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The inscription of desired images of children through contextualized tasks in mathematics textbooks from Flanders and Turkey

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Mathematics textbook studies frequently focus on students' opportunities to learn mathematics and primarily adopt a content perspective. In this comparative textbook study, by drawing on the notion of pedagogical inscription device, we attempt instead to scrutinize what desired images of children elementary school textbooks of Flanders and Turkey are inscribing through their contextualization of tasks. The comparative lens in so doing has helped to identify desired images across both educational region and to discuss the role of mathematics in so doing.

Keywords: Textbook analysis, cross-contextual study, contextualized tasks, pedagogical inscription device.

Introduction

Preparing children to mathematically engage in real-world contexts is considered as a central goal of mathematics education in today's societies (e.g., Organization for Economic Cooperation and Development [OECD], 2019). This desire positions teaching and learning mathematics as having a positive role to cultivate effective and productive generations who are capable of dealing with real life issues. When closely examined, the pedagogical practices in school mathematics, or the practices adopted to support students' learning of mathematics, are not merely concerned with teaching and learning mathematics, but produce normalized images of desired children and society (Yolcu, 2021). That is, pedagogical practices that make mathematics accessible to students also function as pedagogical inscriptions that produce desired images of children by inscribing normalized actions in real life and designating some types of lives as distant from those norms. This paper examines how pedagogical practices circulating in mathematics textbooks of our own countries/regions (Flanders and Turkey) produce normalized images of desired children. In mathematics textbooks, contextualization of mathematical tasks is frequently used as a pedagogical practice. Therefore, we aim to explore what normalized images of desired children are inscribed through contextualized tasks in textbooks from Flanders and Turkey.

Background

Textbook design is a significant social practice of mathematics education (Van Steenbrugge, 2022). Textbook studies have frequently considered students' opportunities to learn mathematics (e.g., Remillard, Harris, & Agodini, 2014), mostly focusing on the textbooks' mathematical content (Fan, Zhu, & Miao, 2013; Van Steenbrugge & Remillard, 2023). At the same time, there is an emerging body of literature that illustrates how mathematics textbooks use images and texts to inscribe particular types of desired people such as modernized farmers by quantification tasks of farming

practices (Neto & Valero, 2018), healthy bodies by data collection tasks for personal activity (Yolcu, 2019), or happy and healthy families by financial planning tasks (Silva et al., 2018). Together, these studies reveal that textbooks are not merely vehicles to teach and learn mathematics, but also pedagogically inscribe children as particular human kinds and thus produce normalized forms of life in each context. Our research field has yet to be engaged in a comparative analysis of pedagogical inscriptions in mathematics textbooks from different contexts. We believe that such a comparative analysis can help to unravel some of the normalizations embedded in the contextualized tasks across regions. We also see potential in such analysis to help us better understanding what the role of mathematics is in this process.

We draw on Hacking's (2007) notion of "making kinds of people". Along this line, we consider that desired images for human kinds (i.e., problem solver, effective citizen, or rational thinker) are not just there to be recognized, but they are made up through pedagogical inscription devices (Popkewitz, 2004). We conceptualize pedagogical inscription devices as "tools and techniques that organize teachers' actions and decisions in mathematics classrooms" (Yolcu, 2021, p. 282). Pedagogical devices are necessary to teach and learn mathematics; however, they also order proper and improper modes of life. That is, pedagogical devices inscribe normalized qualities of action and participation in real-life, shaping and fashioning who the child is and should be – the desired child. Thus, we consider pedagogical inscription devices not only as tools that teachers use to teach mathematics but also as instruments that cultivate normalized images for the child and the society.

In a broader frame, this study is closely associated with Foucault's (1991) works on governmentality. Specifically, we utilize the notion of governmentality to think about how children are inscribed through contextualized textbook tasks and these tasks' press for exactness and in so doing produce norms for participation in multiple spheres of life. Although these desired images and narratives entail plausible statements for children, they inscribe particular forms of life, exercise power relations and exclude those children who are distant from the desired images produced in school mathematics (Yolcu, 2021). Using governmentality and pedagogical inscription devices as our conceptual framework, this study seeks to examine how normalized images for desired children are circulated in the contextualized tasks in Flemish and Turkish mathematics textbooks.

Methods

This paper relates to the initial stage of an on-going study. To facilitate this initial stage, we decided to study textbooks in the educational systems we grew up in. We selected one of the two available textbook series in Turkey, and a recently marketed textbook series published by a major publisher in Flanders. We believe however that there is an appropriate balance between constants and contexts (Osborn, 2004) to allow for a fruitful comparison. Talking to the constants, both in Flanders and Turkey, mathematics textbooks are a central resource during the teaching of mathematics, and textbook tasks are frequently embedded in a specific context. These constants give us a common base to compare. As to the contexts or the potential grounds for variance warranting the comparison, the textbook landscape in Turkey is quite uniform in that there are only two mathematics textbook series (one published by commercial publishers and approved by the Ministry of National Education and

the one being analyzed in this study being published by the Ministry of National Education) versus a landscape with multiple mathematics textbook series published by commercial publishers in Flanders.

We have analyzed *De Wiskanjers* published by Plantyn in Flanders and the textbook series published by the Turkish Ministry of National Education (which has no specific name), and we did so in relation to the textbooks published both for grades 2 and 5 to include spread in the grades. The major part of these textbooks, in Flanders and Turkey, consists of mathematical tasks to be solved by the students.

The analysis consists of three consecutive steps, each with a particular focus. Whereas steps 1 and 2 respectively relate to identifying contextualized tasks and specifying the context, step 3 focuses on pedagogical inscriptions of desired children. As a *first step* in our analysis, we identified all mathematical tasks that were embedded in a context; either through the use of images or by means of verbal descriptions. Bare mathematical tasks with no context other than the mathematical content were not included. Having identified all tasks with a context, the *second step* included determining the type of context. We drew on the context categorisation proposed by the PISA 2018 mathematical framework: personal, occupational, societal, and scientific context (OECD, 2019). We also specified subcategories to the four PISA context categories to better understand what these contexts were about. We alternated between individual coding and related discussions where we also looked at concrete tasks from the other educational context. Already in the beginning of these discussions the focus on exactness in solution of tasks in both educational contexts became apparent, and so we also additionally coded for a press toward exactness of solution versus flexibility in the solution. The former relates to tasks where students are instructed/expected to come up with the one and only one possibly correct answer, whereas the latter included instances where students were to estimate the answer and/or where multiple solutions appeared to be possible. Thinking about the type of contextualization and the press for exactness in the tasks that are considered as relevant to children's personal life informed our aim of how these contextualised tasks inscribed normalised desired images for children. The *third step* consisted of several passes of discussing and coding the normalized images of desired children that were inscribed through the subcategories of the personal context together with the focus on exactness. Informed by our theoretical framework, the analytical emphasis was on the ways in which textbook images or descriptions inscribe children as particular kinds of people in their real lives. That is, we focused on the instances of how human conduct was organised, regulated and normalised by these contextual tasks. From these discussions, it appeared that specific subcategories and the press for exactness inscribed specific normalized images, primarily across the two educational contexts.

Our extensive discussions have helped us in dealing with the comparability-validity dilemma intrinsic to all comparative study (Clarke, 2013). Indeed, we believe that these discussions have helped us approaching our data in a way that is both valid to the Flemish and Turkish educational contexts as well as allowed for a comparison across these two educational contexts.

Findings

Use of contexts and focus on exactness as two pedagogical practices

Table 1 reveals the strong emphasis on the use of personal contexts and a focus on exactness as two dominant pedagogical practices in the textbooks from Flanders as well as from Turkey. The use of

personal contexts is more pronounced in the Flanders textbooks compared to the Turkish textbooks, where instead there is somewhat more use of occupational, scientific, and societal contexts. Additionally, there is a clear focus on the exactness of the solutions in the two textbook series from both countries with 94% and 90% of the tasks with a context focusing on the exactness of a solution in Flanders and Turkey, respectively. These percentages add up to more than 100% because of some tasks that require students to first estimate the solution and then to calculate the correct solution and compare the exact calculation to the estimate. In such instances, both the codes of exactness and flexibility were assigned. In the next section, we zoom in on the personal context because of its clear prevalence both in the Flemish and Turkish textbooks.

	Contextualization					**Focus on exactness**	
	Personal	**Occupational**	**Scientific**	**Societal**	**Other**	**Exactness**	**Flexibility**
Flanders (*n* = 344)	302 (88%)	18 (5%)	12 (3%)	7 (2%)	5 (1%)	324 (94%)	51 (15%)
Turkey (*n* = 351)	272 (78%)	23 (7%)	29 (8%)	27 (8%)	/	315 (90%)	49 (14%)

Table 1: The use of contextualization and focus on exactness as two pedagogical practices

Use of personal contexts in the Flemish and Turkish textbooks

Table 2 lists the identified categories of personal contexts associated with the mathematical tasks in the analysed textbooks. *Finances* is the most prevalent personal context, in the Flemish as well as in the Turkish textbooks – yet, more prevalent in the Flemish textbook. The three contexts *Food*, *School*, and *Home, city, neighbourhood* appear to similar extents in the Flemish and Turkish books, but whereas these three contexts come on the second, third, and fourth place in the Turkish textbooks in terms of frequency, in the Flemish books they are preceded by *Free time, friends, play* and *Time & time management*. In the Turkish textbooks, these two latter context categories come at the very end in terms of frequency. Both in the Flemish and Turkish textbooks, a minority of personal contexts focuses on *Sports*. Furthermore, we have identified three categories of personal contexts that are unique to either the Flemish or the Turkish textbooks: *Transport* in the Flanders textbooks and *Plants and animals in close environment* and *Health* in the Turkish textbooks. In the next section, we zoom in on how these categories of personal context in tandem with a focus on correctness normalize specific desired images of children.

Country/Region	**Personal context categories**
Flanders ***n* = 302**	Finances (26%); Free time, friends, play (14%); Time & time management (13%); Food (13%); School (13%); Home, city, neighbourhood (10%); Sports (4%); Transport (3%); Other (5%)
Turkey ***n* = 272**	Finances (17%); Food (17%); School (16%); Home, city, neighbourhood (13%); Plants & animals in close settings (10%); Time & time management (6%); Free time, friends, play (5%); Sports (4%); Health (2%); Other (5%)

Table 2: Personal contexts in Flemish and Turkish textbooks

Contextualization and focus on exactness as an inscription device for desired images of children

Both in the Flemish and Turkish textbooks, similar normative images of desired children are inscribed (See Table 3). The percentages in the column on the right side in Table 3 indicate that this happens primarily to the same extent. Exceptions are the *Responsible consumer of economic goods* and the *Daily life organizer and time manager*, which are more frequent in the Flemish textbooks.

Inscribed/desired child	Description of normalized actions in real life	Personal context category & frequency
Responsible consumer of economic goods	Calculate price prior to/after sales, unit price, cost to pay; Keeping track of quantity bought; Pay correctly & calculate the change; manage budget; save money; Deciding on campaigns	Fla: Finances – 26% Tur: Finances – 17%
Daily life organizer and time manager	Organizing daily routine and sleeping hours; Using time effectively; Start/end/duration activity; Correct reading of clocks; Importance of being on time; Taking public transport; Distance to travel; Number of days abroad; Checking fuel level	Fla: Time & time management; Transport – 16% Tur: Time & time management – 6%
Food provision manager	How much is eaten/food left; How much to eat/drink; pizza, (pan)cakes, chocolate, soft drinks; How much ingredients needed to make food; Food/fruit sharing	Fla: Food – 13% Tur: Food – 17%
Preparedness to use mathematics in everyday life	Free time, friends and play related calculations, counting plants or animals in close settings	Fla: Free time, friends, play – 14% Tur: Free time, friends, play; Plants & animals in close settings – 15%
Mathematics/school student	How to behave at school (equally share goods, how to group, eat/drink healthy, track time on task); Quantify number of students, books, cards; presenting data of class group in graphs	Fla: School – 13% Tur: School – 16%
Settled citizen	Home and neighbourhood context examples (measuring the length of items at home, calculating distances between buildings, locating buildings in the neighbourhood); Working in the garden and other garden-related activities	Fla: Home, city, neighbourhood – 10% Tur: Home, city, neighbourhood – 13%
Sportive citizen	Quantifying sports prestations (comparison of scores in a play or sports game, running distance), almost everyone sports, famous sports events/persons	Fla: Sports – 4% Tur: Sports – 4%

Table 3: The inscribed child

Figure 1 includes four examples of contextualized tasks, two from Flanders and two from Turkey, to illustrate how the combined use of personal contexts and a focus on exactness as a pedagogical practice is a) inscribing children as responsible consumers of economic goods and b) setting a norm to be prepared to use mathematics in everyday life. All four examples in Figure 1 focus on exactness with only one possibly correct solution. The Flemish example indicative for the *Responsible consumer of economic goods* asks children to mark the change they need to get back after buying an ice-cream and crayons by circling as little coins as possible. The task description is thus very explicit in that students should use as little coins as possible, which limits the number of possible solutions to just one singular solution. This particular context is picturing children as consumers of economic goods; the focus on the change to get back and the instruction to come up with only one possibly

correct answer signals the importance of being very careful and precise in spending one's money, hence the responsibility imposed on children. The Turkish example indicative for the *Responsible consumer of economic goods* is set in a shopping context where students are to use mathematics to compare the price of items bought by the two children. Besides the task asking students to focus on the exact calculation with one single answer, the task sets a norm for being "frugal" by spending less money during the shopping event. That is, calculating the total money spent by each child and figuring out the frugal person based on comparing who spent less money is producing a desired image for the children to consume economic goods in a responsible manner. The frequent use of such contexts connected with a push for correctness, we argue, sets a norm of being a responsible consumer of economic goods.

Responsible consumer of economic goods	**Preparedness to use mathematics in everyday life**
 Circle the change you get back. Use as little coins as possible. I buy – I pay with … – I get … back *(Flanders grade 2)*	 Mo sits on the left side. Stan and Sabine sit on the right side. Who will go up? *(Flanders grade 2)*
 ● Compare the products that children buy. ● Which child's book is more expensive? ● Which child's book is cheaper? ● Who is frugal by spending less money on shopping? *(Turkey grade 2)*	 Hülya, Selin and İpek played basketball. Hülya shot 23, Selin shot 29 and İpek shot 25 baskets. Order the basket shots from smallest to largest. *(Turkey grade 2)*

Figure 1: Examples of contextualized tasks from the Flemish and Turkish textbooks

In the Flemish example indicative for *Preparedness to use mathematics in everyday life*, students are asked to indicate the side of the scale that will go up, given the weight of the three people pictured. The particular context of play, as well as other contexts closely related to students' personal life in other tasks such as going to the movies, the airport, or school relates mathematics to the personal spheres of the students' lives. A task as this one can be worked out through estimation, yet, the proposed strategy (only available to teachers) signals that an exact calculation is expected. Students are prepared to use very precise mathematics in their daily lives. In the related Turkish example, mathematics becomes a tool to order and organise a play-related activity. Despite the basket shot

numbers not being necessary to function in today's world in terms of consumption of economic goods, the comparison of the basket shots from smallest to largest, with thus only one possible solution, stresses again the evidence to be prepared to use precise mathematics in their personal lives. In this paper's final section, we discuss how the inscription of such norms through contextualized textbook tasks possibly is supported by specific perspectives of mathematics.

Two perspectives of mathematics supporting the inscription of desired children

This study aimed at analysing normalized images of desired children that are inscribed through contextualized tasks in textbooks from Flanders and Turkey. Our findings indicate that largely similar images of desired children are inscribed in these two educational contexts. This is in spite of differences in the textbook landscape as described in the methods section (Flanders: strong commercialized market, Turkey: strong regulation by the Ministry of Education). We find these similarities remarkable. In wondering about where the similarities come from and by looking at the inscription of desired children across these two regions (see Table 3), we have come to identify two overarching perspectives on mathematics that might support the inscription of these desired norms through contextualized tasks, both in Flanders and Turkey: a pragmatic and an awareness perspective.

The pragmatic perspective underlines the usefulness of mathematics; mathematics is pictured here as a useful and necessary tool to function in today's world. For instance, contexts such as the calculation of the change when buying ice-cream and crayons and the press for exactness by circling the least amount of coins to indicate the change sets a norm of being a responsible consumer of economic goods and does so by drawing on a notion of mathematics as being pragmatic. The inscriptions *Responsible consumer of economic goods*, *Daily life organizer and time manager*, and *Food provision manager* are shaped particularly through a pragmatic notion of mathematics connected to daily life's practicalities such as dealing with money, time, and food.

The awareness perspective draws on a notion of mathematics as a perception tool; mathematics is pictured here as a tool to perceive and understand the world. For instance, the precise ordering of basket shots from small to large stresses the need to be prepared to use mathematics in everyday life by drawing on the notion of mathematics as a tool to perceive the children's play context numerically. It is primarily by means of such an awareness perspective that the contextualized tasks are inscribing the norms *Preparedness to use mathematics in everyday life*, *Mathematics/school student*, *Settled citizen*, and *Sportive citizen.*

As a final remark, despite the nuanced differences in these particular tasks, which need further analysis, both textbook series seem to predominantly involve tasks that inscribe responsibility in the economic life of children.

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