

# Analyzing the use of textbook in mathematics education: the case of Estonia

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*Textbooks are among the most powerful influences on school mathematics. In this paper, the results of the empirical study of Estonian lower secondary mathematics teachers' approaches to the use of textbooks will be discussed. The analysis is based on the survey of 164 teachers and observation of 29 lower secondary mathematics classes. The aim is to understand the range of approaches in which textbooks are used in different mathematics classrooms. Analyses reveal that textbook serves as a central instructional tool which is in active use in Estonian mathematics classes in about half of the lesson time. At the same time, most of the teachers use the textbook simply as an exercise book. It appears that often pupils have a limited access to the textbook, and in this way textbooks are not fully used as multifaceted resources for learning pupils.*

**Key words:** *textbook studies, lower secondary mathematics, learning outcomes, content literacy, teaching, teacher*

## Introduction

It has been well documented in mathematics education research that textbooks are among the most powerful influences on school mathematics (Mullis, Martin & Foy, 2008; Valverde, Bianchi, Wolfe, Schmidt & Houang, 2002). Textbooks are equally important resources for both groups – for pupils to learn mathematics and for teachers to plan and teach their mathematics lessons. Also, in Estonia, mathematics classroom instruction is, in many cases, generally organized around and delivered through the textbooks.

Estonia has a long tradition of developing its own mathematical textbooks. Now-

adays, there are several alternative textbook series on the market for every grade. Textbooks are free for pupils studying at the compulsory school level, and schools supply all pupils with the necessary textbooks. Normally, teachers make a joint decision at the school level regarding which textbook series will be used. It is also common practice that schools prescribe textbooks to be circulated, i.e. they are used for two or three consecutive years. This means that a quick change of a textbook to be used is not possible.

Typically, materials presented in Estonian textbooks are structured according to the topics which could include material for several sequential lessons. Every topic

starts with the presentation of a new content, and often there are examples followed by a set of tasks and activities. In order to meet the different needs of pupils, the tasks in the textbooks are organised in modules based on their complexity. Thus, in addition, there are always more challenging tasks available for more able pupils. And it is a prerequisite for pupils to have the textbook for every lesson. Learning mathematics with a textbook comprises activities such as reading explanatory texts and acquiring a new content, analysing tables and graphs, looking through worked examples, solving tasks, etc. It is the teacher who orchestrates the students' use of textbook materials during the lesson. So, the same textbook as an instructional tool could be used differently in different mathematics classrooms. Teachers may or may not use the textbook in the lessons; they may simply use it as a source of exercises or they may utilize the full potential of the materials presented in the textbook.

Much has been written in the literature about the work of teaching, but surprisingly little effort has been devoted to examining and conceptualizing teachers' approaches to textbook use. At the same time, however, it is argued that a marked dependence on textbooks is "perhaps more characteristic of the teaching of mathematics than of any other subject" (Robitaille & Travers, 1992, p. 706). Thus, textbooks are actively used in mathematics lessons, but the problem is – *with which educational purposes?* The research carried out in several countries reports an extremely limited use of different textbook materials in mathematics classrooms – teachers tend to use textbooks mainly as sources of tasks (Pepin & Haggarty, 2001). This means that

often pupils have a limited access to different components of textbooks, and in this way textbooks are not fully used as multifaceted resources for pupils' learning.

Textbook use in mathematics classrooms in Estonia has not been studied systematically, and it appears that the different ways in which our teachers and pupils employ textbooks in their lessons are relatively unknown. So, we miss information in which way the textbook as an instructional tool functions in our mathematics classrooms, which components of the textbook are actively used and which not.

In this paper, the results of the empirical study of Estonian lower secondary mathematics teachers' approaches to the use of textbooks will be discussed. The study describes and compares mathematics teachers' approaches to textbook use. The aim is to find out which resources provided in the textbook are utilized in practice and thus to understand the range of approaches in which textbooks are used in different mathematics classrooms. Based on the data collected via teachers' survey and classroom observations, the following research questions will be discussed:

- To what extent do Estonian lower secondary mathematics teachers rely on textbooks while planning their lessons?
- In which way do Estonian mathematics teachers employ textbooks in their lessons?

### **Studies on the use of textbooks**

Textbooks are one of the most important artefacts in mathematics education. "The textbook should arouse students' interest in learning mathematics, help students to study mathematics actively, develop

students' potential in creativity through the process of learning basic knowledge, improve students' mathematical thinking when trying to understand the essence of mathematics knowledge, and raise students' awareness to apply mathematics knowledge in everyday lives" (Li, Zhang & Ma, 2009, p. 743). This very important role of textbooks is also reflected in the remarkable body of literature where the main focus of research has been on textbook itself, the studies devoted to the analysis and understanding of the potential effect of the different features of the textbook on mathematical learning (Fan, Zhu & Miao, 2013; Mikk, 2000; Pepin & Haggarty, 2001; Remillard, 2005; Valverde et al., 2002). These investigations reveal nuanced insights into variations in what is made available in textbooks and how it is made available. Such analyses certainly serve as an effective basis for the on-going development of new and better textbook versions.

Another important direction in textbook research draws attention to the role of the textbook in the teachers' planning and preparing for instruction. Textbooks are often perceived to reflect the officially intended curriculum by the teachers. Research has documented a strong influence of textbooks on the mathematics content that is taught and learned. Thus, textbooks control material selection and sequencing – the teacher becomes an implementer of the learning process which is regulated by textbooks (for overview, see Pepin & Haggarty, 2001). The topics presented in the textbook are very likely to be introduced in the classroom; on the other hand, however, topics not included in the textbook are most likely not to be pre-

sented by the teacher (Johansson, 2006). Most of the examples presented by teachers and the exercises that the students work with, either during lessons or at home, come mainly from textbooks as well (Viholainen, Partanen, Piironen, Asikainen & Hirvonen, 2015). Since textbooks usually reflect national goals set down in the (intended) curriculum and at the same time they strongly shape the instruction given in classrooms (implemented curriculum), thus, in the framework for the Third International Mathematics and Science Study (TIMSS), the textbooks were treated as the *potentially implemented curriculum* (Valverde et al., 2002).

From previous research we also find that the textbook influences the teacher's decisions regarding the instructional approaches used in the classroom. Several empirical studies have shown that "textbooks appear to play a role in teachers' pedagogy by conveying pedagogical messages and providing an encouraging or discouraging curricular environment for them to employ different teaching strategies" (Fan et al., 2013, p. 636). In many mathematics classes, student assignments, the questions the teacher asks, the ways in which students are grouped, the forms of assessment and much more originate in curriculum materials. Thus, pedagogical approaches reflected in the textbook in all probability will be translated into practice in the classroom, and textbooks in many ways serve as the models of instruction (Bush, 1986; Johansson, 2006; Lloyd, 2002; Tyson-Bernstein & Woodward, 1991).

Textbooks are also an integral part of a teachers' daily work and are intimately connected to the enactment of instruction.

Literature has repeatedly documented the fact that textbooks are used extensively in mathematics classrooms (see Fan et al., 2013; Pepin, Gueudet & Trouche, 2013; Reys, Reys, Lapan, Holliday & Wasman, 2003). However, the question of *how textbooks are employed* remains relatively unanswered. There is insufficient information available regarding the nature and quality of textbook implementation – *the way in which textbooks are actually used in mathematics classrooms*. It is the teacher who orchestrates the students' use of textbook materials during the lesson. Teachers may or may not use the textbook in the lessons; they may simply use it as a source of exercises or they may utilize the full potential of the materials presented in the textbook. For example, in their study based on teachers' logs, Freeman and Porter (1989) analysed the way in which four fourth-grade mathematics teachers in the US were using the same textbook. They detected striking differences in the practices of these teachers in the use of textbooks. Thompson and Senk (2014) studied how 12 teachers from nine different states in the US applied the same mathematics textbook in their teaching of congruence. They found differences among the teachers both in the selection of topics and in instructional strategies. It has been described also by Remillard (1999) that the use of similar textbooks does not guarantee equal learning opportunities for all students, because the teacher has the key role in affecting how the resources provided in the textbook are utilized in practice. Studies have documented also cultural differences in the way teachers employ textbooks in their lessons.

Haggarty and Pepin (Haggarty & Pepin, 2002; Pepin & Haggarty, 2001), for ex-

ample, describe different traditions of textbook use in lower-secondary mathematics lessons in England, France and Germany. Teachers in all three countries emphasised the use of textbooks for exercises. At the same time, however, French teachers used the books for explanations, but insisted on providing the rules and the essence of the lesson without the textbook and in a different way to it. German teachers used worked examples that were different to those provided in the textbooks, in order to initiate class discussion about the problems that might be encountered. English teachers mostly introduced and explained a concept or skill to their students and then gave examples on the board and expected pupils to practice on their own.

So, the existing research reveals the critical role that teachers play in the use of textbooks in classrooms. The research reveals that teachers emphasise the use of textbooks mainly for exercises, at the same time other textbook components are used much less. Thus, the textbooks' potential to provide different learning opportunities for students is not fully used. The ways in which the teacher mediates the textbook are largely unknown also in Estonian mathematics education; surprisingly little effort has been devoted to examining and conceptualizing our teachers' approaches to textbook use. The work reported in this paper aims to partly fill this gap and attempts to shed light on the extent to which different components of textbooks are used in mathematics classrooms in Estonia.

## **Methodology**

Textbook use in mathematics classrooms in Estonia has not been studied systematically, and it appears that the different ways

in which our teachers and pupils employ textbooks in their lessons are relatively unknown. To shed light on that area, a survey of lower secondary mathematics teachers and an observation of their classes were carried out. The objective of the study was to explore mathematics teachers' and their pupils' approaches to textbook use.

To collect empirical data, teachers' survey and lesson observations were used. The survey enabled to collect information from the bigger sample of teachers and thus to develop a broader picture of their approaches. At the same time, the lesson observations provided a deeper understanding of concrete cases of classroom practices. In this way, the two complementary methods of data collection were combined to raise the validity of the results.

The questionnaire used in the survey consisted of two modules and included 20 items.

The first questionnaire module included 8 statements about the role of textbook in planning and preparing a lesson (see Table 2), for example "*The textbook is the primary tool to plan and prepare my lessons*".

Teachers were required to respond using a 5-point scale:

*(Fully disagree)...2...3...4...5 (Fully agree).*

The second module included 12 items about classroom practices (see Table 3) responding to the question: "*How often do students in your class use textbooks for the following activities*".

Teachers had to respond on the frequency they use such approaches using the 5-point scale:

*never, in about one-quarter of lessons, in about one-half of lessons, in about three quarters of lessons, in almost every lesson.*

The data were collected using a web-page questionnaire in spring 2015. The invitation to participate in the survey was sent to 596 lower-secondary mathematics teachers. 164 teachers from 128 different schools responded, so the response rate was 29%. The distribution of the length of teaching experience of the respondents is shown in Table 1. As can be seen, teachers with different teaching experience are well represented in the sample.

*Table 1. The respondents' length of teaching experience*

<b>Years of teaching experience</b>	<b>Teachers %</b>
... 5	11
6... 10	10
11... 15	9
16... 20	10
21... 25	10
26... 30	15
31... 35	19
36... 40	9
41...	6

The alternative part of data collection – the lesson observations – was carried out also in spring 2015. The aim of these observations was to fix and analyse all textbook-related activities in randomly selected lower secondary mathematics lessons. A special formular was developed to fix the observation data. Using these formulars, all main activities and their length in the observed lessons were documented. Also, comments were added about the details of the observed textbook-related activities.

Lesson observations are time-consuming activities. In our investigation, specially instructed student teachers – future

mathematics teachers – were used as observers. Students carried out observations during their regular school practice periods. In this way, 29 mathematics lessons (grades 6 to 9) carried out by 13 different teachers were observed and documented.

## Analyses and results

### *1. Using the textbook as a tool to plan and prepare lessons*

This section is based on teachers' responses in the first module of the survey. The purpose of the presented analysis is to shed light on the extent to which teachers rely on textbooks in preparing and planning their lessons and thus answer to the first research question of the paper.

From the previous research, we find that the textbook influences the teacher's decisions regarding the content to be cov-

ered as well as the instructional approaches used in the classroom (Johansson, 2006). Teachers' responses in our survey reflect also Estonian mathematics teachers' remarkable dependence / reliance on textbooks. The distribution of teachers' responses is characterised in Table 2.

The use of the textbook begins with a choice between the alternatives available in the textbook series. If the textbook is considered as the major curriculum resource, then it would be recommendable for the teacher to have the freedom to make his / her own choice between the available alternatives and to use the version which best suits the teacher's preferred instructional style. Only then will the teacher make the most effective use of the different materials and activities presented in the textbook. Responses of teachers show (see Table 2) that about two thirds of them

*Table 2. Distribution of teachers' responses*

Statements	Distribution of responses (%)				
	fully disagree	disagree	neutral	agree	fully agree
I have chosen the textbook I use for teaching	10	7	14	20	49
Overall, I am satisfied with the textbooks I use	1	6	21	48	24
The textbook is the main tool to plan the courses and the study year	2	8	25	40	25
The textbook is the primary tool to plan and prepare my lessons	1	8	26	43	22
In the majority of lessons I limit to textbook and workbook materials	2	12	31	36	19
Tasks for the lesson I choose mainly from the textbook	1	9	29	45	16
I skip some topics presented in the textbook	9	19	20	34	18
My teaching approaches are often driven by instructional approaches of the textbook	6	15	41	29	9



have had the possibility to choose the textbook. Probably this is one of the reasons why 72% of respondents claim they are satisfied with the textbook in use and 65% claim that the textbook is the main tool to plan their courses and prepare lessons. However, a bit smaller proportion of teachers (55%) claim they limit themselves with textbook and workbook materials only in the preparation for lessons. As can be seen from Table 2, the choice of tasks for the lessons is mainly based on the textbook for 61% of teachers. At the same time, only 9% of teachers in our sample disagreed with the statement “*the textbook is the primary tool to plan and prepare my lessons*”. So, it could be summarised that in terms of content Estonian teachers rely heavily on the textbook while planning and preparing their classes. It appears, therefore, that in Estonia the majority of teachers tend to “teach by the book”.

From the previous research, we find that a textbook influences also the instructional approaches used in the classroom. As can be seen from Table 2, based on teachers’ responses to the statement “*My teaching approaches are often driven by instructional approaches of the textbook*” it is not the case in Estonia – only 38% of our teachers agreed, 41% remained neutral, and 21% disagreed to that statement. So, based on teachers’ self-reflection, they are relatively independent in their pedagogical behaviour. One explanation to that may be also the fact that in Estonia there are no teachers’ guides in use as is the case in many other countries. So, teachers have the tradition to develop their own instructional approaches and not to copy the pedagogical behaviour suggested by the textbook.

It is also noticeable that the level of teachers’ autonomy from the textbook grows by the length of teaching experience. For example, there claimed to base mainly on the textbook in their planning and preparing for lessons 78% of teachers with less than 5 years and 64% of teachers with more than 10 years of teaching experience. Analogically, agreed with the statement “*My teaching approaches are often driven by instructional approaches of the textbook*” 55% of teachers with less than 5 years and only 39% of teachers with more than 10 years of teaching experience. The general trend was the same in responses to all analysed statements.

## **2. Textbook use in the lessons**

The second research question of the paper concerned the ways of utilizing textbooks in mathematics classrooms. To seek answers to that question, the analysis of teachers’ responses to the statements from the second module of the questionnaire is presented in Table 3.

The analysis reveals a strong reliance on tasks from a textbook by teachers in the survey. As can be seen from Table 3, in almost every lesson the *textbook serves as the source for exercises* for 51% of the teachers. Others claim to employ such practice at least in every second lesson. Solving tasks from the textbook is, based on the teachers’ responses, also the most common type of homework used in every or every second lesson by 85% of teachers in the survey. Thus, it appears that this is one of the basic ways of using textbooks. Additionally, tasks from other sources are used quite often. So, solving tasks seems to be one of the central activities in mathematics lessons, and textbooks are heavily used as sources for exercises.

Table 3. *Distribution of teachers' responses concerning the usage of textbooks in the lessons*

Distribution of teachers' responses (%)					
How often do students in your class use textbooks for the following activities:	Never	One quarter of lessons	One half of lessons	Three quarters of lessons	(Almost) every lesson
Solve tasks from the textbook	0	7	18	24	51
Solve tasks not from the textbook	0	39	32	22	7
Have homework as tasks from the textbook	2	12	16	37	33
Have homework as tasks from other sources	6	59	22	11	2
Solve repetition tasks at the end of the chapter in the textbook	3	48	19	23	7
Read the description of a concept or rule from the textbook	7	36	21	22	14
Study new material from the textbook individually	15	54	18	10	3
A figure or schema from the textbook is jointly discussed	5	41	26	19	9
To recall earlier learned concepts using the table of contents in the textbook	20	58	11	5	6
The textbook is used to review the earlier studied material	11	46	21	14	8
Study from the textbook newly introduced material as homework	31	37	16	10	6

Traditionally, teachers are the mediators of new knowledge in mathematics lessons. At the same time, all textbooks also include texts introducing new concepts and providing additional material about the content covered. Thus, one of our interests has been how common it is among the teachers to use texts from the textbook for pupils' individual acquisition of knowledge. According to teachers' responses to the item "*How often do students in your class use textbooks to study new concepts individually?*" (see Table

3), *the* a majority of them (69%) never let students study new concepts individually from the textbook or do so only in some lessons. The same is the situation with homework: 68% of teachers claim they seldom or never ask their students to study individually newly introduced material from the textbook as their homework. As can be seen from Table 3, at least with respect to the item "*How often do students in your class use textbooks to read the description of a concept or a rule from the textbook*", about half of the teachers have



responded that this is regular practice in about every second lesson for them. But at the same time as many as 44% of our teachers have claimed their students seldom or never practice it. It also appears (see Table 3) that 67% of teachers seldom or never ask their students to use the textbook to review the earlier studied material and as many as 78% of teachers seldom or never let their students to recall earlier learned concepts using the textbook. Thus, our analysis reveals the limited use of texts in the textbook in learning situations; reading mathematical texts in the textbook is not seen as an opportunity for learning by the majority of teachers in our sample.

In addition to tasks and textual parts, there are also lots of illustrations, figures and schemas in the textbooks. Analysis reveals that also this component of textbooks is used only to a small degree in mathematics classes. As can be seen from Table 3, only 28% of teachers claimed that figures or schemas from the textbook are often discussed in their lessons; at the same time, as many as 46% of teachers have claimed they seldom or never use that type of activities in their lessons.

In order to explore mathematics teachers' and their pupils' approaches to textbook use, also classroom observations were used. The aim of these observations was to fix and analyse all textbook-related activities in these 29 randomly selected lower secondary mathematics lessons. The summary of these observations is presented in Table 4.

The analysis of observation data presented in Table 4 reveals that the textbook was in active use in these lessons in about 48% of the lesson time. Thus, the textbook appears to be an important resource which is in use in about half of the study time. At the same time, the list of different textbook-based activities proves to be short and reflects the limited use of different textbook resources. As can be seen from Table 4, the most popular form of textbook usage is solving tasks presented in the textbook. It was the case in 24 out of 29 observed lessons with the average length of 20 minutes (the length of lessons is 45 minutes). Additionally, eight lessons included also checking the solutions of tasks solved as homework and five lessons where the teacher explains solutions to the tasks from the textbook which typi-

*Table 4. Textbook-based activities in the observed 29 lessons*

<b>Textbook-based activities</b>	<b>Average length (min)</b>	<b>Number of lessons including this type of activity</b>
Students discuss and solve tasks from the textbook	20	24
Check of homework (tasks from the textbook)	8	8
Teacher explains the task from the textbook	7	5
Teachers' textbook-based introduction of a new content	7	4
Students study and jointly discuss a figure from the textbook	9	2

cally serves as the preparation for the next homework. Thus, based on the observation data it is also obvious that textbooks are mainly used as the sources of tasks.

Teachers' survey showed that students' independent textbook-based study of a new content or a review of earlier learned concepts were rarely used activities. The same conclusion is confirmed by the observation data. None of the observed lessons included activities where students had to read texts from the textbook and individually study the introduction of a new content or the description of a concept presented in the textbook. However, in the four observed lessons the textbook was used while the teacher introduced the new content, and in two classes the students studied and jointly discussed the figures from the textbook.

Thus, also the results of classroom observations reveal the limited use of different textbook components in mathematics classrooms. Textbooks are used mainly as task books: 94% from all the time devoted to textbook-based activities in the observed lessons students solved tasks. Our teachers emphasize the use of textbooks for exercises – whether to be solved in the lesson or as homework. Other components in the textbook were used only in a few lessons. Probably teachers consider pupils unable to study new concepts or methods independently from the textbook. Thus, for them, the theory in textbooks is written for teachers, and the textbooks are just exercise books for pupils. Therefore, we can agree with the conclusion made by Pepin and Haggarty (2001): “Although the textbook seems to influence the lesson to a large extent, it appears that it is rarely used as a *pupil book*” (p.164).

## Conclusions and discussion of presented results

The purpose of analysis carried out in this paper was to shed light on the extent to which teachers rely on textbooks in preparing and planning their lessons and the ways in which they use the textbooks in their classrooms.

Several earlier studies have shown teachers' relatively high dependence on textbooks while planning and preparing their lessons (Fan et al., 2013; Johansson, 2006). Based on this study, we can conclude that also Estonian mathematics teachers rely heavily on the textbook in their lesson preparation work. Teachers are generally satisfied with textbooks, and 65% of them claim that the textbook is the main tool to plan their courses and prepare lessons. As much as 54% of teachers in the survey also claim that in the majority of lessons they limit themselves with textbook and workbook materials, and only 10% disagreed with that statement. Thus, the presented research has documented a strong influence of textbooks on the mathematics content that is taught and learned. This result is in accordance with the framework for the Third International Mathematics and Science Study (TIMSS) where textbooks are perceived as the *potentially implemented curriculum* (Valverde et al., 2002). However, differently from several earlier studies, the results of this survey indicate that Estonian teachers' dependence on the textbook is lower in their choices of the teaching methodology. Only 38% of our teachers agreed with the statement that their teaching approaches are often driven by the instructional approaches of the textbook. So, teachers seem to have the tradition to develop their own instruction-

al approaches, which makes the teaching practice more diverse and without doubt is a positive and strong side of the Estonian mathematics education.

Research literature is clear about the fact that textbooks are used extensively also in mathematics classrooms (Fan et al., 2013). Learning mathematics with a textbook comprises activities such as reading explanatory texts and acquiring a new content, looking through worked examples, solving tasks, etc. It is the teacher who orchestrates the students' use of textbook materials during the lesson. One of the aims of this study was to find out *how textbooks are employed* in mathematics classes in Estonia.

Analyses carried out in this paper reveal that the textbook serves as the central instructional tool which is in active use in Estonian lower secondary mathematics classes in about half of lesson time. At the same time, our study shows only a limited use of the full potential of textbooks by many teachers – the *majority of teachers in the study tend to use the textbook only as an exercise book*. More than 90% of the time that students worked with the textbooks they just solved tasks from there. The worrying conclusion of the analyses is that the other components of the textbook, especially textual elements, are used much less or are not used at all in mathematics classes. Traditionally, teachers are the mediators of new knowledge in our mathematics lessons. Consequently, pupils are not given the opportunity to learn mathematics from the textbook without the teacher's mediation. Pupils are obviously perceived as not being able to cope independently with the texts in the textbook.

Reading mathematical texts in the textbook could be an important part of a pupil's learning process. At the same time, our analysis reveals the limited use of texts in learning situations; *reading of mathematical texts in the textbook is not seen as an opportunity for learning by about two thirds of the teachers*. If the textbook is mainly used as a source of exercises and tasks to solve, pupils' reading is limited to the reading of the text of a given task. Österholm (2005) presents the notion of *content literacy*, which refers to "the ability to read, understand and learn from text from a specific subject area" and stresses the need to develop this ability by regular practice of specific reading activities in mathematics. Mathematical literacy should be recognized as an integral part of mathematical competences (Niss & Højgaard Jensen, 2002). "Thereby, reading and reading comprehension could be more explicitly included in mathematics education, in teaching as well as examinations, and some agree it *should* be included" (Österholm, 2005, p. 326). In the study carried out by Haggarty and Pepin (2001), which was based on textbook use in England, France and Germany, the researchers came to the same conclusion that pupils in their study had almost no opportunity to develop their reading and comprehension skills in mathematics.

During recent decades, a considerable amount of energy has been put into developing new and better mathematics textbooks. At the same time, teachers' approaches to textbook use have seemingly remained unchanged. Our study shows only a limited use of the full potential of textbooks by many teachers – the majority of all teachers in the study tend to use the

textbook only as an exercise book. Thus, mathematics textbooks turn out to be useful only for the practice opportunities they provide, but not for the knowledge and learning opportunities they might make available. Consequently, and this is the problem, pupils are not given the opportunity to learn mathematics from the textbook without the teacher's mediation. Pupils are obviously perceived as not being able to cope independently with the texts

in the textbook. It leads us to the main and worrying conclusion that *too often pupils have a limited access to the textbook, and in this way textbooks are not fully used by the teachers as multifaceted resources for pupils' learning*. If this is the case, we should strive for teachers who try to mediate another view of the textbook, which would give the textbook the chance to fill an even more important role in students' learning.

## REFERENCES

- Bush, W. S. (1986). Pre-service teachers' sources of decisions in teaching secondary mathematics. *Journal for Research in Mathematics Education*, Vol. 17(1), p. 21–30.
- Fan, L.; Zhu, Y.; Miao, Z. (2013). Textbook research in mathematics education: development status and directions. *ZDM Mathematics Education*, Vol. 45, p. 633–646.
- Freeman, D. J.; Porter, A. C. (1989). Do textbooks dictate the content of mathematics instruction in elementary schools? *American Educational Research Journal*, Vol. 26(3), p. 403–421.
- Haggarty, L.; Pepin, B. (2002). An investigation of mathematics textbooks and their use in English, French and German classrooms: who gets an opportunity to learn what? *British Educational Research Journal*, Vol. 28(4), p. 567–590.
- Johansson, M. (2006). Textbooks as instruments: Three teachers' ways to organize their mathematics lessons. *Nordic Studies in Mathematics Education*, Vol. 11(3), p. 5–30.
- Li, Y.; Zhang, J.; Ma, T. (2009). Approaches and practices in developing school mathematics textbooks in China. *ZDM Mathematics Education*, Vol. 41, p. 733–748.
- Lloyd, G. M. (2002). Mathematics teachers' beliefs and experiences with innovative curriculum materials, The role of curriculum in teacher development, In G. C. Leder, E. Pehkonen, G. Törner (eds.). *Beliefs: a Hidden Variable in Mathematics Education?* (pp. 149–160). Dordrecht: Kluwer Academic Publishers.
- Mikk, J. (2000). *Textbook: Research and Writing*. Frankfurt am Main: Peter Lang.
- Mullis, I. V. S.; Martin, M. O.; Foy, P. (2008). TIMSS 2007 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades. Chestnut Hill, MA, USA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College.
- Niss, M.; Højgaard Jensen, T. (eds.). (2002). Kompetencer og matematiklæring – Ideer og inspiration til udvikling af matematikundervisning i Danmark, Report no. 18 – 2002, Undervisningsministeriets forlag, Copenhagen, Retrieved November 25, 2014, from <http://pub.uvm.dk/2002/kom/hel.pdf>
- Österholm, M. (2005). Characterizing reading comprehension of mathematical texts. *Educational Studies in Mathematics*, Vol. 63, p. 325–346.
- Pepin, B.; Gueudet, G.; Trouche, L. (2013). Investigating textbooks as crucial interfaces between culture, policy and teacher curricular practice: two contrasted case studies in France and Norway. *ZDM Mathematics Education*, Vol. 45, p. 685–698.
- Pepin, B.; Haggarty, L. (2001). Mathematics textbooks and their use in English, French and German classrooms: a way to understand teaching and learning cultures. *ZDM*, Vol. 35(5), p. 158–175.
- Remillard, J. T. (1999). Curriculum materials in mathematics education reform: A framework for examining teachers' curriculum development. *Curriculum Inquiry*, Vol. 29(3), p. 315–342.

Remillard, J. T. (2005). Examining key concepts in research on teachers' use of mathematics curricula. *Review of Educational Research*, Vol. 75(2), p. 211–246.

Reys, R.; Reys, B.; Lapan, R.; Holliday, G.; Wasman, D. (2003). Assessing the impact of standards-based middle grades mathematics curriculum materials on student achievement *Journal for Research in Mathematics Education*, Vol. 34(1), p. 74–95.

Robitaille, D. F.; Travers, K. J. (1992). International studies of achievement in mathematics. In D. A. Grouws (ed.). *Handbook of Research on Mathematics Teaching and Learning* (pp. 687–709). New York: Macmillan.

Thompson, D. R.; Senk, S. L. (2014). The same geometry textbook does not mean the same class-

room enactment. *ZDM Mathematics Education*, Vol. 46, p. 781–795.

Tyson-Bernstein, H.; Woodward, A. (1991). Nineteenth century policies for twenty-first century practice: The textbook reform dilemma. In P. Altbach, G. Kelly, H. Petrie & L. Weis (eds.). *Textbooks in American Society* (pp. 91–104), Albany: SUNY Press.

Valverde, G. A.; Bianchi, L. J.; Wolfe, R. G.; Schmidt, W. H.; Houang, R. T. (2002). *According to the book. Using TIMSS to investigate the translation of policy into practice through the world of textbooks*. Dordrecht: Kluwer Academic Publishers.

Viholainen, A.; Partanen, M.; Piironen, J.; Asikainen, M.; Hirvonen, P. (2015). The role of textbooks with respect to theory, examples and exercises in upper secondary mathematics, *Nordic Studies in Mathematics Education*, Vol. 20(3) (in press).

## VADOVĖLIŲ NAUDOJIMO MOKANT MATEMATIKOS ANALIZĖ: ESTIJOS ATVEJIS

### Madis Lepik

#### S a n t r a u k a

Straipsnyje pateikiama matematikos vadovėlių naudojimo mokant matematikos Estijos mokyklose analizė. Tradiciškai vadovėliai labai svarbūs mokant matematikos, tačiau šiandien vadovėlis nėra vienintelė matematikos mokymosi priemonė, mokytojas gali rinktis ir kitas priemones. Tarptautiniai TIMMS tyrimai rodo, kad efektyvus matematikos vadovėlių naudojimas pagrindinio ugdymo mokykloje daro įtaką mokinių matematikos mokymosi rezultatams. Tai taip pat patvirtina įvairių šalių mokslininkų atliekami tyrimai, kurie rodo, kad šiuolaikiniai mokytojai labai įvairiai panaudoja vadovėlių medžiagą ugdymo procese.

Straipsnyje pateikiami ir aptariami atliktos

matematikos mokytojų apklausos (N = 164) ir pagrindinės mokyklos ugdymo pakopoje stebėtų 29 matematikos pamokų tyrimų rezultatai, kurie parodo, kokiais būdais Estijos matematikos mokytojai naudoja matematikos vadovėlius. Tyrimo duomenys rodo, kad vadovėliai nėra efektyviai panaudojami, neišnaudojamos visos vadovėlių galimybės, nors pusė aktyvaus pamokos laiko yra skiriama dirbti su vadovėliu. Tyrimo rezultatai atskleidė, kad dauguma mokytojų vadovėlį naudoja pratyboms, matematiniam uždaviniams spręsti.

**Pagrindiniai žodžiai:** vadovėlio analizė, pagrindinės mokyklos matematika, mokymosi rezultatai, mokymas, mokytojas.

*Įteikta: 2015 09 21*

*Priimta: 2015 10 30*