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Gender representation and gendered attitudes in Finnish 1st Grade Mathematics Materials

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Abstract

Gender differences in mathematics are sometimes discussed through achievement outcomes. However, international research and behaviour assessments consistently show persistent differences in attitudes including confidence, self-concept, and mathematics-related anxiety. Given the importance of early school years for the development of beliefs, the learning materials used in the first years of primary education are relevant to how mathematics is socially framed for children. Following representation theory, this thesis examines how gender is represented in selected Grade 1 mathematics learning materials used in Finland and questions how these representations may relate to broader research results on gendered mathematics attitudes, for examples ones from PISA.

This study uses a qualitative approach utilising content analysis and critical discourse analysis. The dataset consists of 6 books of teacher guides. The findings show that, within Finnish context, girls are not typically excluded from being depicted in mathematical problems. However, notable differences emerge when examining representation through role allocation and context. Girls were found more often depicted as active participants in domestic or social everyday mathematical settings, while boys appeared in more technical or scientific examples of mathematical activity.

Because many of these examples are embedded in teacher guides, they may be especially influential in how tasks are performed in classrooms.

The findings showed that evaluating equality in early mathematics materials cannot rely only on frequency of appearance but should also consider how competence and agency are repeatedly framed in different types of mathematical examples. The results suggest both progress compared with common international textbook patterns, and a clear area for improvement. Strengthening counter-stereotypical opportunities in technical and scientific framings, can help present early mathematics as more equity-aspiring for all learners.

Keywords: gender representation, mathematics education, early childhood education, textbooks, teacher guides, Finland, primary education

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1 Introduction

Background of the study

Education and schooling are not only about learning subject contents and transferring knowledge. Education is one of the first institutional spaces where children learn what kind of identities, roles, and behaviours are considered normal (Banks, 2015). In primary school, these messages are not delivered only through teaching methods and classroom interaction, but also through textbooks and learning materials that are used every day (Apple, 1992; Blumberg, 2008). For this reason, textbooks cannot be viewed as neutral containers of information alone. They also function as cultural texts, which communicate values, assumptions, and expectations about who is visible, and capable in different subject areas (Apple, 1992; Banks, 2008; Blumberg, 2008). In this sense, representation in textbooks is part of the hidden curriculum which affects how kids understand school subjects and how they feel they belong within them (Apple, 1992; Blumberg, 2008).

This is relevant in mathematics education, where gendered beliefs about ability and belonging have remained slightly stereotypical, even when achievement gaps have nowadays come to be small or inconsistent. There is extensive research across many countries that shows that mathematics textbooks tend to reproduce certain stereotypical patterns when representing boys and girls, not only in how frequently each gender appears, but also in the context they are placed, such as their role in mathematics or the activity the participate in (Blumberg, 2008; Jehle et al., 2024; Nurlu, 2021). Those recurring patters typically show boys that are more frequently positioned as active participants, problem-solvers, or participants in technical contexts, while girls are more often positioned in supportive, social, or domestic contexts (Blumberg, 2008; Tainio & Karvonen, 2015). Even when these representational choices may seem minor, their cumulative effect can influence how children interpret who “naturally” belongs in mathematics and what mathematical competence typically looks like (Blumberg, 2008; Eccles & Wigfield, 2002).

In primary education, representation is even more important. At these ages, children are still developing their identities and self-concepts, and visual cues may have a strong influence on

how school subjects are understood (Nikolajeva & Scott, 2001; Bian et al., 2017). This makes representation in early grade mathematics materials especially important, as these materials make for the earliest formal experiences through which children are introduced to mathematics.

The Finnish and broader Nordic context makes this issue especially interesting to examine. Nordic education systems are generally associated with equality, inclusion, and strong public education systems. However, research on educational materials shows a recurring paradox, where progressive policy commitments do not automatically eliminate subtle stereotypical hierarchies in practice (Harju-Luukkainen & Eriksen, 2021; Stoet & Geary, 2018; Tainio & Karvonen, 2015). Research within Finnish context shows that classroom activity is very dependent on textbook use (Tainio & Karvonen, 2015; Viholainen et al., 2015), which means that lessons are developed around the use of textbooks. In this context, representational choices in school materials matter pedagogically, because students encounter them repeatedly throughout their lessons.

This concern is also connected to some international research on attitudes seen in girls toward mathematics. PISA findings and related research suggest that, while average gender differences in mathematics performances are often limited, there still remain persistent gaps in self-concept, confidence, and mathematics-related anxiety (OECD, 2021; Else-Quest et al., 2010; Hyde & Mertz, 2009). These patterns point to how important it is that we examine, the cultural and school environments through which children form their attitudes toward mathematics and not simply be interested in their achievement outcomes. Textbooks and teacher guides are a big part of the classroom environment, as they help structure what mathematics looks like socially, and who is repeatedly positioned as competent within it (Blumberg, 2008; OECD, 2021).

Within this context, the study of gender representation in Grade 1 mathematics learning materials used in Finland is educationally significant. Early primary materials are not only instructional resources, but also part of the symbolic environment through which children begin to form ideas about mathematics, themselves, their competence, and belonging. Examining how gender is represented in these materials, therefore offers a way to explore

whether everyday textbook representations may reflect, reinforce, or rather challenge broader gendered patterns found in mathematics attitudes documented in international research and PISA results (Blumberg, 2008; Else-Quest et al., 2010; OECD; 2021).

Problem statement

Research has showed that gender representation within school textbooks can frame how subjects, gender roles, and competencies may be socially understood. On the other hand, international studies in mathematics education have identified recurring gendered patterns in textbook content, including differences in visibility, agency, and the social contexts of the examples in which boys and girls are portrayed (Blumberg, 2008; Jehle et al., 2024; Nurlu, 2021). Although educational policy and general opinions in Finland and other Nordic countries strongly support equality and inclusion, that does not guarantee that examples in learning materials used in classrooms promote equality. Textbooks may often appear neutral, while still reproducing assumptions through repeated choices in characters, activities, and contexts (Apple, 1992; Blumberg, 2008).

In mathematics education, where social stereotypes about confidence, ability, and subject belonging remain persistent, such representational patterns are especially important because they can become part of the hidden curriculum through which children learn what kind of participation is considered normal (Blumberg, 2008; OECD, 2021). More importantly, most research in the Finnish context usually focuses on higher levels of education, like middle school and high school, and there remains limited recent research on early mathematics materials used in Finland, and how they may represent gender compared to what research shows about gendered mathematics attitudes.

A further limitation of current research is that textbook studies often emphasise on visibility or numerical balance alone (Blumberg, 2008; Tainio & Karvonen, 2015), which is still important but not sufficient for the purpose of this thesis. For the present study, the central issue is not only whether boys and girls are present, but how they are positioned in mathematical situations. Focusing on presence alone would not adequately address this study's broader purpose, which is to examine whether textbook representations may reflect,

reinforce or oppose patterns associated with gendered attitudes toward mathematics, as identified in international research and PISA-related discussions (OECD, 2021; Else-Quest et al., 2010).

Studies on PISA results are relevant because they show that certain patterns of depictions of genders found in mathematics are not linked to students' achievement scores. Across countries, girls and boys often perform at very similar levels, if not better, in mathematics. Yet there are still differences in their own reports on confidence, self-belief, interest, and anxiety, suggesting that performance and personal opinions do not always align (OECD, 2021; Else-Quest et al., 2010). In Finland, this issue is especially important as the country has generally performed well in mathematics, while still showing gendered differences in how students experience the subject individually (OECD, 2021; Stoet & Geary, 2018). These findings underline that gender in mathematics education should be understood, not only through outcomes, but also through the social and psychological meanings that are attached to the subject, which may be created long before students reach later stages of schooling (Hyde & Mertz, 2009) and start forming opinions and beliefs. This makes it necessary to examine the everyday educational materials through which mathematics is introduced and socially framed. Grade 1 materials are particularly relevant, since they form part of children's earliest formal experiences of mathematics and may contribute to early assumptions about competence and belonging.

The specific problem that I address in this thesis, therefore, is the lack of sufficiently detailed, context-sensitive analysis on how gender is represented in early mathematics learning materials, particularly in ways that move beyond frequency counts and consider how representation is constructed through text-image relations, role allocation, and contextual framing. This study attempts to offer a deeper understanding of how early mathematics materials may affect how gendered attitudes toward mathematics are formed, while identifying representational patterns that may challenge them.

Research aim

This study aims to examine how gender is portrayed in selected Grade 1 mathematics learning materials from Finland, and to evaluate how these depictions may relate to certain gender trends in mathematics education research and PISA results. The study views textbooks and teacher guides not only as instructional tools, but also as representational and pedagogical texts that may contribute to how mathematics is socially viewed during early school years.

More specifically, the study looks for how gender is depicted in both text and image, and analyses how these depictions may reflect or challenge broader gendered assumptions linked to mathematics. The purpose is not to establish a connection between textbook representation and possible later student outcomes, but to examine whether the representational environment of early mathematics learning may include patterns that can be linked to documented differences in mathematics self-concept, confidence, and anxiety, .

To address this aim, the study is guided by the following research questions:
1. In what ways is gender represented in selected Grade 1 mathematics textbooks in Finland?
2. What representational patterns are found in these materials, and in what ways may these representations potentially shape early gendered attitudes towards mathematics?

These questions are examined through a qualitative approach which combines systematic content analysis with critical discourse analysis, allowing the study to locate recurring patterns while also interpreting how meaning is constructed through text-image relations and contextual framing.

2 Theoretical framework: Representation theory and gendered meaning in Education

The theoretical framework of this study contains three complementary perspectives. Theory from multicultural education (Banks, 2008) provides a foundation to establish that inclusive representation in educational materials is a prerequisite in order to achieve educational equity. Critical Pedagogy (Freire, 1970; Giroux, 1983) adds a political layer by pointing out how schooling and textbooks may reproduce or challenge social norms. Finally, representation theory (Bishop, 1990; Hall, 1997) serves as the primary analytical lens, guiding the examination of how ideas about diversity and gender are constructed through language and images in textbooks. Together, these frameworks make up an analysis that attempts to connect content and imagery with ideology, pedagogy, and policy.

2.1 Multicultural Education theory

The theoretical framework for this study begins with multicultural education theory, providing the baseline for why curriculum materials should reflect diversity and equity. Banks highlights that textbooks are not neutral carriers of knowledge rather they are cultural artifacts that either challenge or reinforce inequality. In a similar logic, Blumberg (2008) points out that different messages in textbooks can subtly communicate who is more important in knowledge domains, shaping students' attitudes and expectations. When math problems consistently depict boys solving problems and girls supporting central characters, the implicit message is that mathematical activity can be differentiated by gender. This is consistent with Banks' opinion that if we do not deliberately include diverse views, we risk reinforcing dominant cultural norms and preserving bias. Especially for primary education, where children's identities and self-concepts are not yet shaped, these messages can have long-lasting effects on motivation and academic achievement (Eccles & Wigfield, 2020). Therefore, analysing mathematics textbooks should take into consideration their cultural strengths in communicating values about identity, ability, and belonging.

At the same time, researchers point to positive trends new practices. Bishop's (1990) known metaphor of books as "mirrors, windows, and sliding glass doors" has influenced curriculum

reform by pointing out that learners need to both see themselves reflected and encounter diverse others in literature and learning materials. Geneva Gay's (2010) framework of culturally responsive pedagogy extends this logic, arguing that inclusive representation must be tied to instructional methods in classrooms, through which teachers attempt to validate the cultural identities of their students, and therefore positively affecting their engagement. These updates on the field of education have encouraged some publishers and education authorities to revise their school materials in order to ensure a greater balance in their images and text (Bruillard, 2019). Nevertheless, progress remains uneven, and gendered and cultural stereotypes still persist.

2.2 Critical pedagogy and critical multiculturalism

Critical multiculturalism and critical pedagogy provide a theoretical lens to examine not only the presence of diversity within educational materials but also the power dynamics that construct them. Paulo Freire's Pedagogy of the Oppressed (1970/2000) emphasises that education itself is also never neutral. Education can either help reproduce existing social hierarchies or challenge them by cultivating critical thinking in students (Freire, 2000). From this perspective, the way textbooks may represent, or fail to represent, diverse groups is not simply a matter of inclusion, but a question of empowerment and symbolic recognition. When groups are mentioned stereotypically or excluded completely, educational texts can contribute to what Freire would describe as a form of oppression, preserving inequities by normalising certain groups as knowledge producers while marginalising others.

Applied to mathematics education, this means that the portrayals of who engages with mathematical reasoning, and in what contexts, carry ideological meaning. A child repeatedly encountering world problems that depict boys as the mediators in scientific or competitive fields, and girls in household or supportive tasks, can deliver a hidden message about their own potentials. Critical pedagogy insists that such representations must be challenged, since they reinforce cultural biases about abilities in mathematics being divided by gender, a concern already visible in international evidence such as the PISA findings, where there are consistent differences in confidence and attitudes towards mathematics between boys and girls (OECD, 2021; Blumberg, 2008).

2.3 Representation theory

Representation theory provides a tool to examine how meaning is created and communicated through texts. Stuart Hall's (1997) theory emphasises that representation is not simply a reflection of reality, but a process through which cultural meanings are constructed. In other words, texts, including educational materials, shape how we understand social norms, identities, and values. In the context of teaching, this suggests that textbooks and classroom resources do more than simply present information. They can be part of creating ideas about who is seen as competent in particular subjects, such as mathematics.

Bishop (1990) offers a complementary view through the metaphor of "mirrors, windows, and sliding glass doors" as mentioned shortly previously. She argues that literature can function as a mirror, allowing readers to see themselves reflected, something that validates their experiences and their identity. Texts can also serve as windows, providing access to the experiences and perspectives of others, thus encouraging understanding and empathy. Sliding glass doors offers another level to this metaphor, by pointing out the opportunities that texts offer, for readers to be invited into different realities, engaging them in alternative experiences. When we apply this to mathematics education, this theoretical framework indicates the importance of representation in all learning materials. When students encounter content that reflects their gender or cultural identity, it can influence their engagement, self-efficacy, and academic outcomes.

Botelho and Rudman (2009) extend representation theory through a critical multicultural perspective, analysing how texts construct and negotiate social stratifications. They search for whose voices are centred and whose are marginalised, revealing how texts can either reinforce or challenge social inequalities. Translating this perspective to mathematics textbooks, one can investigate how gendered representations appear through problem contexts, images, and examples. Based on research (Blumberg, 2008; Nurlu, 2021), boys are often depicted in roles of solving mathematical problems or in technical examples, while girls may appear less frequently in general, or they appear in more gender stereotypical roles.

Representation theory thus offers the central foundation for this research. It is utilised in order to understand how meaning is structured through repeated patterns and choices of depictions in educational materials. In the context of early mathematics, it prompts the examining of how inclusion, diversity, and meaning are constructed in textbooks, and how these portrayals may relate to broader educational research, such as the gender gaps identified in PISA results. The way characters are positioned in mathematical solving examples, the contexts in which mathematical activity take place, and the roles that are assigned to characters within these scenarios contribute to implicit messages about who is expected to engage with mathematics and in what ways. This makes representation theory particularly relevant for analysing learning materials that are aimed at young learners, where image and text cues may play a central role in forming their opinions.

While representation theory provides the primary lens for analysing how meaning is constructed through text and image, it is complemented in this study by perspectives that focus more directly on power, agency, and learning. Critical pedagogy highlights how educational materials can reproduce or challenge the existing social norms, particularly through what is normalised or left unquestioned in everyday classroom content (Freire, 1970). At the same time, research on motivation and academic identity emphasises that students' self-perceptions are shaped through repeated encounters with the representations and depictions of educational materials (Eccles & Wigfield, 2002).

3 Gender, diversity, and representation in early Mathematics education

3.1 Diversity in Primary Education: educational theory

Diversity in primary education has become a central goal of educational research, since globalisation and international mobility have increased diversity in classrooms. Researchers have highlighted that inclusive and equitable education systems must recognise and accommodate for diverse cultural, linguistic, socioeconomic, and gender backgrounds of their learners (Banks, 2015; OECD, 2023). In early years schooling, both materials and teaching practices play a vital role in shaping learning outcomes and children's identities, but also their general sense of belonging. Inclusive approaches contribute to unity and have been shown to enhance engagement and achievement for all learners (Gay, 2010; Sleeter & Grant, 2007).

As Banks (2015) states, "A major goal of multicultural education—as stated by specialists in the field— is to reform schools, colleges, and universities so that students from diverse racial, ethnic, and social-class groups will experience educational equality" (p.3). However, Klein (2012) states that another equally important goal is to provide "both male and female students an equal chance to experience educational success and mobility". There is an intense interest in Multicultural Education Theory on how the interaction of different diversity categories, specifically race, class, and gender, affects education (Grant & Zwier, 2012, as cited in Banks, 2015). It is important to note that research shows that most mathematics and science teachers claim they cannot recognise how cultural contexts and assumptions not only exist within but also affect science subjects (Banks, 2015) due to a lack of sufficient knowledge or necessary disciplines to deal with these issues.

Banks (2015) emphasises that multicultural education is essential because schools are socialising institutions that shape students' understanding of society, identity, and power. He argues that superficial inclusion of diversity is insufficient to challenge systemic inequities, or validate the experiences of marginalised students (Banks, 2015). He has generally been regarded as a central figure in this field, having outlined the five dimensions of multicultural education: content integration, knowledge construction, prejudice reduction, equity

pedagogy, and empowering school culture, from which content integration and knowledge construction are particularly relevant for the analysis of textbooks. Content integration refers to the extent to which curriculum materials include examples and perspectives from diverse groups, while knowledge construction considers how implicit biases embedded in texts can shape learners' opinions. In mathematics education, not having stereotypical examples of different diversity categories, including gender roles, can help narrow children's perceptions of who can be successful in which subject.

Sonia Nieto (2010) reinforces this perspective, framing education as a political and cultural project in which learners' identities must be recognised in order for them to engage meaningfully. She argues that students are more likely to succeed when they encounter curricular materials that validate their cultural, linguistic, and social experiences. Similarly, Gay (2010) provides empirical and theoretical evidence that culturally responsive teaching, in which learning materials and instructional approaches reflect students' backgrounds, positively affects achievement, motivation, and engagement. Representation in textbooks is thus not merely symbolic. It shapes students' learning outcomes, and it affects their interest and engagement.

Sleeter and Grant (2007) distinguish between superficial and meaningful approaches, emphasising that textbooks frequently reproduce existing social hierarchies by failing to interrogate whose knowledge is prioritised and whose perspectives are often marginalised. They also highlight that educational materials have a tendency to settle for shallow depictions of diversity, where diverse figures are included without meaningful integration (Sleeter & Grant, 2007). Slee (2011) extends this critique by situating curricula within a wider framework of exclusion, expressing that schools systematically marginalise differences and how then lack of representation in materials can contribute to students' social and academic alienation (Slee, 2011).

Internationally, policy frameworks agree with these theoretical concerns. OECD (2023) identifies gender, ethnicity, language, SES (Socioeconomic Status), disability, and family structure as key dimensions of diversity and points out that in order to achieve equity outcomes, it is important to thrive for inclusive representation in curricula and instructional

materials (OECD, 2023). Textbooks that reflect student diversity are associated with reduced inequities in learning, and students having stronger engagement, higher self-efficacy (Gay, 2010), emphasising the policy logic behind the need to integrate multicultural and inclusive content throughout primary education.

Collectively, these perspectives establish that diversity representation in educational materials is very important. Beyond superficial inclusion, textbooks and instructional resources can serve as tools for socialisation, identity validation, and equitable learning. Research has demonstrated that when schools and curricula neglect or marginalise differences, they reproduce social inequalities. On the other hand, when they purposefully include diversity in materials, they contribute to creating learning environments in which all students can see themselves, engage meaningfully, and achieve academic success.

3.2 Representation, hidden curriculum and diversity patterns in textbooks

Educational texts used in primary schools carry cultural meaning which extends far beyond their instructional purposes. While textbooks make up the formal curricular content, they also function as socialising tools through which children learn implicit messages about identity, ability, and belonging. This phenomenon, often called the hidden curriculum, refers to norms, values, and expectations that are embedded in classroom practices and school materials (Apple, 1992). In mathematics education specifically, where cultural stereotypes usually equate mathematical competence with masculinity (Lindberg et al., 2010), subtle cues that may be embedded in textbooks can significantly affect children's early perceptions about who is naturally more able to participate or succeed in mathematics (Apple, 1992; Blumberg, 2008).

Across different countries and educational levels, studies consistently show that textbooks reflect cultural beliefs about gender, ethnicity, and social class. Blumberg (2008) notes that textbooks globally tend to portray boys as active participants in solving mathematical problems and girls depicted in more supportive or domestic roles. Such portrayals matter, not only because they misrepresent reality, but also because they show which identities are associated with competence in certain educational domains. The cumulative effect of

repeated exposure to such patterns influences children's self-concept and academic choices, particularly in subjects like mathematics, where stereotypes are already strong in everyday life.

Representation theory helps explain more why these messages have an impact. Meaning in educational texts is not passively transmitted but it is constructed through the interaction of language, imagery, and cultural assumptions (Hall, 1997). Characters positioned in different roles and contexts within textbooks, actively contribute to stereotypical opinions about who belongs in certain environments and academic spaces. Botelho and Rudman (2009) emphasise that these decisions regarding the representation of who is visible, who speaks, who acts, can shape children's understanding of social hierarchies long before they can consciously identify implicit bias. In mathematics textbooks, the selection of storylines, problems contexts, and illustrations of children doing math, serves as a powerful mechanism for possibly reinforcing or challenging gendered and cultural norms (Apple, 1992; Blumberg, 2008).

The hidden curriculum is particularly significant in early primary education because young learners are still forming their opinions and values about identity and ability. Research in developmental psychology shows that children internalise gender norms about academic ability as early as the age of six. More particularly, Bian et al. (2017) found that girls at this age already associate intellectual ability more strongly with the male gender. Textbooks that reproduce these societal assumptions may unwillingly encourage the repetition of these stereotypes. For instance, when boys are consistently depicted as building, measuring, or handling tools, and girls as shopping, or constantly assisting others, the representational environment teaches children to align certain mathematical competencies with particular genders (Blumberg, 2008).

Based on research, many other aspects of diversity such as race, ethnicity, language, disability, and socioeconomic status are similarly underrepresented. In a review of educational systems, OECD (2023) notes that linguistic and cultural minorities are rarely represented meaningfully and purposefully in textbooks. When inclusion does occur, it is often superficial and characters appear as background figures or in stereotypical depictions,

rather than as active participants in learning scenarios. This type of superficial inclusion fails to challenge existing power relations and does not offer enough opportunities for marginalised students to view themselves and form their identities (Nieto, 2010).

Images within textbooks amplify these representational patterns. Educational researchers note that children often interpret images before text, particularly in early primary school ages (Nikolajeva & Scott, 2001). Thus, illustrations in mathematics textbooks also carry considerable significance in how children interpret the meanings behind images. If images repeatedly show boys using objects or investigating, while girls are shown as passive observers, students may assimilate certain generalisations about capability that may not even be expressed explicitly in text. These subtle cues become part of the hidden curriculum and can shape students' attitudes which later could strongly affect their mathematical self-concept, enjoyment, and perseverance (Else-Quest et al., 2010). Even more importantly, all these variables have been shown to predict mathematics engagement and achievement equally as strongly as content knowledge (Eccles & Wigfield, 2002).

International policy frameworks have clearly stated the importance of diverse and equitable representation in curriculat. UNESCO (2006) argues that intercultural education requires that curricular materials promote both recognition (seeing oneself reflected) and dialogue (encountering others meaningfully). The OECD (2023) also links representational equity to broader educational outcomes, meaning that materials which exclude certain groups can actively contribute to gaps in self-concept and long-term academic trajectories. Yet many countries, including those who have long been associated with dedication for gender equity, continue to rely on textbooks that reproduce majority experiences and fail to reflect modern social realities.

In summary, representation in textbooks is neither decorative nor incidental. It is a foundational element of the learning environment which shapes children's academic identities and expectations, and such portrayals implicitly teach that mathematical reasoning belongs more naturally to certain groups (Blumberg, 2008; Hall, 1997). The effects of this exclusion could be connected to differences observed in international assessments such as PISA, where girls report lower confidence and higher anxiety in mathematics despite similar

achievement levels (OECD, 2021). Additionally, this exclusion can have more general effects in students' long-term engagement and academic achievements (Eccles & Wigfield, 2002).

3.3 Textbook research and gendered representation

Textbook research has showed that educational materials are not neutral carriers of content, rather they are selectively construct knowledge and social depictions (Apple, 1992; Hall, 1997). Across subjects and contexts, studies have repeatedly demonstrated that textbooks reflect prevailing cultural assumptions regarding identity, power, and normality, often through subtle patterns rather than explicit statements (Apple, 1992; Blumberg, 2008). That means that representation is not only a matter of whether certain groups are simply mentioned, but also how often they appear, what roles they are given, and which kinds of activities or contexts are often associated with them (Blumberg, 2008; Hall, 1997). In this sense, textbook studies have increasingly moved beyond simple counting of characters toward analysing agency, positioning, and the hidden curriculum, especially in relation to how learners come to understand who belongs in academic contexts (Apple, 1992; Banks, 2008; Blumberg, 2008).

In mathematics education, this broader textbook research is particularly relevant, since these recurring patterns of gender representation have been documented in multiple countries and curricula. Research consistently shows that boys are more often linked with active, technical, and problem-solving roles, while girls are more frequently associated with supportive or relational roles, even when visibility is relatively balanced in frequency (Blumberg, 2008; Jehle et al., 2024; Nurlu, 2021; Tainio & Karvonen, 2015). These findings suggest that the issue is not simply underrepresentation in a numerical sense, but the repeated normalisation of different forms of participation. For that reason, studies of mathematics textbooks increasingly examine not only presence or absence of genders or situations, but also the visual and narrative presentation of competence, agency, and subject belonging (Blumberg, 2008; Nurlu, 2021; Tainio & Karvonen, 2015), which is especially important in early primary education materials, where learners are still forming ideas about who can do mathematics (Eccles & Wigfield, 2002; Nikolajeva & Scott, 2001). These depiction choices also form part of the hidden curriculum through which learners absorb assumptions

about who “does mathematics”, who may be better in technical fields, and what kinds of activities are associated with each gender (Apple, 1990). These findings are consistent across many countries and decades of research, which shows that gendered representation is not incidental but embedded in educational curricula.

Blumberg’s (2008) cross-national review remains one of the most influential studies in this area. Synthesising results from over twenty textbook analyses, she found a steady pattern: male characters appeared more frequently overall, and they were more often depicted as active agents, or handling tools, technology, or scientific instruments. Female characters appeared less often overall, and they were disproportionately placed in roles surrounding house chores, relational to the protagonists, or simply overall supportive. These patterns persisted regardless of the country’s economic status, gender equality indexes, or curricular goals. This suggests that textbook authors can more easily, even though possibly unconsciously, reproduce prevalent social stereotypes rather than attempt to depict the gender-equality aspirations of society and their education systems.

Similar studies have provided more evidence. A recent cross-national European analysis of mathematics and language textbooks from countries like Germany, Italy, Lithuania, the Netherlands, and Romania found that female characters were underrepresented in frequency and were less often depicted as primary figures in the problems or in diverse occupational roles than male characters in mathematics contexts (Jehle et al., 2024). These gendered patterns persisted across all countries’ studies, although they tended to be somewhat smaller in more gender-egalitarian contexts, showing how even Western OECD countries suffer from subtle biases in representational roles in learning materials (Jehle et al., 2024).

A study conducted in Turkish primary school mathematics textbooks for gender fairness (Nurlu, 2021) revealed that even though visibility was more balanced, different stereotypical gender differences persisted strongly. Men were more frequently associated with work and a wider range of occupations, while women were more often linked to caregiving roles and stereotypical settings or activities such as caregivers and nurturers at home, as well as nurses and teachers. Such depictions may seem subtle, but they can communicate powerful messages to young learners. As mentioned previously, research on early childhood cognition

confirms that visual cues significantly shape children's perceptions of competence and belonging (Nikolajeva & Scott, 2001), so these depictions are even more influential at ages when gender identity and academic identity are still very malleable.

Gendered examples in mathematical problems influence learners' engagement and performance. Good et al. (2010) showed through their research, that exposure to stereotypically gendered mathematics contexts reduced girls' persistence and self-evaluation, even when their actual performance remained unaffected. These findings show that the symbolic environment of mathematics, the imagery, narratives, and examples, shapes the development of identity, confidence, and motivation, values that are known predictors of long-term achievement (Pajares & Miller, 1994). Thus, textbook content contributes to the cognitive enrichment, but also the psychological experience of each subject.

There are further studies documenting that gender representations contribute to persistent gender differences in students' attitudes towards mathematics. Else-Quest et al. (2010), combining cross-national evidence across many countries, concluded that gender disparities in mathematics motivation and self-efficacy were strongly associated with cultural indicators of gender equality. Research seems to be pretty consistent here, suggesting that curricula that reproduce gendered messages may reinforce stereotype threat, shaping student behaviour even in systems where achievement differences between boys and girls are small or non-existent.

Stoet and Geary (2018) offer further details by stating that in highly gender-equal countries, including Finland, girls often excel in reading more than in mathematics and they are therefore more likely to align themselves with literacy-oriented academic routes . A representational environment that subtly hints mathematics as masculine may intensify these tendencies. Overall, empirical literature demonstrates that mathematics textbooks play an important role in constructing learners' expectations about gender and mathematical ability. These patterns are deeply entrenched, cross-cultural, and observable across time. They also add on the importance of analysing how textbooks used in Finland, both Finnish-language and English language versions, portray gender and other diversity categories, and

whether the representations align with or challenge broader trends that have been documented in international assessments.

3.4 Finnish context: Diversity and representation in educational materials

Nordic education systems, including Finland, Sweden, Norway, Denmark, and Iceland, are internationally recognised for their strong commitments to equality, inclusion, and high-quality comprehensive schooling. Yet, research on Nordic curriculum materials reveals a persistent gendered representational paradox: despite progressive policy frameworks, textbooks still reproduce subtle gendered and cultural hierarchies. This makes the Nordic context an important setting for examining the hidden curriculum.

Despite high levels of gender equality in education and employment, Nordic countries, including Finland, exhibit noticeable gender disparities in STEM-related higher education fields. Stoet and Geary (2018), analysing data from over 60 countries, identify what they call the “gender-equality paradox”. The paradox shows that in countries that have higher gender equality indices, women are less likely to pursue STEM degrees relative to men than in less gender-equal societies. Finland is very close to this pattern, where women often outperform men in school mathematics, however they are significantly underrepresented in university-level STEM fields such as engineering, physics, and information technology (Stoet and Geary, 2018). They argue that these patterns cannot possibly be explained by differences in ability, but they could reflect complex interactions between cultural norms, identity formation, self-concept, and educational environments. These findings underscore the importance of examining earlier stages of schooling, including primary-level learning materials, where attitudes toward mathematics and gendered opinions on academic competencies may form and later influence educational choices.

When it comes to textbook use, research in Nordic mathematics education shows that textbooks play a central role in shaping classroom activity, something that further amplifies the importance of representational choices within textbooks. Viholainen et al. (2015) show that Finnish upper-secondary mathematics teaching is strongly textbook-driven (in structure, examples, task types), a pattern that seems to begin already in basic education. Where

textbooks are central, any systematic bias in characters, roles, or contexts can transfer to the teaching practice. In other Nordic countries, empirical studies of mathematics-related materials also show similar patterns of gender representation. In Norway, Smestad and Fossum's (2024) historical analysis of Norwegian compulsory school mathematics examinations from 1962 to 2020 finds that representation of identity markers (including gender) changes over time, but that inclusion remains uneven, showing how even "neutral" texts can carry social signals about normality and who is visible in mathematics contexts.

In the Finnish education system, these issues are similarly relevant for multiple reasons. Although the Finnish National Agency for Education provides the national core curriculum, which guides teaching objectives and values, textbooks themselves are not subject to a formal state of evaluation or approval before entering classrooms. Instead, the responsibility for selecting and evaluating materials is largely delegated to teachers and schools. This decentralised model does reflect a high level of trust in teacher professionalism and expertise, but it also means that representational patterns embedded in textbooks may persist without systematic external review. As a result, the analysis of textbook content becomes even more important in the Finnish context, as these materials play a key role in shaping how curriculum values, such as equality and inclusion, are translated into everyday classroom practice.

In Finland, Tainio and Karvonen (2015) offer one of the most detailed analyses of textbook gender representation. Their study, which combined textbook content analysis with teacher interviews, found that male characters were consistently shown as active, agentic, and technically competent, while female characters were depicted in aiding roles. Teachers noted these patterns as problematic yet found it challenging to counter them since textbooks structure much of the instructional flow. They mention that "In Finland, school textbooks are designed in the spirit of the national curriculum, but there is no official examination of the material by the state. The suitability of the textbooks for teaching is assessed by the teachers themselves" (p. 126). The study highlights an important point for this thesis: even though representational patterns are noticed by educators they still remain embedded in materials due to structural features and the absence of a textbook review system.

Finnish textbook studies in language subjects reach similar conclusions about visibility of genders and role allocation. For instance, Kujanpää (2015), in a comparative EFL (English as Foreign Language) textbook analysis, showed that male characters dominated proactive and leading roles, whereas female characters were not positioned as frequently in central positions. Beyond gender, the representation of minority identities is also uneven. The Finnish Institute for Children's Literature's Kirjakori (2018) national overview, covering 1,190 children's and youth titles, notes that characters with disabilities are rarely depicted as main protagonists, indicating that ambitions for diversity and inclusion do not always result in visibility. Although Kirjakori is a literature survey (not a math-textbook audit), it is widely cited in Finland as an indicator of what children see across print culture, including materials that influence classroom reading.

Thus, the Nordic evidence becomes contradicting. Despite progressive educational goals and strong policy commitments to equality, representations within teaching materials continue to reflect subtle stereotypical and cultural hierarchies. These patterns affect for how students internalise confidence, motivation, and perceived competence, all factors that influence learning outcomes in measurable ways. The following section examines PISA findings to contextualise how differences in confidence, anxiety, and self-concept in mathematics persist in high-performing, equity-oriented systems such as Finland and Nordic neighbours.

3.5 PISA results and gendered trends

The Programme for International Student Assessment (PISA) has consistently highlighted how gendered attitudes toward mathematics may develop and how they differ across cultural contexts. While PISA results show that performance differences between boys and girls are often small or negligible, persistent gaps appear in attitudes, such as confidence, self-concept, interest, and anxiety. These gaps in attitudes are extremely relevant to textbook research, since they suggest that the learning environment surrounding mathematics teaching may shape outcomes as much as knowledge transfer.

According to OECD's PISA 2018 Results (Volume II, 2021), girls in most countries that participated reported significantly lower self-efficacy in solving mathematics problems, and

higher levels of anxiety related to mathematics than boys, even though they consistently achieved similar scores. Finland demonstrates this pattern strongly: Finnish girls, on average, perform equally well to boys, yet they rate their mathematical abilities lower, and they experience greater anxiety as well (Figure 1). This discrepancy suggests that cultural narratives and representational cues shape learners' self-concept, not actual achievement.

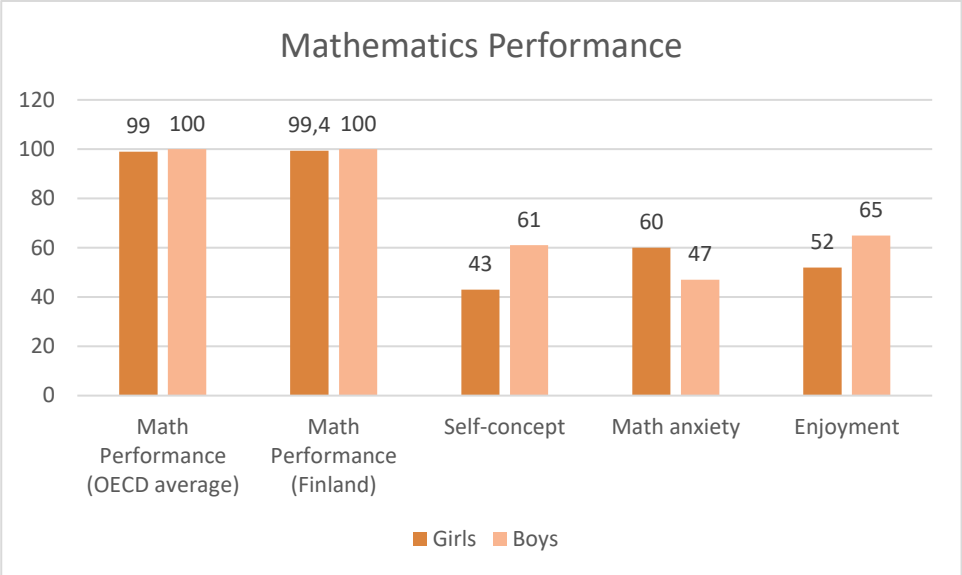

Figure 1 Mathematics performance, OECD 2021[1]

Hyde and Mertz (2009) provide evidence that the gender performance gap has closed dramatically across countries, which negates the previously cited argument about ability-based explanations. Instead, they emphasise the influence of cultural messaging and social expectations. Similarly, Else-Quest et al.'s (2010) meta-analysis found that girls' mathematics self-confidence and interest vary considerably across countries and correlated strongly with measures of gender equality. In societies with higher gender equity, achievement gaps diminished, but attitudinal gaps often persisted. This indicates that even when educational opportunities are equal, subtle cultural cues can still remain embedded in textbooks.

[1] The scores of the boys for mathematics performance were not 100%. I turned the highest registered score into the scale, so we can see how similarly girls score

Stoet and Geary (2018) offer an important addition to these findings. In their study of 67 countries stated previously, they noted that countries that score higher in gender equality often also show greater gender differences in academic preferences, with girls more likely to excel in reading and boys in mathematics. Even though this can be linked to many possible factors such as personal strengths or cultural norms, these patterns still suggest that textbooks which associate mathematics with masculine characters may amplify these tendencies by reinforcing the idea that mathematics competency comes more naturally to boys.

Within Finland, where overall academic outcomes are high and gender equality is claimed to be a long-established policy priority, these attitudinal gaps are especially contradicting. Finnish girls' consistent underestimation of their mathematical abilities (OECD, 2021) may be linked to subtle stereotypical cues in their learning environment, including textbooks. Blumberg's (2008) and Tainio & Karvonen's (2015) findings suggest that if early mathematical materials consistently show boys as more active in solving than girls, such patterns can contribute to internalised beliefs about mathematical competence. Given that identity beliefs formed in early primary education affect later academic choices (Eccles & Wigfield, 2020), representational biases in textbooks can easily have long-term consequences.

PISA results therefore serve as an important context for this thesis. They show that gender disparities in mathematics attitudes are widespread, persistent, and culturally mediated, not determined by biological differences in ability. They also highlight the importance of examining the environment around mathematics instruction, including textbooks used in the earliest years of schooling. Textbooks influence both the form and content of classroom mathematics, so if we want to interpret the differences in attitudes observed in PISA data, it is important to understand how textbooks represent gender and other diversity categories.

4 Methodology

This study uses qualitative methods combining content analysis and critical discourse analysis, to examine how gender is represented in mathematics textbooks for Grade 1 in Finnish primary education. The purpose of this is to initially identify what kinds of representations exist through content analysis and then interpret how these representations may reflect wider cultural and ideological patterns through critical discourse analysis.

This approach aligns with the study's theoretical grounding in representation theory, multicultural education, and critical pedagogy, which together view educational texts as social constructions which communicate values, identities, and power relations.

4.1 Data

In Finland, basic education schools and municipalities select learning materials locally, rather than using one nationally prescribed textbook. For this reason, the Finnish-language sample in this study focuses on Mathematics series from the two most established and widely distributed learning-materials publishers, Sanoma Pro and Otava Learning. Research on the Finnish learning-material field identifies these companies among the most prominent commercial actors supporting comprehensive schooling, indicating their central role in the materials most teachers encounter in practice (Seppänen et al., 2023). Sector analysis further characterises the market as dominated by these two publishers, reporting an estimate for 2014 in which Sanoma Pro held "over 60%' and Otava "nearly 35%" of the learning materials market (Suomen tietokirjailijat re, 2015). As mentioned previously, these textbooks are designed to follow the national curriculum, without having a state-mandated examination to verify their applicability (Tainio & Karvonen, 2015).

After personal contact with both publishers, the most widely used Finnish-language mathematics series were identified. Additionally, after personal contact with all International schools in Finland, I found that half of the schools use English-language materials in mathematics from one of these two publishers.

Not all the books were the latest edition out currently, but I was informed by both publishers that every edition mainly tweaks minor mistakes like spelling.

The books are as following:

Table 1 Books

Books that were analysed for this research

Publisher	Series	Book	Language	ISBN	Edition	Latest edition
Otava Learning	Oivaltaja	1a opettajan opas	Finnish	978-951-1-37776-4	2021 (1st ed.)	2024
Otava Learning	Oivaltaja	1b opettajan opas	Finnish	978-951-1-39994-0	2021(1st ed.)	2024
Otava Learning	Star Maths	1a Teacher's guide	English	978-951-1-37776-4	2017 (1st ed.)	2023
Otava Learning	Star Maths	1b Teacher's guide	English	978-951-1-39994-0	2017 (1st ed.)	2024
Sanoma Pro	Milli	1A Opas	Finnish	978-952-63-6026-3	2021 (4th ed.)	2022
Sanoma Pro	Milli	1B Opas	Finnish	978-952-63-4967-1	2018 (1st ed.)	2024

It is important to note that, after the initial coding of the first book, it was discovered that student's editions consisted entirely of exercises and illustrations, with very limited written text. In several cases, tasks were presented without any explanatory instructions, leaving important contextual information implicit. Thus, it was deemed necessary to analyse the Teacher's Guides. The Teacher's Guides contained the pages pictures from the students' books, combined with narratives, prompts, contextual explanations or tips and additional

exercises, not included in the books solely intended to be narrated by the teacher. Analysing this material ensured that I captured not only what students saw on the page, but also the full pedagogical framing through which the tasks were meant to be introduced in the classroom. It should also be noted that Teacher's guides were updated way less frequently than students' books.

At least two different books were coded multiple times, before finalising the coding categories

4.2 Content analysis

The first stage of analysis is content analysis to establish a quantitative baseline of how gender is represented in the selected Grade 1 mathematics textbooks. Content analysis provides a systematic approach to describing manifest content in texts and images, allowing patterns to be identified and compared across materials (Krippendorff, 2018). In the context of this study, it provides the foundation for identifying how often male and female characters appear, what roles they are assigned, and in what kinds of mathematical or everyday contexts these roles are embedded.

The coding frame was developed deductively (before coding the text), following established principles of category construction and codebook development in qualitative content analysis (Mayring, 2019). To ensure that the coding categories were operationalised in a way consistent with prior textbook gender research, the framework also drew on Brugeilles and Cromer's (2009) methodological guide, which emphasises coding both visibility and role allocation, rather than treating gender bias as a matter of numerical imbalance alone.

Every character appearing in a word problem or an illustration is coded according to the following coding categories:

- Count (how many humans appear in the unit of analysis)
- Gender (male, female, other)
- Mathematical Domain (technical/scientific, domestic/social)

- Role in mathematical activity (problem-solver, supportive/helper, everyday/domestic task, neutral/other)
- Visibility (Central or background character)
- Valence (positive, neutral, negative portrayal)

For example, a boy depicted as building a tower with blocks while solving a math problem would be coded as male, problem-solver, central, positive. A girl shown assisting in shopping-related tasks would be coded as female, everyday/domestic, central, neutral. These coding decisions are recorded systematically in a spreadsheet, allowing for both frequency counts and cross-tabulation across categories.

The codes of count and gender create the baseline of the analysis, following the suggestions of Brugeilles and Cromer (2009), as well as the logic used in the study of Tainio and Karvonen (2015). However, Blumberg (2008) as well as Tainio and Karvonen (2015) have raised concerns, noting that gender bias in textbooks often emerges less from explicit numerical exclusion than from cumulative patterns of representation, who is depicted, in what roles, and with what evaluative tone. For this reason, the coding framework extends beyond frequency by including the codes of visibility, role allocation, and valence. In addition, to examine the types of mathematical activity shown in the examples, I developed the code of mathematical domain. This was following research showing that female characters are often associated with caregiving or domestic contexts (e.g. childcare, kitchen or household related activities), whereas male characters are more frequently linked with different occupations or roles surrounding work (Blumberg, 2008; Nurlu, 2021). This is also why I focused on the difference of the characters being active or passive participants in a mathematical example, since presence alone does not necessarily capture mathematical agency.

The framework was thus created to attempt to quantify the patterns that would be found in the content analysis, in order to be able to make both numerical and semantic arguments.

The full coded dataset ended up being 462 entries/lines. Before conducting the category-level analysis, I manually reviewed all entries to identify inconsistencies in formatting, label use, and coding notation. This initial clearing stage was necessary, because even minor formatting

differences (e.g. an accidental space before a code, a typo) could affect spreadsheet searches, filtering, and excel codes' reliability. After the initial coding and subsequent analysis, the dataset was reviewed again to check for missing values, formatting irregularities, and coding inconsistencies.

Following this initial dataset cleaning, every analytical category was processed separately. Relevant variables were transferred to a new worksheet for focused re-checking, and once again manually reviewed and standardised before category-specific coding comparisons were conducted (for example, gender in relation only to mathematical domain). After this, the category-level results were coded using Excels formulas and codes in order to get counts and chances, before re-checking manually if said counts are in fact correct.

The reason the dataset was checked manually multiple times was because, even a small typographical or formatting error could affect the counts coding. If there was an accidental space before the code "3M" meaning three male characters were coded, then those three male characters may have never been considered in the codes. So the purpose was to reduce counting errors and improve consistency across the dataset.

Research has raised concerns that gender bias in learning materials can emerge at multiple levels, from the frequency of genders appearing in mathematical problems to the context that each gender appears in. A large portion of the data focuses on visibility and frequency (Blumberg, 2008; Jehle et al., 2024), since numerical underrepresentation is already a common indicator of imbalance. At the same time, scholars warn that counting alone can be limited, since it may leave unanswered questions about how characters are positioned in relation to competence and active participation (Tainio & Karvonen, 2015). For this reason, the coding results were organised by examining all possible connections of the coding categories, starting from simple one to one comparisons to more complex combinations. The initial coding is the most basic baseline: frequency of genders in general, both in appearances and in total number of characters. Next, gender was cross-referenced with mathematical domain, to examine whether boys and girls were more frequently positioned in specific contexts, such as domestic/social or technical/scientific framings of mathematical activity. Similarly, the connection of gender and role in mathematical activity was coded, to

identify differences in agency within the examples that the characters were not simply present in an example but had a specific role. Finally, all coding categories were combined, to see whether the patterns were conditional. In other words, to see if one gender was more often active participants within a certain domain, while appearing more often in supportive roles in another domain. This coding would make it possible to move beyond the question of "who appears" and towards a more detailed understanding of how mathematical competence and participation was placed across different contexts, revealing both balances and imbalances.

4.3 Critical discourse analysis

The operationalisation of this critical stance also draws on Critical Discourse Analysis (CDA) as outlined by Fairclough (1995) and van Dijk (1993, 2015). CDA offers tools to examine how ideologies are embedded in seemingly neutral texts by paying attention to recurring linguistic choices, role allocations, and contextual framing (Fairclough 1995; van Dijk, 1993).

Fairclough (1995) emphasises that ideological effects are more powerful when they become normalised. That is, when particular representations and assumptions are presented as common sense through semantics rather than as socially constructed positions and opinions. Van Dijk's socio-cognitive approach complements this perspective by explaining how such patterns connect to shared knowledge, beliefs, and group-based ideologies which shape how readers interpret texts and understand social categories such as gender or ability (2015).

In the case of mathematics textbooks, CDA therefore makes it possible to highlight how diversity categories are represented, or excluded, and how these textual decisions align with wider societal discourses about identity and competence (Fairclough, 1995; van Dijk, 2015). Integrating CDA within a critical pedagogy framework therefore allows for a deeper understanding of how curricular content can help shape students' sense of belonging and their perceived potential in mathematics by reproducing, or potentially challenging, naturalised assumptions.

Several studies have effectively utilised CDA in textbook and classroom analysis. Tainio and Karvonen (2015), for instance, applied CDA to examine Finnish teachers' interpretations of gender bias in school textbooks. Their findings revealed that textbooks often naturalised traditional gender roles through visual composition and role descriptions, even in contexts assumed to be egalitarian. Similarly, Sunderland et al. (2002) used CDA to analyse English language teaching materials, identifying how gendered subject positions were casually placed through discourse and narrative structure. In another example, Lazar (2008) combined CDA with feminist linguistic analysis to uncover how opinions of power are reproduced in educational and media texts. Consequently, CDA provides a methodological framework for possibly linking textual analysis to broader social issues as gender equality in education.

Applied to this present study, CDA complements the earlier stages of content analysis by enabling an interpretative reading of the ideological baseline of the textbook content. This approach focuses on how visual and textual elements work together to construct gendered meanings, examining patterns such as agency (who acts and who observes), activity type (domestic, technical, academic), and evaluative language (competence, emotion, cooperation). Integrating CDA within a critical pedagogy framework therefore enables a deeper understanding of how curricular content contributes to shaping students; sense of belonging and potential in mathematics.

4.4 Coding reliability and second coder

In order to strengthen the consistency and transparency of the coding process, a second coder independently coded a selected subset of 15 examples form the dataset (total 462) using the same coding framework and category definitions applied in the primary analysis. The subset was used as a reliability check rather than a full double-coding. After comparison of the coding decisions, the compatibility rate was 75%. Given the mixed image-text nature of the material and the inclusion of interpretive categories (e.g. role allocation, contextual framing, and categories) the level of agreement was considered acceptable for the purposes of this study.

In addition to coding decisions, the second coder provided qualitative comments on several examples. These comments were naturally more subjective than the primary coder's entries, which is understandable in this context. The second coder examined a small, selected sample from the full dataset, and therefore encountered individual examples without the broader comparative context that became more easily visible during the repeated coding of the 462 entries. For this reason, the comments were not treated as qualitative results nor were they used to alter frequency counts. Instead, they were used as interpretive feedback to identify ambiguous cases, test the clarity of the category definitions, and strengthen the transparency and self-reflection of the analytical process. In this sense, possible disagreement and comments were analytically useful, since they helped reveal where representational examples were less straightforward or when text would change the meaning completely.

4.5 Considerations and limitations in coding gender

The central focus of this thesis is the representation of gender in early primary mathematics textbooks. However, the concept of gender itself is multifaceted. Modern discourse distinguishes between biological sex, gender identity, and gender expression, acknowledging that gender is not a fixed binary, but a socially and culturally constructed spectrum (Butler, 1990; Connell, 2009).

Despite this complexity, for the purposes of this study it was necessary to adopt a pragmatic coding strategy. Because textbook characters in the selected materials are overwhelmingly represented in binary terms (boys and girls, men and women), and because visual cues and names rarely provide information beyond assumed binary categories, coding was limited to biological gender presentation (male/female/other). This decision does not reflect a stance that reduces gender to biology, but rather a methodological boundary that ensures coding reliability and objectivity. By focusing on the most visible and consistently codable dimension of gender, the analysis can systematically identify patterns in representation. At the same time, the study is grounded in a critical educational stance, which emphasises that inclusive and unbiased portrayals of genders can create space for broader acceptance and recognition of gender diversity in classrooms (Rogers, 2011; Freire, 2000).

An additional methodological consideration arises from the Finnish language itself. Unlike English, Finnish does not mark gender in pronouns, using hän to refer to both he and she. This linguistic choice means that gender representation is less explicit in Finnish-language texts and must often be inferred from illustrations, names, or contextual cues. The apparent neutrality of Finnish nouns and pronouns does not eliminate gendered assumptions in practice (Lappalainen, 2009), rather gender ideologies are often conveyed indirectly through context and imagery. The present analysis relies more heavily on visual cues in the Finnish materials, while English texts often make gender explicit through pronouns. This difference underscores the importance of analysing both text and image together, as meaning is not always located in a single mode of communication.

5 Findings

The analysis revealed patterns in how gender is represented in these specific textbooks in Finland. At the same time, multiple results and arguments seem to contradict with trends that have continued to emerge in cross-national reviews and research throughout the years. The coding resulted in 460 lines of codes across the 6 categories in the coding scheme. In general, most student's books contained limited text and the teacher's guides had varying levels of teaching guidance, suggestions and advice for the teachers. The main importance behind this is that, if there is a stereotypical context located, it may seem unnecessary since the context is only added via the text provided in the teachers' guides, even though that makes it more easily corrected. On the other hand, the positive influence of counter-stereotypes and positive gendered examples and attitudes is more direct and instant.

5.1 Analysis of the textbooks

The first series to be analysed was the English series from the first publisher. The cover of this first series introduces the two main animal characters of the book, Kassie the magpie and Chip the squirrel who appear throughout the material and help structure the storyline around the exercises. The Teacher's guides shortly introduce the structure of the books and the lessons, explanation of certain exercises, as well as the book's timeline. They contain the main learning objectives, the story and narrative behind the illustrations, and the introductions to the tasks intended to be delivered by the teacher. They also provided exercise explanations and prompts. In contrast, the student's book contained pictures, and the captions of problems. At the beginning of the chapters, there frequently was a photo and a story explaining the image and/or introducing the current mathematical topic at hand, however the story was only in the Teacher's guide, so it is always narrated by the teacher. Thus, the meaning of many images and tasks is often framed only after the teacher reads the accompanying story aloud. An important note is that in this book, the Teacher's guide pages correspond directly to the students' books' pages which made cross-referencing and coding more persistent.

A notable linguistic feature of this series is that many tasks are written in passive voice. Additionally, even though the book and Teacher's guide is in English, personal pronouns are used sparingly in problem instructions, while the words student or pupil are utilised frequently. This choice creates a sense of neutrality in the wording of the exercises. However, although the language itself often avoids explicit gender marking, gendered patterns still emerge through the character-based storyline and the contexts used in illustrations and examples.

In general, human characters are not positioned as the centre of the problems, but rather as part of the broader context given for a specific problem, alongside the animal characters. The characters that appear most frequently are Alec and Emma. These two characters appear in most images and story-based problems and mostly appear together. However, despite their shared visibility across images and text, the narrative focus seems to fall more heavily on Alec, particularly his school progress, his preferences, or his ideas or thoughts.

This is apparent already on the first page of the student book (page 05 of the 1a Teacher's guide), where the illustration includes 3 female characters and 2 male characters, but the storyline centres on Alec: "Alec smiles, he is happy. ... he is now a schoolboy! ... All summer Alec has waited most for mathematics lessons! Alec can already list quite a few numbers he is familiar with. He decides to practice calculation to pass time before the teacher arrives. "How many blue book boxes are there in the classroom? I'll count them!" Alec thinks to himself.".

This pattern reappears later in the series, when Alec is repeatedly described as highly engaged and academically motivated, particularly in relation to reading. For example, on page 66 of the Teacher's guide, Alec is characterised as a "bookworm", and the storyline includes detailed praise about his reading habits. It goes on to mention that "The pupils of the class have read plenty of books. Last week, Alec read a whopping 7 books. This week, he has been very busy and read 8 new books. The teacher is admiring what an avid reader Alec has been. "I got so carried away that I started practically devouring this great book series. ...". While these depictions are not negative on their own, they do stand out due to their emphasis

on Alec's effort and ambition, and strong academic identity, as well as the absence of similar comments or storylines for the female most frequently depicted character, Emma.

At the same time, the series also includes moments that may attempt to balance this narrative. On page 70 of the 1b Teacher's guide, it is mentioned that "Alec's grandmother is also an avid reader. When she was a child, many fairytales were read to her, and now she likes to read detective stories. When Grandmother hears that the teacher has challenged the class to read one hundred books, she instantly agrees to bake a cake to celebrate the occasion.". This portrayal provides a more positive and nuanced example of a female character associated with literacy, encouragement, and interest for knowledge, rather than placing this reference along a passive role.

In terms of the mathematical examples themselves, most objects used in tasks are relatively neutral, suggesting an effort to avoid overt stereotyping. However, some instances still rely on familiar gendered associations, translated through the choices of items. A notable example occurs on page 115 of 1b Teacher's guide, where a counting activity remains neutral until the focus shifts to Emma, when the objects to be counted become hair clips. Similar patterns appear elsewhere in the material: hairpins appear in girl-associated examples, while balls are linked to boys within the same task, racing cars and dinosaurs appear in male-only examples, while ponies or beads appear in female-only examples. On page 146 of 1b Teacher's guide, one of the very few times where a single female character appears by themselves (Emma), and she is depicted making jewellery. These choices are relatively subtle, especially when compared to results from cross-national research, but because they do occur, they still may reinforce familiar gendered assumptions through repetition rather than through explicit messaging.

A similar dynamic is visible on the chapters where reading was of interest. There were occasions where Alec's reading was praised strongly and in detail, whereas Emma's reading received additional framing which seemed way less necessary. For example, on page 42 of the 1b Teacher's guide, Emma's books are described by Alec as containing very little text and mainly pictures. Even in a later example, where Emma is praised by the teacher for reading many books (page 58), the teacher's encouragement includes the reassurance that it does

not matter that the books contained little text and many pictures. Although the intention here appears to be supportive, and a very important message indeed, the repeated emphasis on the simplicity of Emma's reading material may create an unintended contrast between the two characters, indirectly positioning Alec as the stronger or more serious reader. Especially since, in the same examples mentioning how many books Alec read ("a whopping 7 books last week … 8 new books this week") the teacher is admiring him without any additional comments.

Equally as important are the counter-stereotypical portrayals that the series includes, that suggest representational choices were not accidental. One strong example is again Alec's grandmother, who is described as both intellectually engaged and socially supportive. Other examples include captions such as "Alec sings, Emma counts …" (page 23 of 1a Teacher's guide). In addition, on page 114 of the 1b Teacher's guide, the pupils visit a farm where the farmer is intentionally presented as a woman, and she supports the pupils in counting eggs in cartons. There also appears to be a conscious attempt to balance the number of word problems featuring male-only names with problems featuring female-only names throughout the series, rather than assigning mathematical action consistently to one gender.

Finally, whereas the main focus of the analysis is gender, there were also occasional instances of casual diversity representation beyond gender, such as the inclusion of a character named Ahmed. While such moments are limited and not central to the series, they indicate some degree of broader representational awareness, even if it is integrated in a discreet manner.

The next series is Finnish series 1 from the first publisher. The covers introduce two recurring robot characters Hoksnokka and Pii who appear consistently throughout the problems and visual materials. According to the teacher's guide and the accompanying online materials Hoksnokka is described as a character who "helps to use the calculators in mathematics lessons and gives tips on solving problems" and it is also mentioned that "Hoksnokka=a person who figures things out quickly", while Pii is described as a character who "has fun doing problems, and may also be hiding sometimes". Visually, both characters appear in different colours, mainly blue, yellow, and green, and are depicted in ways that avoid clear gender marks. Their clothing, activities, and roles do not provide strong cues which would allow readers to assign a specific gender, suggesting an intentional attempt to maintain neutrality.

Each new chapter begins with an image accompanied by a poem, or a song connected to the mathematical topic currently at hand. Human characters and personal names are largely avoided in the materials. Linguistically, the series utilises passive voice a lot, however that is more typical for the Finnish language but important to note since the pronoun hän is not found too often. Other times, it simply uses minä (I), often without visual constructions to indicate who "I' refers to. This approach appears to encourage students to read and position themselves directly within the learning situation or the action. Whenever third person references are used, typically to guide the teacher to encourage the children to participate, they tend to remain generic, typically through words such as oppilas (student) or lapsi (child).

It was evident that the teacher's guide contained a lot of guidance for teachers. Each chapter includes a section titled Pedagogiset Huomiot (Pedagogical Considerations) where teachers are given advice on potential learning difficulties, key points of attention, and suggested approaches for supporting students. This series also places a strong emphasis on activity-based and experiential learning, encouraging teachers to incorporate movement, games, and interactive tasks into mathematics instruction. Many activities are designed to combine physical engagement with numerical thinking. For example, some of these games instruct students to "rise slowly and at the same time count 1-2. During count 2, jump into the air. Let's land back down into a squat while counting the numbers 2-0". Some of the proposed

activities take place outdoors, which typically aligns with common practices in Finnish classrooms, but also demonstrates a deliberate effort to integrate mathematics into embodied and playful learning contexts. The mathematical tasks themselves frequently refer to everyday scenarios, particularly shopping and familiar real-life situations.

Two aspects of this series stand out positively. First, the visual materials include a wide range of diversity across multiple dimensions. Many illustrations depict children of different ethnic backgrounds, and several include visible markers of disability, such as wheelchair use. This diversity appears consistently across chapters rather than simply isolated examples. At the same time, because human characters are not often central in the narrative or problem-solving parts of the series, the representational potential of the diversity at hand may not be fully realised. The images portray inclusion visually, yet the absence of recurring human protagonists or storylines to contextualise them, limits opportunities for these identities to develop into active mathematical influence within the storyline.

Second, the series places notable emphasis on students' emotional and reflective engagement with learning. At the end of each chapter, students are offered some self-assessment activities in which they reflect on statements such as "Learning new things feels good", "I work calmly", and "I enjoy the experience of learning". These suggest an attempt to position mathematics not only as a cognitive task, but also as an affective experience. By emphasising emotions, confidence, and self-perception, the material acknowledges that learning mathematics involves more than learning content. It also involves building positive relationships with the subject and the emotions associated with it.

A notable feature that was noticed in the analysis of this series, and the other Finnish-language series is that all sentences in student's books were fully pre-spelled. For example, instead of a sentence typed as "Tutki lukumääriä. Yhdistä laatikot, joissa on yhtä monta.", it showed "Tut-ki lu-ku-mää-riä. Yh-dis-tä laa-ti-kot, jois-sa on yh-tä mon-ta". And that goes for all sentences and captions that appear in the student's books. While initially this appeared rather unusual, research on early reading development helps explain why such scaffolding is common in Grade 1 materials. Children begin school with a wide variation in decoding skills, phonological awareness, and reading confidence, and highly controlled or decodable text

support those who are still learning to connect sounds and letters (Mesmer, 2005; Walgermo et al., 2018; Castles et al., 2018), especially since the issue on focus is not reading itself. In this sense, the format can be understood as a form of interdisciplinary support, allowing pupils to engage in mathematical ideas while at the same time strengthening early literacy skills.

The next series analysed was the second Finnish series from the second publisher. The cover of the first book introduces three of the main characters, Milli the robot, Olli, and pikkusisko (little sister) Annoona who are depicted playing a board game. Additional main characters are Jalo and ystävä (friend) Eena, who are introduced in the characters' page of the book. At first glance, the group appears to consist of two girls and two boys alongside the robot character. However, certain aspects of how the characters are introduced draw attention in regard to the differences in positioning. The male characters are presented as independent individuals, identified simply by their names. Although the book later notes that Jalo and Olli are twin brothers (mentioned as "Jalo's twin brother Olli"), Olli is still introduced as a standalone character rather than in relation to Jalo. In contrast, the two female characters are introduced through relational roles: Annoona as the "little sister" (mentioned at some point as "Jalo's little sister"), and Eena as a "friend". While these relational identifiers are not used consistently throughout the series in problems and stories, where all characters are mostly referred to by their names, their inclusion at the introduction may subtly position the female characters as more peripheral compared to Milli, Olli, and especially Jalo (who remains the key reference to two out of three relationships), even though they appear throughout the material with equal frequency. The second book's cover continues the shared storyline and the group dynamic, by depicting Milli with Eena and Jalo engaging in birdwatching.

The Teacher's guide begins with a detailed explanation of both printed and online materials, as well as the structure and logic of the tasks included. It provides extensive guidance for teachers, including the yearly timelines and explanation of the way the chapters are laid out. Similar to the previously analysed series, the student book uses pre-spelled captions and sentences.

Pedagogically, the series follows a similar pattern of activity-based learning and frequently suggests games and tasks. Mathematics is often linked to physical activities or real-life scenarios, which aligns with broader Finnish classroom practices. Visual materials generally show characters engaged in everyday actions, however the narrative framing in the Teacher's Guide often positions the mathematical activity outside the characters themselves. For example, problems are framed in ways such as "Jalo is trying to throw seven balls into a box. If five make it in, how many are left?". In these examples, characters participate in the scenario but are not always depicted as actively performing mathematical activity themselves. Similarly, many tasks focus on realistic situations rather than comparisons of efficiency or performance, such as shopping scenarios or everyday counting contexts (e.g. calculating change after a purchase). This approach grounds mathematics in familiar experiences rather than competition between the characters.

Some specific examples stood out during the analysis, albeit few in comparison to the total amount of codes. In one word problem referring to the board game introduced on the book cover, the title states "The boys are playing a board game / Pojat pelaavat lautapeliä" (page 45, 1A Open opas). However, both the cover illustration and earlier visuals at the beginning of the chapter show Annoona participating in the game alongside Olli, and in the related word problem Jalo, Olli, and Annoona are all mentioned. The wording therefore does not fully reflect the visual context. In another instance, two consecutive exercises (pages 64 and 68 of 1B Open opas) showcase subtle differences in character action. In the first, Jalo is shown actively contributing to problem-solving, while in the second, Eena's role is limited to naming quantities of animals, which serve as context for the mathematical task at hand, rather than demonstrating engagement in the mathematical reasoning itself.

At the same time, the series includes several positive and counter-stereotypical depictions. There are multiple illustrations in which the female characters take leading roles in physically active or competitive contexts, such as Eena wall-climbing or Annoona skateboarding or racing a car while Jalo and Olli cheer her on. These portrayals, although not always directly connected to mathematical reasoning, contribute to a broader representation of girls as active, confident, and capable participants in activities. In addition, the material includes

more casual forms of diversity representation, such as different ethnic backgrounds and indications of different cultural or religious identities.

5.2 Gender representation in textbooks

5.2.1 Consistent balance of gender visibility across the textbooks

Following the qualitative analysis of each textbook series, this section examines gender visibility in quantitative terms across the analysed series. The aim is not only to identify whether male and female characters are equally present, but also how frequently they appear, whether they appear alone or together, and how often the problems and/or illustrations are framed around one gender only. This provides a basis for understanding representation patterns begore moving to more detailed values such as role allocation.

Figure 2 presents the frequency of gender appearances across the full series (two Finnish and one English series combined) and only the English-language series. The analysis distinguishes between four different dimensions of gender visibility and appearances: total number of characters that were gendered, and thus coded, total number of character appearances per gender, gender-exclusive appearances, meaning problems or illustrations in which only female or only male characters appeared, and single-character appearances, i.e. how many of the times that female characters appeared was it only one female present, and the attention was therefore centred exclusively on said character.

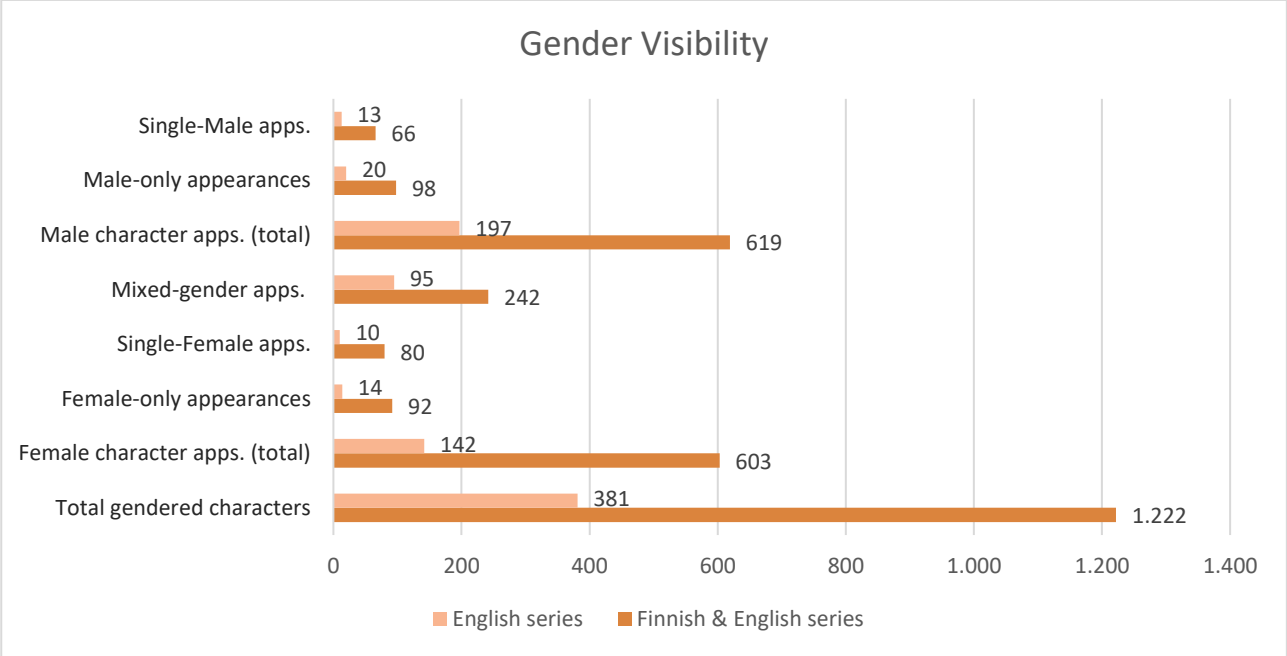

Figure 2 Gender visibility

At the most general level, the dataset contains 1,222 gendered characters in total, of which 381 originate from the English-language series. The difference reflects the larger number of Finnish-language materials included in the analysis in a relatively balanced way. However, it is important to remember that the English-series relied more heavily on human characters, even though there were frequent appearances of the 2 animal characters as well, whereas one whole Finnish-series did not contain any central human characters. There are 619 total male character appearances and 603 total female character appearances. In contrast, the English-series shows a more uneven distribution, with 197 male appearances and 142 female appearances, meaning 28% less.

The second dimension focuses on gender-exclusive contexts, i.e. problems or images in which only one gender is present. Across the combined series, there are 98 male-only instances and 92 female-only instances indicating a relatively balanced distribution when tasks are framed around a single gender, even though female appearances were again less frequent. In the English series these instances are fewer overall, with 20 male-only appearances and 14 female-only appearances, following a pretty similar proportional

pattern. This suggests that both boys and girls are represented independently in comparable ways, however there is still the trend of lower numbers linked to the female gender.

The third dimension focuses on single-character appearances, where only one human character is present in a problem or illustration, and the attention is directed exclusively on that individual, no matter their activity or contribution in said example. In the combined series, there are 66 single-male appearances and 80 single-female appearances, changing the trends followed in the previous dimensions. In the English series the corresponding numbers are 13 single-male and 10 single-female instances, following the same trend seen previously of constantly slightly less female mentions. These cases are analytically significant, as single-character depictions tend to assign clearer agency and responsibility within the task, potentially shaping how competence and participation in mathematical activity are associated with gender.

Mixed-gender appearances make up the most common grouping across the materials. The combined series includes 242 instances in which both genders were present within the same problem or illustration, compared to 95 of such instances in the English series. This prevalence indicates that the textbooks often position boys and girls within shared mathematical contexts rather than separating them consistently into scenarios in which only one gender appears. As a result, gender representation may be constructed relationally, through interaction and co-presence, rather than isolated portrayals.

Taken together, the data suggest that overall gender visibility is relatively balanced at this level of presence, particularly in the combined data, where total male and female character appearances are highly comparable. The English-series shows a somewhat stronger male presence in appearances, but the difference is less strong when examining single-character and single-gender contexts. Importantly, the notability of mixed-gender appearances indicated that the textbooks generally create shared spaces for mathematical activity. These findings imply that representational differences may be unlikely to be stemmed primarily from presence or absence of characters, but rather from how characters are positioned, what roles they occupy and in what frequency, and how agency is distributed within mathematical examples.

Overall, the quantitative overview demonstrates that both male and female characters are somewhat consistently visibly across the analysed materials, with frequent co-presence in learning contexts. At the same time, variations in single-character appearances and in total character counts suggest that visibility alone does not fully capture the dynamics created in the textbooks. The next section will look further into function instead of frequency, examining how gender is contextualised through roles, actions and framing within mathematical tasks. This allows for a more explicit understanding of how representation operates beyond just numerical balance and into the structure of participation itself.

5.2.2 Gender and mathematical domain: Dominance of Domestic/Social contexts and slight male-leaning representation

This next analysis considers the mathematical domains in which gendered characters appear. In this study, each coded problem or illustration was categorised by its domain: Domestic/Social; (everyday, relational, school or home scenarios, being outside) or Technical/Scientific (measurement, mathematical reasoning, formal operations, structures numerical tasks, using tools). The aim is to identify whether gender visibility remains similar across domains, or whether boys and girls appear disproportionately in one type of mathematical framing.

Figure 4 summarises the dataset by showing both task-level counts (times) and character-level totals (n – number) within each domain. The figure therefore combines four levels of information:

1. Number of examples that are coded within each domain (overall distribution)

2. Number of examples in which female and male characters are present

3. Number of total female and male character appearances occurring in each domain

4. Number of times only female or only male characters are present in each domain

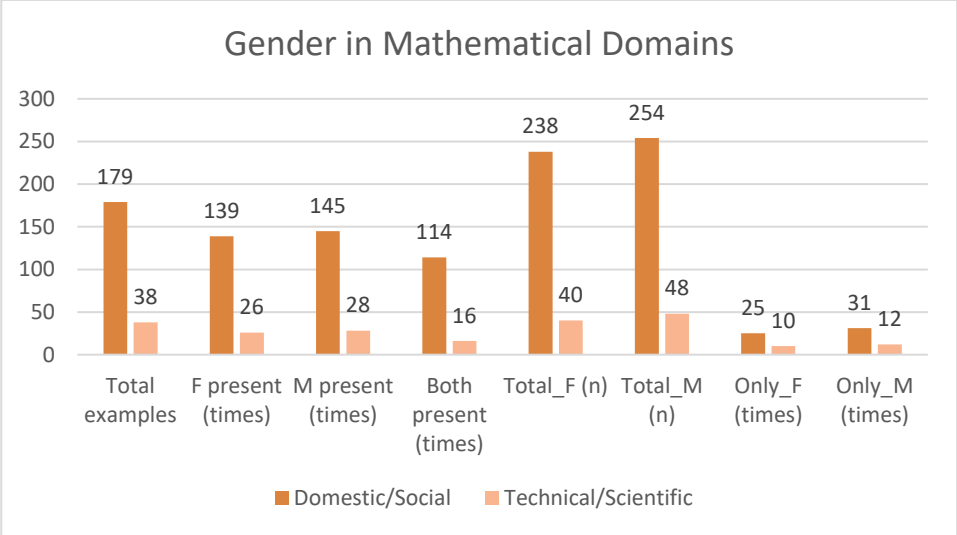

Figure 3 Gender in mathematical domains

Overall distribution of mathematical domains

The value named Total examples showcases the overall examples of the dataset across the two mathematical domains. Most mathematical examples fall under Domestic/Social (179) while a smaller portion are coded as Technical/Scientific (38). This indicates that the textbooks, overall, probably tend to embed early mathematics more often in familiar and everyday contexts rather than in explicitly technical framings. This baseline is important, because later comparisons should be interpreted with the understanding that the books contain far more domestic/social examples overall.

Gender presence within each mathematical domain

The values named F present (times), M present (times), and Both present (times) represent how many Domestic/Social or Technical/Scientific examples include at least one female character, at least one male character, or both genders together. Both genders were present a total of 114 times in Domestic/Social mathematical examples, and 16 times in Technical/Scientific examples. Female characters were present a total of 139 times in Domestic/Social mathematical examples, while 26 times in Technical/Scientific examples. Male characters were present 145 times in Domestic/Social mathematical examples, and 28 times in Technical/Scientific mathematical examples.

These figures show that within both domains, girls and boys tend to appear in broadly comparable numbers at the task level. In Domestic/Social examples, male presence is higher than female presence, but that difference is small. In Technical/Scientific examples, both genders appear again at similar rates, though the total numbers are lower because the domain itself is less commonly coded in the dataset.

The Both present value indicates that mixed-gender examples form a substantial share of the material, especially in the Domestic/Social domain (114). Mixed gender representation is therefore structurally common, meaning many tasks and illustrations depict boys and girls within the same learning situation.

Total character appearances within each mathematical domain (Total_F / Total_M)

Total_F (n) and Total_M (n) values shift from total instances to total counts of individuals, showing how many total female and male character appearances were coded within each mathematical domain. The amount of female appearances were 238 in Domestic/Social and 40 in Technical/Scientific contexts. On the other hand, the amount of male appearances were 254 and 48 respectively.

These totals suggest a subtle male-leaning pattern in both domains. Male characters appear slightly more frequently than female characters overall, both in Domestic/Social and in Technical/Scientific contexts. However, the gaps are not extreme, and the pattern is consistent across both domains rather than concentrated in one particular domain.

Gender-exclusive examples (Only_F / Only_M)

Finally, the last two bars of the chart represent examples where only one gender is present in the task or illustration, no matter the number of characters present. The number of times only female characters were present in Domestic/Social mathematical problems was 25, and 10 in Technical/Scientific mathematical problems. The number of times only male characters were present was 31 and 12 respectively.

These figures show that single-gender examples do exist in both domains, with a slightly higher number of male-only than female-only examples overall. Importantly, the presence of female-only examples in the Technical/Scientific domain indicates that girls are not restricted exclusively to Domestic/Social framings, although male-only examples remain slightly more frequent there as well.

Taken together, the domain distribution indicates that most mathematical tasks across the analysed materials are framed within Domestic/Social examples, with Technical/Scientific examples appearing much less frequently. Female and male characters are present in both domains, and mixed-gender participation is common, particularly in everyday scenarios connected to school, home, or leisure activities. At the level of total character appearances, male figures occur somewhat more often than female figures overall, though both genders remain visible across the full range of domains. Overall, the pattern points to a shared representational structure, in which early mathematics is largely situated in familiar, real-life examples rather than explicitly technical ones.

5.2.3 Role allocation in mathematical activity: balanced presence of genders in active roles

Following the examination of gender visibility, the analysis turns to how male and female characters are positioned within mathematical activity. While frequency of appearance provides a good baseline, the roles assigned to characters offer a more considerable indication of how participation in mathematics is constructed. This section therefore examines the distribution of roles across the dataset, distinguishing between Active/Problem Solving roles, Supportive roles, Everyday/Domestic roles and a neutral presence. The comparison is again distinguished between the combined series and the English-language series.

Both genders equally present in Active/Problem-Solving and Supportive/Helper roles

The Active/Problem-Solving role is distributed relatively evenly between genders and materials as well. In the combined series, female characters appear in 36 active/problem-solving roles, and male characters in 35 such instances. The English-language series reflects the same pattern, with both genders appearing equally with 19 instances each. The English-series held more than half of those instances, however, as I mentioned before, Finnish-series were not as human character based, and one of the two series did not contain any central human characters at all. From the aspect of numerical distribution, the numbers suggest that both girls and boys are positioned as capable participants in mathematical reasoning. The data therefore do not indicate a systematic exclusion of female characters from mathematically active roles, a pattern that contrasts with earlier textbook research and may even showcase deliberate effort in doing so.

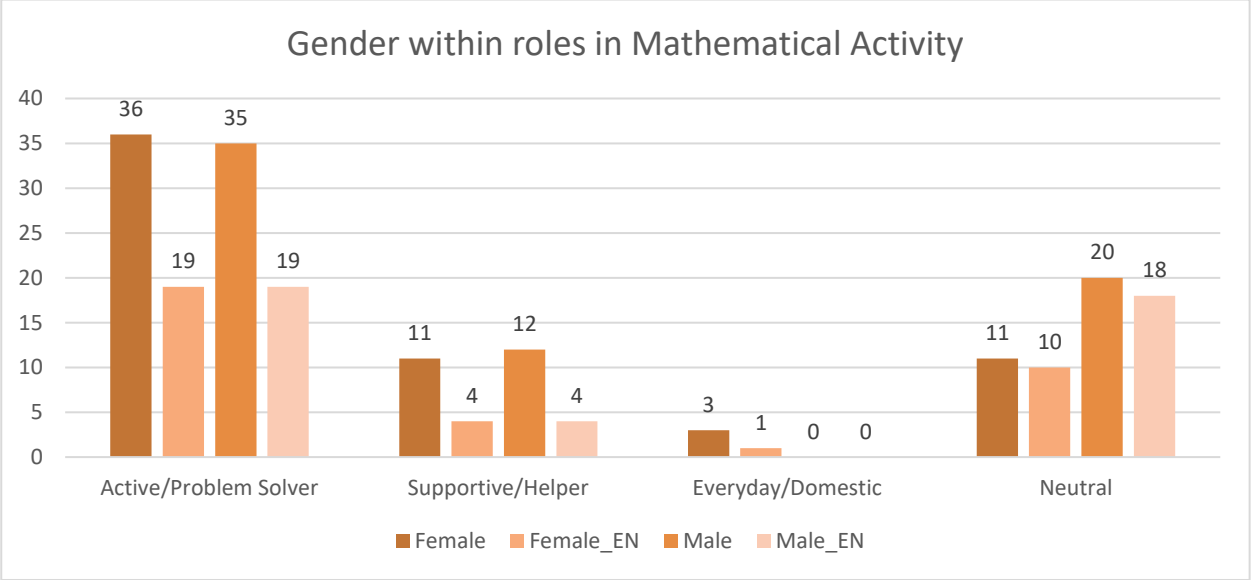

Figure 4 Gender within roles in mathematical activity

Supportive or helper roles occur less frequently overall and appear in comparable numbers across genders. In the combined dataset, female characters are present in 11 supportive instances and male characters in 12, while the English-language series includes 4 such instances for each gender. This even distribution suggests that supportive positioning is not

strongly gendered across the materials, but rather forms a secondary narrative purpose across both groups.

Only female characters depicted in Every day/Domestic examples

Everyday or domestic examples appear only rarely in the dataset, however they are exclusively associated with female characters. In the combined materials, three examples are recorded, with no comparable examples for male characters. The English-language series include one of these three instances. Although numerically very limited, this pattern was notable. Importantly, two out of the three examples occur within mathematical examples situated in technical or scientific mathematical domains. One example is an exercise explaining subtraction, and a female character is showed weighing some apples. In these cases, the everyday setting of the activity functions primarily as a frame to introduce everyday forms of mathematical tasks, rather than defining the nature of the activity itself. However, the fact that only female characters appear in such contexts, and the absence of comparable examples for male characters indicates that everyday contexts remain more easily associated with girls even when the underlying mathematical reasoning is not.

Higher number of male characters as neutral participants

Neutral roles, where characters appear in mathematical problems without actively driving the mathematical reasoning, show a different distribution. In the combined dataset, male characters appear in neutral positions almost twice as often as female characters. The English-language series follows a similar pattern, with 18 male and 10 female neutral appearances. These figures indicate that boys are more frequently present as background participants within mathematical situations, shaping visibility even when not directly associated with problem-solving actions.

Overall, the findings demonstrate that gendered representation in these materials does not manifest primarily through exclusion from mathematical action. Instead, differences emerge through contextual positioning and background visibility. The relatively balanced presence in active roles suggests a shift away from earlier patterns documented in textbook research, yet

the persistence of gendered contextual associations indicates that representation continues to be shaped by everyday narrative framing.

5.2.4 Representation structured by mathematical context and role in activity: girls dominate as active agents in social contexts while boys dominate technical contexts

This section combines the three dimensions examined previously; gender, mathematical domain, and role in mathematical activity. The purpose is to show how representation is structured when their features co-occur in the same problems and illustrations. Figure 5 reports both the instances and number of characters for each gender/mathematical domain/role combination.

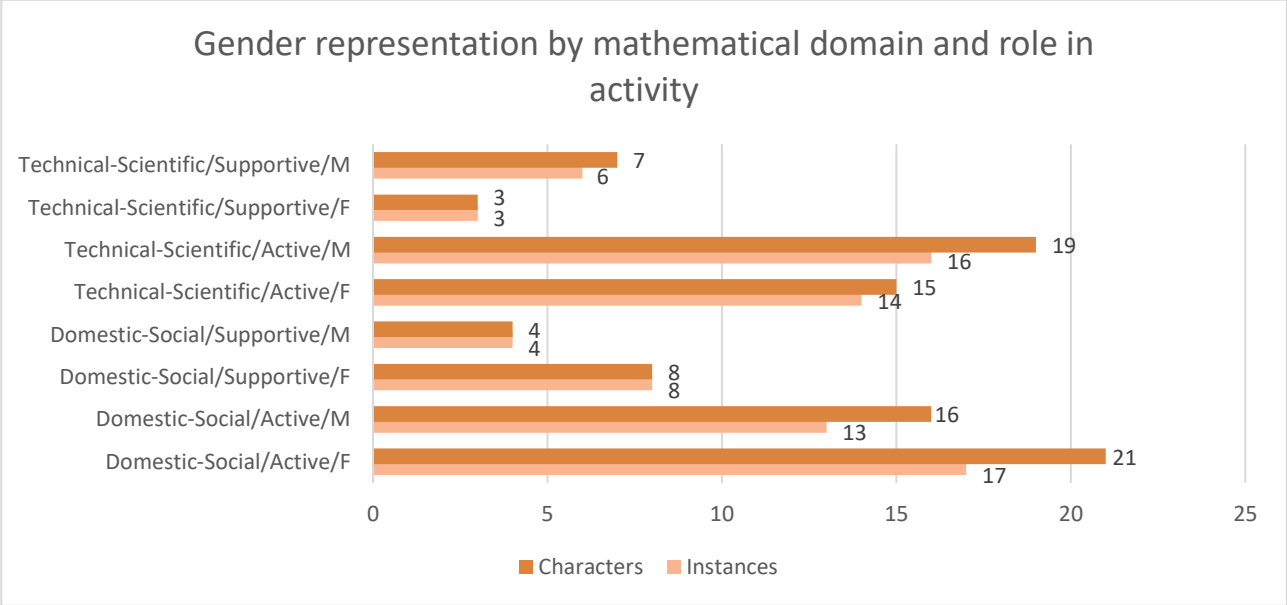

Figure 5 Gender representation by mathematical domain and role in activity[2]

[2] Active = Active/problem-solving role; Supportive = Supportive/helper role. Instances = number of problems/images coded in the category. Characters = total number of gendered characters appeared and coded within those instances.

Within Domestic/Social problems, female characters appear most frequently in Active/Problem Solving roles. More specifically, there are 17 different instances in which girls are coded as Active/Problem-Solvers in Domestic/Social mathematical scenarios, representing a total of 21 female character appearances in said settings. The comparable male category is smaller, with 13 instances and 15 male appearances as Active/Problem-Solvers in Domestic/Social mathematical contexts. In other words, when mathematics is framed within an everyday or socially familiar context, for example playing, being outdoors, counting of money or possession of everyday items, girls are very often positioned as doing the mathematically central action, and not merely present as observers.

The Domestic/Social mathematical domain also included Supportive/Helper roles, where girls again appeared more frequently than boys. Female Supportive/Helper portrayals occur 8 times, with 8 appearances of female characters in Domestic/Social problems, compared to male Supportive/Helper portrayals which occurs 4 times with 4 male characters appearances. While the absolute numbers are not large per se, the direction of the pattern is consistent with earlier observations, that supportive framing occurs for both genders, but is apparently more commonly found for female characters in the Domestic/Social context.

In Technical/Scientific contexts, the pattern changes. For Active/Problem-Solving roles, gender representation is slightly more similar in numbers to the previous domain. Male characters appear as active/problem-solvers 16 times, with a total of 19 male appearances, and female characters appear 14 times with 15 total character appearances. This distribution is important because girls are not restricted to everyday contexts and not shown only in domestic backgrounds as well. However, male appearances are now higher than female appearances in this domain, marking a reversal from earlier numbers where girls were slightly more visible in active roles in the Domestic/Social domain. This shift follows trends identified in previous textbook research, where technical and scientific mathematical contexts tend to feature boys more often as central or active participants.

Supportive roles within the same mathematical domain are limited overall, yet they still show an imbalance. A total of 7 different characters, in six examples, are coded as Supportive-Helper in Technical/Scientific mathematical examples, as compared to the 3 female

characters in 3 different instances. This suggests that when technical contexts are present, male characters are still more often positioned within the activity than female characters, even if it is within supportive roles.

Taken together, Figure 5 suggests that the strongest concentration in the data is female characters in Active/Problem-Solving roles in Domestic/Social contexts, followed by Active/Problem-Solving male characters in Technical/Scientific mathematical contexts. Supportive/Helper roles appear less frequently overall, however female characters dominate that category in Domestic/Social problems, as opposed to male characters dominating that same category in Technical/Scientific problem categories. Therefore, participation is differently structured depending on the domain in which mathematics is situated.

When gender, mathematical domain, and role are examined together, the results reveal structured representational tendencies rather than evenly distributed participation. Girls are most prominently positioned as active mathematical agents in everyday and socially framed problem contexts, whereas boys appear more frequently in technically framed mathematical activity. At the same time, supportive positioning follows a similar domain-based division, leaning towards female characters in Domestic/Social tasks and male characters in Technical/Scientific tasks. These differences are visible at the level of both the instances and the total character appearances and therefore reflect consistent narrative choices rather than isolated examples. As the final analytical layer of the results chapter, this combined view demonstrated that representation in textbooks operated through contextual placement and role allocation, not through simple presence or absence.

5.3 Summary of the findings

The results presented in this chapter collectively show that gender representation in the analysed mathematics textbooks is structured not through whether someone is present but rather through patterns of positioning, context, and role allocation. Across the full dataset, male and female characters appear in broadly comparable numbers, and mixed-gender participation is frequent. This indicated that the materials generally situate both genders within shared learning environments rather than separating them into distinctly gendered scenarios. At the level of basic visibility, the data do not point to systematic exclusion of either gender, and overall participation appears to be designed to include both genders within the same kinds of learning scenarios.

However, once representation is examined beyond simple frequency, more defined tendencies start to emerge. The analysis of mathematical domain offers an important lens for more detailed interpretation. Most mathematical tasks are situated in Domestic/Social contexts, reflecting the pedagogical emphasis on familiar and everyday examples in early mathematics education. Within these contexts, both genders appear regularly and often together, even though there is an overall slightly higher appearance of male characters overall. In Technical/Scientific mathematical examples, which occur less frequently overall, male appearances also become somewhat more prominent, which suggests that, even though total visibility was somewhat the same, when the mathematical setting shifts away from everyday or domestic scenarios to more technical contexts, representations becomes slightly more gendered in the direction of male visibility. The domain findings therefore do not suggest that girls were absent from technical mathematical contexts, but they do suggest that said scenarios are a more sensitive representational site where gender distribution seems to shift.

Role allocation adds another layer of interpretation. The analysis shows that both girls and boys are positioned as active participants in mathematical activity with equal frequency, and the distribution of active/problem solving roles is largely balanced, meaning that girls are not consistently positioned as passive or assisting characters in the direct act of solving problems. This finding is meaningful, because it shows deliberate effort toward a more

balance depiction of mathematical agency. However, that balance is shifted in the section of Everyday/Domestic role category, where only female characters appear in the entire dataset, even though the number of instances, three, was significantly small. Additionally, male characters seemed to be more frequently positioned in neutral presence compared to female characters.

The combined analysis of gender, roles, and mathematical domains finally shows that representation shifts depending on the type of mathematical activity: girls are most visible as active agents in socially framed problems, whereas boys appear more often in technically framed ones. In practice, this means that overall balance in active/problem-solving roles does not necessarily translate into balance across all contexts. Instead, agency appears distributed differently depending on the setting. Girls' active participation is most strongly placed in Domestic/Social mathematical contexts, whereas boys' presence and activity become more pronounced when the problems refer to Technical/Scientific contexts. This finding is important because it suggests that representational bias, wherever it exists, operated through the interaction with the context rather than through a more straightforward exclusion of certain characters.

Collectively, we see that gender representation is generally characterised by inclusion at the level of visibility, however results differ at the level of participation. While boys and girls appear in broadly similar numbers and frequently placed within shared mathematical scenarios, the positioning of the roles is not uniform. Girls were consistently more present as active participants in social and everyday mathematical examples, whereas technically framed problems showed a tendency towards higher male visibility and participation.

It is also important to note that the code of Visibility is not interpreted further in this study for methodological reasons. In most analysed images, when a human character appeared, they were centrally positioned, meaning that "visibility" did not meaningfully distinguish levels of prominence or importance. In addition, some series relied heavily on background figures, decorative human depictions, or non-human elements that were not narratively connected to the mathematical task. In these cases, coding visibility would have risked raising the representational value of characters who were not actively participating in the mathematical

activity itself. Because the analytical focus of this research is on how gender is linked to mathematical participation, role allocation, and domain, visibility alone would not provide reliable interpretive value.

6 Discussion

6.1 Interpretation of the results

The findings of this study should be interpreted in relation to a simple but important principle: Learning materials are human cultural products. As such, they are created through decisions made by humans about wording, character roles, contexts and illustrations, and it would be unrealistic to expect them to be entirely free of assumptions, oversights or even subtle biases. Educational texts are not produced in a social isolation. Rather they reflect broader cultural norms, even when they aim to promote equality (Apple, 1992; Blumberg, 2008). From this perspective, the presence of minor tensions, unevenness, or occasional stereotypical traces does not automatically indicate deliberate discrimination or a “failed” textbook. Instead, such traces are best understood as part of how representation is continuously negotiated in curriculum materials, especially when these materials attempt to balance pedagogical clarity (Apple, 1992).

At the same time, the analysis also demonstrates that representational patterns become visible in ways that are not always apparent during ordinary reading. One reason is the relativity of the perception. It is often easier to recognise a representational feature after encountering a different series that does not use it or uses it differently. For example, when one set of materials normalises a particular kind of character positioning and framing, it can become invisible until it gets contrasted with alternatives. This is one justification for the repetitive nature of the coding and review process in this study, as repeated passes through the materials were not only a methodological accuracy check, but also a way to reduce the risk of treating familiar patterns as neutral simply because they became familiar. For example, the first series analysed consistently showed the female and male characters together, which seemed positive until I realised that they do not participate in almost any mathematical reasoning. Then, in following textbooks, it was normal for the unequal presence of the main characters to be noted but also the active participation in mathematics to be appreciated. In textbook research, this kind of re-reading is often necessary, because representational meaning is cumulative and frequently carried by small choices that only become clear after comparison (Apple, 11992; Blumberg, 2008) and addition of context.

The findings of this study align with but also extend certain patterns identified in previous research on gender representation in educational materials. While earlier studies have frequently documented clear numerical imbalances in favour of male characters (Blumberg, 2008; Jehle et al., 2024), the present analysis suggests that, at least in the examined Finnish materials, representation is more balanced at the level of frequency. This supports the idea that textbook development has responded to long-standing critiques of underrepresentation or the claims behind Finland's educational system and equality-oriented educational practices. However, consistent with arguments by Blumberg (2008) and Tainio and Karvonen (2015), the results also demonstrate that representation cannot be fully understood trough counting alone. Subtle patterns emerge when examining how characters are positioned within mathematical activity and across contexts. In particular, the tendency for girls to be more visible as active participants in Domestic/Social contexts and for boys to appear more prominently in Technical/Scientific settings reflects earlier findings that gendered patterns are often embedded within role allocation and contextual framing, rather than in noticeable exclusion (Nurlu, 2021). In this sense, the present study both supports and refines existing research by showing that even in materials where numerical balance is largely achieved, representational differences may still persist through the interaction or other representation factors.

If parts of the findings contradict trends that are reported in international textbook research, it should not be interpreted as an anomaly. In fact, it should be interpreted as evidence that representational patterns are not fixed across contexts and that equity-oriented systems may, in certain aspects, succeed in disrupting older textbook conventions. Thus, this could showcase deliberate effort. This is especially relevant given the fact that research on gender and mathematics outcomes increasingly emphasises attitudes, self-concept, and anxiety, and not only achievement, as key dimensions of inequality (Else-Quest et al., 2010; Eccles & Wigfield, 2002). Where the materials appear to avoid common representational hierarchies documented elsewhere, the results can be interpreted as an example of how educational materials may have already started challenging the "common sense" about gender and mathematics, even if they do not do so perfectly in every instance.

In this study, the emphasis is therefore not on proving neutrality, but on identifying how representational choices may open or restrict possibilities for identification. More importantly, avoiding representational risk is not the same as promoting equality. A strict commitment to “playing it safe” can lead to minimalism, which may reduce obvious stereotyping but also avoids opportunities to introduce counter-stereotypical roles and narratives. Because gendered beliefs about mathematics are shaped partly through repeated cultural cues about who is expected to lead, solve, explain, or succeed, equity-oriented representation requires more than merely balancing characters’ presence. It involves actively expanding what is shown as normal and possible (Blumberg. 2008; Eccles & Wigfield, 2002). This is consistent with the broader argument in the thesis that representation is not only about visibility, but also about meaning making. How agency and competence are constructed through patterns across text and image.

The results should also be interpreted through the location of the analysed text, the teacher guides. Because teacher guides frame the pedagogical use of the materials, they can easily influence classroom enactment by shaping which tasks are emphasised, how scenarios are narrated, and how discussions are structured. In that sense, representational meanings embedded in teacher guide wording may carry amplified influence, especially in early grades where teachers rely on guides for pacing, explanation, and classroom routines (Apple, 1992). This does not mean that teacher will subconsciously reproduce representational patterns. However, it does mean that teacher guides become an important place to examine how representational cues are introduced into instruction. At the same time, the placement of perspective in teacher guides also creates an important opportunity. Teachers are professional educators, and teacher education increasingly recognises that implicit assumptions can shape interaction and interpretation even when intentions are pure. Research on implicit social cognition suggests that implicit bias is often unintentional and can persist alongside explicitly held egalitarian beliefs (Greenwald & Banaji, 1995). In practical terms, this means that teachers may be capable of noticing and balancing certain problematic framings, especially if the materials provide opportunities for reflective use. In this way, the fact that many representational cues operate through the narration of teachers can be accepted as a double-edged finding: it may increase the influence of the materials,

but it also makes said influence more professionally examined, and therefore hopefully more open to conscious reflection and correction.

6.2 Representation choices: neutrality vs intentional positive examples

Even though textbook design often aims to appear neutral and avoid gendered language, neutrality in representation does not necessarily translate into neutrality in meaning. Curriculum scholars have argued for some time now, that school knowledge is shaped by selection and framing, and that texts can reproduce cultural norms precisely because they present particular patterns as natural or self-evident (Apple, 1992). In early mathematics materials, representational choices are often embedded in seemingly ordinary scenarios. Who is shown solving, who is observing, and which everyday contexts are used to "ground" mathematical concepts. When these patterns become repetitive, they can operate as part of the hidden curriculum, guiding children's understandings of competence and social roles without ever needing to state those messages directly (Blumberg, 2008).

From this perspective, a textbook can be "neutral" on the surface while still reinforcing gendered expectations through subtle imbalances in visibility, agency, and role allocation. These effects are specifically relevant in mathematics because gendered beliefs about who is expected to be confident in the subject remain persistent, even when achievement differences are relatively small (OECS, 2021). If boys are more frequently positioned as initiators of problem-solving, leaders in mathematical activity, and girls more often appear in supportive or everyday routines, the material may indirectly communicate that mathematical authority is gendered. This aligns with broader cross-national findings presented in this thesis, stating that gender differences in mathematics attitudes, such as self-confidence, and mathematical interest vary across societies and appear to be shaped by cultural influences rather than biological ability (Else-Quest et al., 2010; Hyde & Mertz, 2009).

A key implication of these findings is that equity-oriented representation may require more than balanced visibility and exposure. It may require purposeful counter-stereotypical portrayals which disrupt what appears "normal" in textbook storytelling (Sleeter & Grant, 2007). In practice, this can look like depicting girls as initiators of mathematical reasoning,

active manipulators of objects, leaders in problem-solving scenarios, while at the same time showing boys as naturally engaged in cooperative, caring, or supportive roles without framing them as exceptional. When such portrayals appear repeatedly, they can expand the range of identities that are associated with mathematical competence and reduce the chances that learners interpret mathematics as aligned with one gender or certain aspects of personality (Blumberg, 2008). From a motivational perspective, this matters because children's developing beliefs about competence and self-value influence their persistence, effort, and engagement with learning tasks (Eccles & Wigfield, 2002). In this sense, representation is not only about fairness in images but also about the kinds of academic identities that children are invited to imagine for themselves.

At the same time, the literature suggests that simply adding diverse characters is not automatically transformative. If counter-stereotypes are rare, overly polished, or presented as special "exceptions", they may be interpreted as symbolic rather than authentic and possible, limiting their impact on children's everyday use of what is realistic. This aligns with the broader critique that inclusion can become superficial when diversity is displayed without altering the deeper norms which structure whose competence is expected or validated (Sleeter & Grant, 2007). Since research suggests cultural influence remains powerful on gender differences in mathematics attitudes even when achievement gaps are small (Else-Quest et al., 2010); OECD, 2021), meaningful change in textbook design is more likely when representation is embedded consistently across storylines, contexts, and task types, so that non-traditional roles become ordinary rather than performative. Therefore, the aim is not to "reverse" stereotypes for their own sake, but to broaden representational possibilities in a way that supports sustained belonging and confidence in mathematics for all learners.

6.3 Cross-curricular representational norms

The findings of this thesis provide insight into gender representation within early primary education textbooks, but they do not describe representation across the full curriculum. Students develop expectations about identity and competence through repeated exposure to texts, classroom practises, and peer culture, meaning that subject specific materials form only one part of a wider representational environment. Textbooks therefore contribute to meaning making not in isolation, but within a broader educational system which includes other subjects and narratives (Apple, 1992). This is particularly relevant in contemporary education, where curricula increasingly emphasise interdisciplinary learning and the integration of competencies across subjects rather than treating each subject as an isolated domain (Finnish National Agency for Education [EDUFI], 2016). For this reason, conclusions drawn from mathematics books alone should be interpreted cautiously. Patterns observed in mathematics materials may not fully reflect how gender is represented in language, environmental studies, arts, or other domains. A wider cross-curricular perspective would be necessary to determine whether the gendered role allocations identified here reflect a mathematics-specific pattern or more general convention on educational materials.

At the same time, mathematics remains a particularly important focus because subjects carry different cultural associations each. Mathematics is often positioned as a domain connected to logic, mastery, and technical competence, and these associations can intersect with persistent gender stereotypes in broader society (Hyde & Mertz, 2009). Where role patterns in mathematics textbooks align boys with active reasoning and girls in supportive participation, this may reinforce the long-standing cultural script that mathematical competence is masculine-coded. Such representational cues matter because PISA evidence shows that gender differences in mathematics attitudes, including confidence and anxiety, continue to appear across countries, even when average achievement differences are small (OECD, 2021). This supports the argument that gendered educational outcomes are shaped not only by instruction and performance, but also by the environments in which students learn to interpret what mathematics is and who it is for.

This helps contextualise why gender equality at the societal level does not necessarily translate into equal participation in STEM fields for example. Stoet and Geary (2018) demonstrate that in highly gender-equal countries, women are not necessarily more likely to pursue STEM, a pattern they describe as part of a “gender-equality paradox” in STEM education. When combined with PISA evidence showing that girls tend to report lower mathematics self-concept and higher anxiety despite comparable performances (OECD, 2021) these seemingly neutral or positive results raise an even bigger question mark on which other parts of curricula and academic systems affect and shape these values, which suggest that participation in STEM is shaped by more than just academic ability.

6.4 Future research

Even though the present analysis is limited to mathematics materials, learners’ academic identities are not formed within a single subject in isolation. Motivation, interest, and self-beliefs develop through repeated interactions with learning environments and the meanings that students attach to different school domains over time (Eccles & Wigfield, 2002) as part of the broader ecosystem that school is, and therefore they should not be treated as isolated influences. Thus, cross-curricular comparison would be an important next step for future research. Studies in other subjects, including language learning materials, have also documented gendered patterns of agency and visibility, suggesting that textbook representation may reflect broader conventions of educational publishing rather than being unique to mathematics (Lee & Collins, 2010). So, if similar patterns are repeated across multiple school subjects, their cumulative effect may be stronger than any single textbook’s influence, contributing to an overall sense of normality in school narratives. If, however, representation differs by subject, this would then indicate that gender messages are partly shaped by how each discipline is culturally and societally framed and normalised.

In the Finnish context, this also presumes other suggestions. Since there is no official state-mandated evaluation of school textbooks before they are used in classrooms, suitability of the materials is largely assessed by teachers themselves (Tainio & Karvonen, 2015; Eurydice, 2025). While this allows educators to be flexible and autonomous, it also means that certain representational patterns embedded in textbooks may remain unexamined at a systemic

level. This places additional load and importance on both research and teacher awareness. From a practical perspective, future work could focus on developing clearer guidelines or tools in order to support teachers in evaluating learning materials, particularly in relation to representation and implicit bias. Publishers could also play an even more important role than they do now, by systematically reviewing how characters, roles, and contexts are distributed across their materials, not only within individual subjects but also across textbook series. Ultimately, the findings of this study suggest that improving representation is not only about correcting small, isolated instances, but also about how certain repeated patterns across books, subjects, and classroom practices contribute to the formation of students' academic identities over time.

6.5 Use of AI tools

Artificial intelligence tools were used in this thesis strictly as assistive support throughout the research and writing process. AI was primarily used to generate an initial structure of the thesis, such as possible chapter outlines, in order to improve overall organisation and flow of the thesis. This of course was modified multiple times since the beginning of the writing process. AI was also used as a suggestions tool to provide me with potentially relevant academic literature related to my research topic and the multiple articles I already possessed and had studied.

In addition, AI tools (ChatGPT and Grammarly) were used to support academic writing in certain aspects. For example, I may ask for a more cohesive and academic way of wording my paragraph or sentence (never a bigger piece of text), however they were never copied directly since it is impossible for them to reflect the author's own writing style and way of thinking, so the piece of text would then be re-written, absorbing only certain vocabulary suggestions. Maintaining a consistent but overall personal academic voice was a deliberate priority throughout the whole writing process.

ChatGPT was also used as a methodological suggestions tool, for example when I wanted to know which type of chart would make for a clear representation of my values and complex data, however this was also a trial and error process as research always is. Just for the sake of

a statement, I do not even trust AI to give me a correct reference to a literature citation I provide to it. This is why all of my references and in-text citations were written by me, during the writing process.

The final manuscript was also reviewed by Grammarly, primarily for the use of plagiarism checking and language feedback. While some suggestions related to clarity and cohesion were considered, not all grammatical corrections were implemented, since preserving a natural and personal flow and progression of the text is more important to me than grammatical perfection and uniformity.

All analytical decisions, interpretations, and conclusions presented in this thesis are the independent work of the author.

References

Apple, M. W. (1992). The text and cultural politics. Educational Researcher, 21(7), 4–19 https://doi.org/10.3102/0013189X021007004

Banks, J. A. (2008). An introduction to multicultural education (4th ed.). Boston: Pearson/Allyn & Bacon.

Banks, J. A. (2015). Cultural diversity and education: Foundations, curriculum, and teaching. Routledge. http://lccn.loc.gov/2015043392

Bian, L., Leslie, S.-J., & Cimpian, A. (2017). Gender stereotypes about intellectual ability emerge early and influence children's interests. Science, 355(6323), 389–391. https://doi.org/10.1126/science.aah6524

Bishop, R. S. (1990, March). Windows and mirrors: Children's books and parallel cultures. In California State University reading conference: 14th annual conference proceedings (pp. 3-12). https://files.eric.ed.gov/fulltext/ED337744.pdf#page=11

Blumberg, R. L. (2008). The invisible obstacle to educational equality: Gender bias in textbooks. Prospects, 38(3), 345–361. https://doi.org/10.1007/s11125-009-9086-1

Botelho, M. J., & Rudman, M. K. (2009). Critical multicultural analysis of children's literature: Mirrors, windows, and doors. Routledge. https://doi.org/10.4324/9780203885208

Brugeilles, C., & Cromer, S. (2009). Analysing gender representations in school textbooks. UMR CEPED, Paris: Les collections du CEPED. https://www.ceped.org/IMG/pdf/analysing_gender_representations_in_school_textbookst.pdf

Butler, J. (1990). Gender Trouble: Feminism and the Subversion of Identity. Routledge. http://www.kyoolee.net/GENDER_TROUBLE_-_Preface_-_Butler.pdf

Castles, A., Rastle, K., & Nation, K. (2018). Ending the reading wars: Reading acquisition from novice to expert. Psychological Science in the Public Interest, 19(1), 5–51. https://doi.org/10.1177/1529100618772271

Connell, R. (2009). Gender in World Perspective (2nd ed.). Polity Press. https://books.google.fi/books?hl=el&lr=&id=Xt4IEAAAQBAJ&oi=fnd&pg=PA1927&dq=Connell,+R.+(2009).+Gender+in+World+Perspective+(2nd+ed.).+Polity+Press.&ots=_fXRuUrYW-&sig=x8t1LxWWfwmDsxkWrCUGucO5jIQ&redir_esc=y#v=onepage&q&f=false

Eccles, J. S., & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation. Contemporary Educational Psychology, 61, 101859. https://doi.org/10.1016/j.cedpsych.2020.101859

Else-Quest, N. M., Hyde, J. S., & Linn, M. C. (2010). Cross-national patterns of gender differences in mathematics: A meta-analysis. Psychological Bulletin, 136(1), 103–127. https://doi.org/10.1037/a0018053

Eurydice (2025, October 6). Single-structure primary and lower secondary education. https://eurydice.eacea.ec.europa.eu/eurypedia/finland/teaching-and-learning-single-structure-education

Fairclough, N. (1995). Critical Discourse Analysis: The Critical Study of Language. London: Longman. https://api.taylorfrancis.com/content/books/mono/download?identifierName=doi&identifierValue=10.4324/9781315834368&type=googlepdf

Foster, R., & Nicol, C. (2012). The “Cultural Production” of Mathematics Word Problems: Social and Political Dimensions of a Common Classroom Task. Educational Studies in Mathematics, 80(3), 525–547. https://doi.org/10.1007/s10649-011-9367-9

Freire, P. (2000). Pedagogy of the Oppressed (30th anniversary ed.). New York: Continuum. https://files.libcom.org/files/Paulo%20Freire,%20Myra%20Bergman%20Ramos,%20Donaldo%20Macedo%20-%20Pedagogy%20of%20the%20Oppressed,%2030th%20Anniversary%20Edition%20(2000,%20Bloomsbury%20Academic).pdf

Gay, G. (2018). Culturally responsive teaching: Theory, research, and practice. teachers college press. https://books.google.fi/books?hl=el&lr=&id=uD9qDwAAQBAJ&oi=fnd&pg=PP1&dq=Gay,+G.+(2010).+Culturally+responsive+teaching:+Theory,+research,+and+practice+(2nd+ed.).+Teachers+College+Press.&ots=v0xH-4Unb7&sig=VVKG3dal_aqtmlcKl4t0jq3czNQ&redir_esc=y#v=onepage&q=Gay%2C%20G.%20(2010).%20Culturally%20responsive%20teaching%3A%20Theory%2C%20research%2C%20and%20practice%20(2nd%20ed.).%20Teachers%20College%20Press.&f=false

Good, J. J., Woodzicka, J. A., & Wingfield, L. C. (2010). The Effects of Gender Stereotypes on Women's Performance in Mathematics. Journal of Social Issues, 66(3), 637–659. https://doi.org/10.1080/00224540903366552

Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. Psychological Review, 102(1), 4–27. https://doi.org/10.1037/0033-295X.102.1.4

Grünthal, S. (2008). Finnish children's literature and cultural identity. In G. Westin & A. Öhman (Eds.), Nordic children's literature and cultural identity (pp. 59–76). Stockholm: Stockholm Institute of Education Press.https://www.childlitnordic.pdn.gu.se/

Hall, S. (1997). The spectacle of the other. Representation: Cultural representations and signifying practices, 7, 223-290. https://www.academia.edu/download/49781497/14-1_Hall__The_Spectacle_of_the_Other.pdf

Harju-Luukkainen, H., & Eriksen, N. (2021). Multiculturalism in Nordic schools: Challenges and possibilities. In H. Harju-Luukkainen, S. Garvis, & S. Sheridan (Eds.), Nordic childhoods and early education: Philosophy, research, policy, and practice in Denmark, Finland, Iceland, Norway, and Sweden (pp. 125–142). Springer. https://doi.org/10.1007/978-3-030-72544-1_9

Hyde, J. S., & Mertz, J. E. (2009). Gender, culture, and mathematics performance. Proceedings of the National Academy of Sciences, 106(22), 8801–8807. https://doi.org/10.1073/pnas.0901265106

Jehle, A. M. C., Groeneveld, M., van de Rozenberg, T. M., & Mesman, J. (2024). The hidden lessons in textbooks: Gender representation and stereotypes in European mathematics and language books. European Journal of Education, 59(1). https://doi.org/10.1111/ejed.12716

Klein, S. S. (2012). Gender equitable education. In J. A. Banks (Ed.), Encyclopedia of diversity in education (vol. 2, pp. 961–969). https://books.google.fi/books?hl=el&lr=&id=wiZ1CQAAQBAJ&oi=fnd&pg=PP1&dq=Klein,+S.+S.+(2012).+Gender+equitable+education.+In+J.+A.+Banks+(Ed.),+Encyclopedia+of+diversity++in+education+(vol.+2,+pp.+961–969).+Thousand+Oaks,+CA:+Sage+Publications&ots=V_dAMeafRa&sig=-xbdz0qg1mpOdi6b02wVZu0VxvU&redir_esc=y#v=onepage&q&f=false

Krippendorff, K. (2018). Content Analysis: An Introduction to Its Methodology (4th ed.). Thousand Oaks, CA: Sage. https://books.google.fi/books?hl=el&lr=&id=nE1aDwAAQBAJ&oi=fnd&pg=PP1&dq=Krippendorff,+K.+(2018).+Content+Analysis:+An+Introduction+to+Its+Methodology+(4th+ed.).&ots=y_cnWweQcw&sig=5olYogV5sPWQudDThKOrat7GfoI&redir_esc=y#v=onepage&q=Krippendorff%2C%20K.%20(2018).%20Content%20Analysis%3A%20An%20Introduction%20to%20Its%20Methodology%20(4th%20ed.).&f=false

Kujanpää, E. (2015). Gender representation and equality in EFL textbooks: A comparison between Finland and Mexico (Master's thesis). Tampere University. https://trepo.tuni.fi/bitstream/handle/10024/97645/GRADU-1435658528.pdf?isAllowed=y&sequence=1

Lappalainen, S. (2009). Beyond the Universal Subject: Analysing Gendered Constructions of Children and Childhood in Research Literature. Nordic Journal of Feminist and Gender Research, 17(4), 240–255. https://doi.org/10.1080/08038740903317208

Lassén-Seger, M. (2006). Adventures into Otherness: Child Metamorphs in Late Twentieth Century Children's Literature. Åbo Akademi University Press. https://www.doria.fi/handle/10024/4127

Launonen, K. (2019). Inclusion of students with disabilities in Finnish education: Representation in policy and practice. Scandinavian Journal of Disability Research, 21(1), 103–115. https://doi.org/10.16993/sjdr.573

Lazar, M. M. (2008). Feminist Critical Discourse Analysis: Gender, Power and Ideology in Discourse. Basingstoke: Palgrave Macmillan. https://doi.org/10.1057/9780230599901

Lindberg, S. M., Hyde, J. S., Petersen, J. L., & Linn, M. C. (2010). New trends in gender and mathematics performance: A meta-analysis. Psychology of Mathematics & Education of North America. Available at PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3057475/

Mayring, P. (2014). Qualitative content analysis: theoretical foundation, basic procedures and software solution. https://nbn-resolving.org/urn:nbn:de:0168-ssoar-395173

Mesmer, H. A. (2005). Decodable text: A review of what we know. Reading Research and Instruction, 44(4), 273–294. https://files.eric.ed.gov/fulltext/EJ724456.pdf

Nieto, S. (2001). Language, Culture, and Teaching: Critical Perspectives (1st ed.). Routledge. https://doi.org/10.4324/9781410605818

Nikolajeva, M., & Scott, C. (2001). How picturebooks work. Garland Publishing. https://doi.org/10.4324/9780203960615

Nurlu, Ö. (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

OECD. (2021). PISA 2018 Results (Volume II): Where All Students Can Succeed. OECD Publishing. https://doi.org/10.1787/b5fd1b8f-en

OECD (2023), Equity and Inclusion in Education: Finding Strength through Diversity, OECD Publishing, Paris, https://doi.org/10.1787/e9072e21-en.

Seppänen, P., Kosunen, S., & Kauko, J. (2023). Businessing around comprehensive schooling. In J. Kauko, S. Kosunen, & P. Seppänen (Eds.), Finland's famous education system: Unvarnished insights into Finnish schooling (pp. 139–156). Springer. https://doi.org/10.1007/978-981-19-8241-5_9

Slee, Roger. The irregular school: Exclusion, schooling and inclusive education. Routledge, 2011. https://doi.org/10.4324/9780203831564

Sleeter, Christine E., and Carl A. Grant. Making choices for multicultural education: Five approaches to race, class and gender. John Wiley & Sons, 2008. https://books.google.fi/books?hl=el&lr=&id=FAvWEAAAQBAJ&oi=fnd&pg=PA1&dq=Sleeter,+C.,+%26+Grant,+C.+(2007).+Making+choices+for+multicultural+education:+Five+approaches+to+race,+class,+and+gender+(6th+ed.).+Wiley.&ots=dCg6WK9qtf&sig=PNiICGbIo0f4hsBpcYnMYtQzQpo&redir_esc=y#v=onepage&q&f=false

Smestad, B., & Fossum, A. (2024). Diversity in Norwegian mathematics examinations, 1962–2020. Scandinavian Journal of Educational Research. https://doi.org/10.1080/00313831.2024.2322950

Stoet, G., & Geary, D. C. (2018). The gender-equality paradox in science, technology, engineering, and mathematics education. Psychological Science, 29(4), 581–593. https://doi.org/10.1177/0956797617741719

Sunderland, J., Cowley, M., Rahim, F. A., Leontzakou, C., & Shattuck, J. (2002). From bias "in the text" to "teacher talk around the text": An exploration of teacher discourse and gendered foreign language textbook texts. Linguistics and Education, 13(2), 251–281. https://doi.org/10.1016/S0898-5898(00)00034-6

Suomen tietokirjailijat ry. (2015). Laatua! Oppimateriaalit muuttuvassa tietoympäristössä [Report]. Suomen tietokirjailijat ry. https://www.suomentietokirjailijat.fi/wp-

content/uploads/2025/03/laatua_oppimateriaalit_2015_korjattu_web.pdf?utm_source=chatgpt.com

Tainio, L., & Karvonen, U. (2015). Finnish teachers exploring gender bias in school textbooks. In S. Mills & A. S. Mustapha (Eds.), Gender representations in learning materials: International perspectives (pp. 124–149). https://www.taylorfrancis.com/chapters/edit/10.4324/9781315764092-12/finnish-teachers-exploring-gender-bias-school-textbooks-liisa-tainio-ulla-karvonen

Kirjakori 2018: Statistics over Finnish children's and youth literature published 2018. Tampere: Lastenkirjainstituutti. (pp. 2 & 10). https://lastenkirjainstituutti.fi/2016/wp-content/uploads/2019/05/Kirjakori-2018-English-overview.pdf

UNESCO. (2006). Guidelines on Intercultural Education. Paris: United Nations Educational, Scientific and Cultural Organization. https://unesdoc.unesco.org/ark:/48223/pf0000147878

van Dijk, T. A. (1993). Principles of Critical Discourse Analysis. Discourse & Society, 4(2), 249-283. https://doi.org/10.1177/0957926593004002006

van Dijk, T. A. (2015). Critical Discourse Analysis. The Handbook of Discourse Analysis, 2, 466-485. https://doi.org/10.1002/9781118584194.ch22

Varsik, S. (2022). A snapshot of equity and inclusion in OECD education systems: Findings from the Strength through Diversity Policy Survey", OECD Education Working Papers, No. 284, OECD Publishing, Paris, https://doi.org/10.1787/801dd29b-en.

Walgermo, B. R., Frijters, J. C., & Solheim, O. J. (2018). The dynamic relationship between reading skill and reading self-concept in primary school. Reading Research Quarterly, 53(2), 147–166. https://pmc.ncbi.nlm.nih.gov/articles/PMC5966483/