.80% | 3.70% |
| 5. | Idealism and honour | <i>N</i> | proud, honourable, idealistic | 5 | 30 | 35 |
| | | % | | 1.70% | 4.00% | 3.40% |
| 6. | Wisdom | <i>N</i> | bright, curious, inquisitive | 32 | 90 | 122 |
| | | % | | 11.00% | 12.00% | 11.70% |
| 7. | Immaturity | <i>N</i> | messy, helpless, carefree | 11 | 20 | 31 |
| | | % | | 3.80% | 2.70% | 3.00% |
| 8. | Low intelligence | <i>N</i> | thoughtless, mindless, stupid | 5 | 11 | 16 |
| | | % | | 1.70% | 1.50% | 1.50% |
| 9. | Nonconformity | <i>N</i> | unceremonious, uncompromising, rebellious | 9 | 27 | 36 |
| | | % | | 3.10% | 3.60% | 3.50% |
| 10. | Sense of humour | <i>N</i> | ironic, cheerful, optimistic | 10 | 19 | 29 |

| | | % | | 3.40% | 2.50% | 2.80% |
|-----|----------------------|----------|---|-------|--------|--------|
| 11. | Proactivity | <i>N</i> | ambitious, energetic, taking initiative | 6 | 33 | 39 |
| | | % | | 2.10% | 4.40% | 3.70% |
| 12. | Professionalism | <i>N</i> | competent, hard-working, precise | 20 | 33 | 53 |
| | | % | | 6.90% | 4.40% | 5.10% |
| 13. | Promiscuity | <i>N</i> | immodest, inconsistent, romancing | 7 | 1 | 8 |
| | | % | | 2.40% | 0.10% | 0.80% |
| 14. | Aggression | <i>N</i> | aggressive, bestial, despotic | 9 | 24 | 33 |
| | | % | | 3.10% | 3.20% | 3.20% |
| 15. | Positive strength | <i>N</i> | heroic, determined, brave | 9 | 70 | 79 |
| | | % | | 3.10% | 9.30% | 7.60% |
| 16. | Fame and recognition | <i>N</i> | authoritative, legendary, majestic | 27 | 128 | 155 |
| | | % | | 9.30% | 17.10% | 14.90% |
| 17. | Docility | <i>N</i> | without initiative, conformist, sissy | 6 | 22 | 28 |
| | | % | | 2.10% | 2.90% | 2.70% |
| 18. | Avoidance | <i>N</i> | apprehensive, taciturn, silent | 4 | 19 | 23 |
| | | % | | 1.40% | 2.50% | 2.20% |
| | Overall | <i>N</i> | | 291 | 750 | 1041 |
| | | % | | 100% | 100% | 100% |

($\chi^2=76.295$; $p<.0001$; Cramer's $V=.271$; $p<.0001$)

Note: The percentages correspond to the number of female and male terms separately, with percentages in each column adding up to 100.

Textbook Authorship

In addition to the content of these textbooks, we collected data on the authorship of the 75 analysed books. Of the 32 analysed Polish textbooks, women appeared four times less often among the authors of source texts than men. Even greater differences in numbers were noted for the authors of art reproductions. Significant ranges were also found for supplementary literature authors, and for authors of concepts, theories and formulas (that is, description of the achievements of Maria Curie-Skłodowska). In addition, slightly more men were identified among translation authors. Interestingly, far more women were noted among the authors and editors of the entire textbooks. In 24 mathematics textbooks, all of the authors of reproduced works of art or concepts, theories and formulas were men. In addition, men represented the majority of authors of source texts (that is, Robert Recorde is the author of the quoted excerpts from the textbook on arithmetic, *The Whetstone of Witte*). Women were only greater in number as authors and textbook editors. Finally, the authors of the 19 analysed school readings were all men, while one woman was the author of a translation. Table 7 presents the results of the analysis by gender and type of authorship.

Table 7: Authors' gender and authorship type

| Polish-language textbooks (32 books) | Female | Male |
|---|----------------|----------------|
| Source texts | 17.40% (N=184) | 82.60% (N=871) |
| Art reproductions | 3.70% (N=16) | 96.30% (N=420) |
| Supplementary literature | 11.10% (N=2) | 88.90% (N=16) |
| Translations | 48% (N=47) | 52.00% (N=51) |
| Concepts, theories and formulas | 13.3% (N=6) | 86.70% (N=39) |
| Textbook authorship or editing | 86.9% (N=53) | 13.10% (N=8) |
| $(\chi^2=318,102; p<.0001; \text{Cramer's } V=.431; p<.0001)$ | | |
| Mathematics textbooks (24 books) | Female | Male |
| Source texts | 28.60% (N=4) | 71.40% (N=10) |
| Art reproductions | 0% (N=0) | 100% (N=1) |
| Concepts, theories and formulas | 0% (N=0) | 100% (N=63) |
| Textbook authorship or editing | 70.3% (N=45) | 29.7% (N=19) |
| $(\chi^2=70,244; p<.0001; \text{Cramer's } V=.703; p<.0001)$ | | |
| School readings (19 books) | Female | Male |
| Source texts | 0% (N=0) | 100% (N=19) |
| Translations | 100% (N=1) | 0% (N=0) |
| $(\chi^2=20.000; p<.0001; \text{Cramer's } V=1.000; p<.0001)$ | | |

Discussion

The image of femininity in the analysed textbooks is quite disturbing. Across all books, significantly more characters were found to be male, irrespective of the school subject or the type of content analysed. Polish textbooks seem to accord with the masculinisation trend that is apparent in European masculine societies (see, for example, Kostas 2021; Osler 1994) and worldwide (Cobano-Delgado and Llorent-Bedmar 2019; Kobia 2009). Interestingly, the biggest difference in the number of female and male characters exists in school readings. These books were mostly written between the eighteenth and nineteenth centuries. This shows a certain trend in Polish literature to marginalise female figures. More frequent portrayals of women as young people may perpetuate representations of them as naïve, immature and demanding care. In contrast, the male roles of adults and seniors are associated with life experience, wisdom and independence, which subconsciously correspond to masculinity. It is likely that the image of inexperienced and unwise women discourages girls from taking bold steps towards choosing an intellectually demanding educational path. Presenting women as unemployed or in positions that do not require higher education may have similar effects. Professions related to demanding qualifications, intellectual capacity and talent are reserved for men. Poland is by no means an exception in this matter (see Barton and Sakwa 2012; Kancı 2008). Moreover, presenting men as possessing high and very high financial resources may confirm the common belief that men should earn more (see also Kostas 2021). Consequently, the salaries of women and men practising the same profession differ in favour of men (Sanfey et al. 2017; Williams et al. 2010), which also may discourage girls from aspiring to these positions. The image of family life more often shows women as being in relationships and devoted to parenthood, while men are

more often presented as children (so-called eternal boys) or attractive extended family members. Similar traditional representations of gender roles exist in other masculine European societies, such as Greece (Gouviás and Alexopoulos 2018) and Slovakia (Osad'án, Belešová, and Szentesiová 2018). These representations recreate the hidden principles of the traditional division of labour, with the man as the breadwinner, responsible for the family's survival, and the woman as a threat to the man's interests who should be discouraged by lower earnings (Daniels et al. 2004).

As the results show, male and female characters are generally assigned traditional, or even stereotypical, gender-specific psychological traits. Women are depicted as fragile and emotional, immature, possessing low intelligence, and sometimes too promiscuous, but also as prosocial, with a sense of humour, professional and responsible. Men are presented as outstanding, famous, honourable and wise, nonconformist, strong and active, showing at the same time traits that make social functioning difficult and aggressive. The results correspond to studies conducted in the United States in which males were shown significantly more often as competitive, argumentative and aggressive. Characteristics such as tenderness and being affectionate and emotionally expressive were significantly less often attributed to male than female characters (Evans and Davies 2000). Interestingly, the characteristics associated with being withdrawn and avoiding action, which were traditionally assigned to women, were more often attributed to male characters in the current study (Bem 1974; Spence 1984). This may result from the fact that in masculine societies, women's liberation is based on the ability to reach positions that previously only men could hold. Perhaps such a distribution of traits is one of the manifestations of the quest for women's empowerment (Hofstede 1996; Hofstede Insights 2020). The distribution of other features corresponds to the traditional distribution of gender characteristics in masculine societies (Hofstede 1996; Hofstede Insights 2020), as well as confirming other studies analysing stereotypical representations of psychological gender traits (for example, Atay and Danju 2012; Sovič and Hus 2015). Because gender stereotypes rooted in culture and the characteristics attributed to both genders are relatively fixed and difficult to relate to the opposite gender (Hofstede Insights 2020), children learn that women and men differ, and they lack opportunities to perform the same activities. The woman who is presented in these textbooks does not have any features that are essential for her intellectual and professional development. She is truly professional but only in the narrow sphere of her own household duties. She lacks the nonconformity, entrepreneurship and wisdom that are so important in her future scientific career.

In almost all of the analysed categories of authorship, men were found to be greater in number. Indeed, not a single female author is included among the obligatory school readings (MNE 2017). Similar under-representations of historical or famous female figures have been identified in American (Commeyras 1996) and Greek textbooks (Gouviás and Alexopoulos 2018). Because women only prevail among the authors of the analysed textbooks, it seems that there is tacit approval among female authors of the under-representation of women in their textbooks. Could the reason for this be that few

women have played a role in history and culture? If we reach for less well-known book sources describing the historical achievements of many women, about which school books are silent, then the answer is definitely no (Favilli and Cavallo 2017). Given that there are many valuable representatives of science and literature among women, the question remains: Why do the authors of textbooks consciously decide against referring to women in textbooks? This example of self-discrimination may be evidence of the topicality of the “queen bee syndrome” (Staines, Tavis, and Jayaratne 1974). This refers to women in senior positions who tacitly approve of the system in which they operate and who are also opposed to women’s liberation. They find themselves in the male world, but they do not appreciate other female representatives because of unconscious fear of competition (Sobczak 2018).

School textbooks are not the only source of gender representations; they also depend on social and cultural factors. It has been shown that social awareness and respect for the idea of gender equality may develop despite the stereotypical content in Singaporean textbooks (İncikabı and Ulusoy 2019) or the under-representation of women in Swedish school textbooks (Carlson and Kanci 2017). However, Poland is a country where conservative values prevail, despite the tendency to promote entrepreneurship and individualism (Domański and Dukaczewska 1995). Returning to the question posed in the title of this article, we can now formulate the following answer: women in textbooks are hardly visible because men appear twice more often. And if women do appear, they are usually at home, in a marriage or a relationship, busy with household chores and too immature to deal with science. They are usually depicted as delicate, emotional wives and mothers who require support and have low financial resources. They are stuck on a sticky floor (Berheide 1992), assigned to less prestigious and lower paid jobs, or simply remain unemployed. Men in turn are generally depicted as earning more money and generally as a source of entertainment and knowledge; they are wise, active and famous. They occupy better-paid positions that require more intellectual work. With such a strong cultural transmission of gender roles and traits, and in the absence of appropriate role models, it is not surprising that fewer and fewer Polish women are opting to study science or technology (Trusz 2015). Polish textbooks as sources of traditional gender roles and characteristics teach children that women are unable to think analytically and that men are unable to care for the household. It is a very disturbing fact that in the third decade of the twenty-first century, the picture of Polish society shown in school textbooks is still close to what it was 50 years ago (Szacka 1997). Science textbooks should instead contain content encouraging students to cross the boundaries of imposed social roles, to look for their own development paths and interests, and to go beyond the usual patterns of thinking. This is in the interest not only of Polish women but of the entire country, including its economic and scientific development. However, given the current turn of the Polish government towards right-wing values (Graff 2014), one should not expect systemic support for a more equal presentation of social gender roles. But Poland is no exception here; there is currently a systematic shift towards conservative values across Europe, while efforts to increase gender equality tend to be rejected (Corredor 2019). Nevertheless, for the sake of the economy and development,

we need an education system that strives for equality and neutrality, presenting a fresh and critical view of female and male creators of culture and science. If this situation does not change, then there are legitimate concerns that we will not see another Maria Curie-Skłodowska soon.

Limitations of this Study

Like all studies, our study has not been without restrictions. First, the decision was made to only analyse textbooks selected from two school subjects, which are compulsory for the last two years of elementary school. Therefore, it is not possible to generalise the survey results to the entire collection of school textbooks that are currently available in Poland. Although it took the authors of the article more than a year to analyse the selected set of textbooks and to process the collected data, a data gap still exists and could be filled with further items for analysis. The second limitation is the quantitative nature of this study. Quantitative analyses are a huge generalisation, despite their advantage (which is confirmed by their reliability). In future analyses, the qualitative element of textbook content analysis could act as a kind of complement to the results as a form of categorical illustration. Eventually, controlling for the environmental factors (for example, the influence of family and peers or teachers' attitudes) could also play an important role in validating the potential effect of these textbooks. In future research, it is also worth checking the content of textbooks in feminine cultures. This would help to clarify the comparison that was only hypothetically proposed in this article.

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