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The Role of Mathematics Textbooks in Lower Secondary Education in Croatia: An Empirical Study

Dubravka Glasnović Gracin
Faculty of Teacher Education
University of Zagreb
Croatia

Ljerka Jukić Matić
Department of Mathematics
University of Osijek
Croatia

Abstract: This paper reports a study on the use of mathematics textbooks as curriculum resources in lower secondary education in Croatia. The focus of the study is placed on how and why the textbook is used during the teaching of new content and the practicing phase in classrooms. The aim of the study was also to investigate the influence of a textbook on the teaching instructions. The study was conducted using classroom observations supplemented with interviews with mathematics teachers from observed classrooms. The findings showed that the textbook played a central role in teachers' lesson preparation, as well as in the selection of worked examples and practice exercises for the students. Textbooks were also shown to be very important as a source for homework. The interviews revealed the influence of a social dimension on the utilization of mathematics textbooks in the classroom.

Keywords: Mathematics textbook; Mathematics teacher; Textbook use.

Introduction

A textbook can be described as a book designed to provide an officially sanctioned and authorized pedagogic version of human knowledge (Stray, 1994; De Castell, Luke & Luke 1989). As such, the textbook is an important part of the educational system and curriculum. Fan, Zhu and Miao (2013) note that "[r]esearchers have generally agreed that textbooks as a major conveyor of the curriculum play a dominant role in modern education scenes across different school subjects" (p. 635). Fan (2013) argues that textbooks are seen as an intermediate variable which are affected by other factors (i.e. independent variables) and which affect other factors (i.e. dependent

variables). His research emphasizes the fundamental issue of "how textbooks affect other factors"(p.771) such as teaching.

In Croatia, textbooks are compulsory in primary and secondary education. Textbooks are traditionally purchased by parents in Croatia, apart from a short period from 2006 to 2008 when the Ministry of Science, Education and Sports provided free textbooks for all students in Croatia. Free textbooks are provided in some Croatian cities (for example, Zagreb and Osijek), depending on the city's financial resources. All mathematics textbooks used in schools are authorized by an official group of experts selected by the Ministry of Education. As of 2010, teachers jointly select authorized textbooks for their school for the period of four years.

Role of textbooks in the teaching mathematics in Croatia

Glasnović Gracin (2011) conducted a large-scale study in order to determine teachers' attitudes about the role of the textbook in mathematics education in Croatia. The survey was officially facilitated by the Education and Teacher Training Agency and was conducted at local mathematics meetings all around Croatia in 2008.

The survey involved 987 participants; almost half of the total number of lower secondary mathematics teachers in Croatia (grades 5 to 8). In most of the questions, the teachers' attitudes were measured according to a modified Likert scale with four degrees. Also, several questions involved selecting one or more given answers. The objectives of this quantitative research were to determine to what extent mathematics textbooks are used in grades five to eight and what educational methods predominate in mathematics education when using textbooks in classrooms.

The results showed that the surveyed teachers used the textbook to a great extent in lesson preparation. The teachers stated that they did not use the teacher guides or other materials for preparation as much as they used the textbooks. Also, the teachers in the survey were asked if they followed the structure of the particular textbook lesson in the classroom. More than four fifths of participants confirmed that they relied on the textbook structure to a great extent (sequence of textbook contents, of examples and exercises, etc.) and they carried out their instruction according to that structure.

Traditionally, mathematics exercises have always played a big role in teaching mathematics. Results showed that 97% of teachers in the survey confirmed that their students used the official textbook package for doing mathematics exercises (almost always or often). Also, a very high percentage (99%) of the surveyed teachers stated that they gave homework from the textbook package; most of them almost always.

Results showed that 84% of the surveyed teachers often or almost always used the methods and approaches suggested by the textbook. This is indicative of the extent of the authority of mathematics textbooks in Croatia. Further, 87% of the surveyed teachers stated they presented a new topic standing at the front of the classroom.

The findings suggested that mathematics textbooks play an important role in mathematics education in grades five to eight in Croatia, especially in teachers' preparation, practice exercises for students and homework. Furthermore, participants stated that textbook content and structure influenced their mathematics teaching to a great extent. New material is mainly presented by the teacher at the front of the class, followed by students working individually on the textbook exercises. Since the surveyed teachers prepared their instruction according to the textbook, their role can be considered as the mediator between the textbook and the students.

However, while the study may have answered the question to what extent the textbook is used, it left qualitative questions such as why and how unexplored. At the end of the study, the author noted: "Further studies on this topic would decrease possible misconceptions related to the survey results, such as the giving of socially acceptable responses. In order to get a better picture of the role and the use of mathematics textbooks in Croatia, a range of content analyses of the textbooks should be conducted, as well as teacher and student interviews, classroom observations, and surveys of students" (Glasnović Gracin, 2011, p. 47). This was the motive for conducting a new study, using classroom observations and teacher interviews, to examine the qualitative aspect of textbook use. Thus, the triangulation of survey, observation and interview results could give a better picture of the use of mathematics textbooks in Croatia.

Literature Review – The role of Textbooks from a Curricular Perspective

In order to conduct an empirical study on the use of textbooks in Croatia, the role of textbooks from the curricular perspective should firstly be considered. It is also important to consider the relevant literature on the teachers' use of textbooks in teaching mathematics.

The potentially implemented curriculum

A tripartite model of the curriculum as a "starting point for the model of educational opportunities in school mathematics and science" (Valverde, Bianchi, Wolfe, Schmidt & Houang, 2002, p. 5) has been developed by the International Association for the Evaluation of Educational Achievement (IEA) and TIMSS - the Third International Mathematics and Science Study (Howson, 1995; Schmidt et al., 1997, 2001; Valverde et al., 2002). These three dimensions involve the intended, implemented and attained curriculum. Intended curriculum refers to the intentions, aims, and system goals; implemented curriculum involves instruction and practice activities, and attained curriculum refers to knowledge and achievement. In this model, textbooks play a central role as mediators between the intended and implemented curriculum. On one hand, the textbook content follows and largely reflects the requirements and intentions of the intended curriculum and on the other hand, textbooks are designed as artifacts to be dynamically used in classrooms and thus they influence the instruction (Valverde et al., 2002; Johansson, 2006). This mediating role is complex because of the unique and creative input, which students and teachers contribute in the classroom. Valverde et al. (2002, p. 13) offer the modified tripartite curriculum model by embedding a fourth component: the potentially implemented curriculum as a link between the intended and implemented curriculum. The potentially implemented curriculum involves textbooks and other organized resource materials which translate policy into pedagogy.

However, textbooks "are not only mediators between intention and implementation, they are also components of opportunities to learn school subjects and have their own characteristic impact on instruction" (Valverde et al, 2002, p. 10). Accordingly, textbooks should be researched from the aspect of the content as well as their use in classrooms. Fan et al. (2013) give a systematic view on the development status and directions on mathematics

textbooks. Emphasis on research issues and methods on textbook research are given in Fan (2013), where textbook research is presented as scientific research. All these issues emphasize the importance of textbooks in mathematics education.

Textbooks and the implemented curriculum

In order to get a better picture of mathematics education and the role of textbooks within it, it is important to examine the processes that take place in the classroom. This means that a product-oriented approach should be supplemented with a use-oriented approach (Johnsen, 1993). Such research tries to answer the questions "To what extent and how are textbooks used in the classroom?" and "Which methods are applied by teachers in using textbooks in mathematics education?" A review of research related to textbook use in mathematics classrooms is presented by Fan et al. (2013). Many national and international studies show that textbooks are used to a great extent in mathematics education (e.g. Robitaille & Garden, 1989; Pepin & Haggarty, 2001; Zhu & Fan, 2002). Some of them discuss the way teachers use textbooks throughout the world.

The use of mathematics textbooks by students is also very important in understanding the textbook as part of the implemented curriculum. There are relatively few such studies; they are presented and discussed in Rezat (2013) and Ewing (2004). Fan et al. (2013) pointed out that "[f]urther research on a larger scale, and confirmatory research with experimental design, and on students' use of textbooks, is much needed" (p. 642).

Textbooks and teachers' lesson preparation. The results of empirical studies showed that teachers use textbooks for lesson preparation (Bromme & Hömberg, 1981; Glasnović Gracin & Domović, 2009). They decide what is to be taught mostly according to the textbook content and how and when the textbooks will be used in the classroom. Other materials are used, but not to such an extent. "It appears that teachers, in consultation with their colleagues, decide which textbook or textbooks to use, and where and when to use it in the classroom" (Pepin & Haggarty, 2001, p.164).

These results imply that the role of the teacher is as a mediator between the text and the students (Van Dormolen, 1986; Luke et al., 1989; Love & Pimm, 1996). It is the teacher who decides which textbook to use, when and how to

use it, which parts to use and in what order, when and to what extent the students will work with the text, and so on.

Textbooks and learning mathematical content in the classrooms. The learning of new mathematical content has often been the focus of researchers. One of the examined issues is the role of mathematics textbooks while the students are learning new content in the classroom. Explaining mathematical content new to the class is one of the teachers' major activities in the classroom (Robitaille & Garden, 1989). Observations and interviews in Germany, England and France showed that teachers seem to prefer playing the role of mediator between the students and the new content in the textbooks. They prepare new content for teaching mainly according to the textbook and try to use the same language used in the textbook. The worked examples are mainly influenced by the textbook examples, but mostly they are not the same (Pepin & Haggarty, 2001). Several decades ago, Hopf (1980) found that teachers teach new topics as frontal work rather than letting the students learn it by themselves using their textbooks. These results match the Croatian results, where 87% of the surveyed teachers stated they use frontal work for the presentation of new a topic (Glasnović Gracin, 2011).

Textbooks and exercises, reviewing and homework. The usual textbook structure with the "exposition – examples – exercises" model predominates in the structure of mathematics textbooks (Love & Pimm, 1996). The cross-cultural research of 20 different educational systems in 17 countries showed a great use of textbook exercises in mathematics education (Robitaille & Garden, 1989). "Textbooks containing both explanation and exercises are clearly a major resource in all systems" (ibid, p. 53). Therefore, it seems that the practice exercises are the most important part of the textbook, in terms of students' activities. Research results showed that teachers used the textbooks for assigning exercises and homework to students, and that they also directed student to use a textbook for reviewing (Hopf, 1980; Pepin & Haggarty, 2001; Johansson, 2006).

The literature review prompted deeper reflection on teachers' utilization of textbooks in the teaching of mathematics. It provided the basis for designing the theoretical framework for the study.

Theoretical Framework

The theoretical framework of the study is shaped by frameworks of two studies. They are the framework by Pepin and Haggarty (2001) on the use of textbooks by teachers and students and the framework by Johansson (2006) for lesson observations on the role of textbooks in the mathematics classroom.

The use of textbooks in classrooms

With respect to the use of textbooks by teachers and students, Pepin and Haggarty (2001) distinguish six main areas under which the textbook utilization can be investigated: (1) whether textbooks are used or not; (2) the authority of textbooks; (3) who uses the textbooks; (4) how textbooks are used; (5) the teacher as the mediator of the text; and (6) educational traditions as a potential influence of what happens in classrooms. We will briefly describe each area as presented by Pepin and Haggarty (2001).

Authority of textbooks. In a way the textbook is a book that deals with authorized knowledge. Pepin and Haggarty (2001) describe two kinds of mathematics textbook authority: "authority associated with the mathematics; and authority over negotiation of the text" (p. 164). This refers to the authority of the mathematics content itself, the authority of given methods and the authority of the written text. In addition, textbooks and teachers constitute one authoritative identity. At the same time, the students have a non-authoritative status in relation to the textbook and the teacher: There are further reasons why textbooks have an authoritative character. In some countries, the fact that textbooks are the school's property lends the textbook additional authority. For example, in England and France textbooks have been traditionally provided by the school, although the reduction in school budgets is changing this in recent times. In Germany, textbooks are provided and purchased by parents, except for students from low-income families who receive textbooks from the school. The authority of the textbook is undoubtedly linked to its close connection with the intended curriculum, which is designed by the authorities. In some countries the official textbooks are also authorized and controlled by an administrative source but in some countries this is not the case.

Who uses textbooks. Pepin and Haggarty (2001) provided examples of empirical studies which showed that teachers mainly used the school textbook for their lesson preparation and the textbooks were mainly written for teachers

and their decisions. Therefore, although the textbooks are presented as books written for students, the results show that they are more teachers' than pupils' books.

How textbooks are used. Pepin and Haggarty (2001) present different studies which show that textbooks are mainly used for exercises. One of the important factors for teachers is the quality and differentiation of exercises in the textbooks. Besides that, the textbook is a major factor not only in determining what mathematical topics will be taught and how they will be taught but also in terms of the introduction of new topics into the curriculum.

The teacher as the mediator of the text. Mathematics teachers act as mediators of the text in their lessons. Teachers are the ones who decide "which textbook to use; when and where the textbook is to be used; which sections of the textbook to use; the sequencing of topics in the textbook; the ways in which pupils engage with the text; the level and type of teacher intervention between pupil and text; and so on" (Pepin & Haggarty, 2001, p. 165). This role goes beyond pure selection of the content and includes various pedagogical decisions. They are related to the meta-discourse of the text, the language and the explanations of the text. In addition, the teacher might offer additional materials or examples.

Educational traditions as a potential influence of what happens in classrooms. It appears that textbooks promote the cultural values of a nation. What happens in the classroom is influenced by each system's decisions about specific visions, aims and goals which are expressed in national curricular materials and resources (Pepin & Haggarty, 2001). The textbook represents the link between the intended and implemented curriculum, and as such reflects the whole system of ideas and beliefs; in this way those ideas and beliefs are brought into the classroom through the textbook.

Framework for lesson analysis

In the study on teachers' utilization of textbooks, Johansson (2006) examined the role of the textbook in the classroom, observing how three teachers organize their teaching. She developed a framework for analyzing mathematics lessons. The framework covers classroom interaction, content activity, organization of students and textbook influence.

Classroom interaction was examined through public interaction, private interaction, and mixed interaction. A public interaction is described as a public conversation between the teacher and one or more students. Students are supposed to listen or participate occasionally, and this conversation can be accompanied by written information. A private interaction denotes a situation where students are working in their seats, they may discuss tasks with one another and the teacher may assist them. In mixed interaction, the teacher or students present information in public, but in this type of interaction students do not have to pay attention strictly to what was happening in the classroom.

Organization of students denotes whether students are working individually, in pairs or in groups, in parts of lessons with private or mixed interaction.

Content activity describes the three, mutually exclusive categories of activities: non-mathematical work, mathematical organization, and mathematical work. Mathematical organization refers to a part of the lesson which is somehow connected to mathematics (e.g. mathematics tools, resources, homework, tests), but it does not explicitly and directly contain mathematical content. The category of mathematical work is structured around some mathematical content.

Textbook influence involves different types of textbook use in the classroom. It involves: direct use of a textbook, indirect use of a textbook, but also the absence of textbook use. "Whenever a textbook is explicitly or implicitly used in the classroom one can think about it as an influential factor" (Johansson, 2006, p. 9). The direct use of a textbook refers to the open and explicit use of the textbook: for instance, students working individually or in groups on tasks from the textbook, or the teacher reads out content directly from the textbook. The indirect use of a textbook describes situations where the teacher solves the worked examples from the textbook on the board, or uses motivation examples similar to those from the textbook, or talks about mathematical statements the same way as in the textbook, but the teacher does not explicitly mention the textbook as a source. Textbook absence indicates a situation in which it is clear that the textbook was not included in the lesson and other resources are used. For instance, the teacher introduces a new topic differently than it is given in the textbook or gives exercises that are not taken from the textbook and are not similar to those in the textbook.

Johansson (ibid) also directed her attention to the teachers' activities and how often specific events like problem solving, assignment of homework, assessment, goal statements, and summary of lessons occurred within a lesson.

The frameworks presented in this section helped in designing the research framework, organizing data and explaining obtained results of the new study. Using Johansson's framework supplemented with guidelines on textbook use by Pepin and Haggarty, we obtained a tool with the purpose of not only examining if textbooks are used, who uses them and how they are used, but also what the classroom interaction looks like. This research is of great importance because there have been no such empirical studies on how mathematics lessons are performed in Croatian schools.

Research Framework

The present study reported in this paper builds on an earlier (past) one that is described in the introduction to the paper. The aim of the present study, which draws upon the research design of the past one, is to provide a qualitative view on the use textbook in the teaching of mathematics in Croatia.

The frameworks designed by Pepin & Haggarty (2001) and Johansson (2006) described in the previous section influenced the research instrument. For this qualitative study, the research framework by Johansson (2006) about textbook utilization in the classrooms was used (particularly, classroom interaction, organization of students and textbook influence). Besides that, the framework of Pepin & Haggarty (2001), which had been used in the past quantitative study (Glasnović Gracin, 2011), was further narrowed down into the following issues: how textbooks are used in the classroom and what are the reasons for such use. These issues are elaborated on in detail through questions that appear both in observations and interviews: (1) what is the role of the textbook package in preparing the teacher for mathematics classes?; (2) what is the influence of the textbook content and structure on mathematics education?; (3) what is the influence of the textbook on learning, practicing and examining mathematics knowledge?; (4) what is the connection between textbook use and teaching methods?; (5) what is the connection between textbook use and differentiation according to students' abilities?; (6) teachers' opinion on the quality of textbooks.

The past study (Glasnović Gracin, 2011) used statements in the form of a Likert scale, where teachers selected a degree to which they agreed with the given statement. In the present study, statements we re-formulated in the form of open-ended questions. In this way, teachers were able to elaborate on their answers in more detail. In the present study we wanted to compare the results of the past study with the results of the observations and interviews and to gain deeper understanding of textbook use and factors that influence such use.

Since the past large-scale survey answered the question "to what extent are textbooks used", and left open the questions "how and why are textbooks used" as well as "how teachers develop their own instructions regarding textbook content and structure", the research questions that guided the present study were:
1. How do teachers use textbooks in classrooms and why, particularly: a) for teaching and learning new content? b) for exercises, reviewing and homework?
2. What other curriculum resources are used for lesson preparation and in the classroom?

Methodology

Participants

The participants were 12 mathematics teachers from lower secondary education in Croatia (grades 5 to 8) from two different cities in Croatia. They were reached on the basis of personal acquaintances. However, they were not informed about the object of our research. All the participants are qualified to teach mathematics. All of them are experienced teachers: six of them had more than 30 years of teaching experience, and the other six had been teaching between 12 and 25 years. During the school year when the research was carried out three series of mathematics textbooks were used in lower secondary education in Croatia. They were provided by three different publishers (codes P, A and SK). Seven participants used series P, four of them used series A, and one teacher used series SK.

Methods

We used classroom observations and interviews. The questions for these qualitative methods are designed according to the questions and the results of

the past quantitative research. The combination of two qualitative and a quantitative method provides triangulation of the obtained data (Patton, 1990).

Observations. The observations encompassed three to four lessons by each of the 12 teacher participants, making a total of 45 observed lessons. It was chosen to observe only three or four lessons since, according to methodological research findings, no significant information is obtained by observing more than three lessons (Hill et al., 2008). The choice of classes and content units was left up to the participating teachers, as it comes with the curricular plan and program.

The observations were based on a structured plan, with the main focus of identifying the role of mathematics textbooks in real classroom situations. According to Cohen, Manion & Morrison (2007, p. 396) an important "feature of observation as a research process is that it offers an investigator the opportunity to gather live' data from naturally occurring social situations". In order to avoid conscious or non-conscious artificial behaviors and situations, participant teachers were not directly informed that the use of textbooks was the main focus of the observations.

In accordance with the research aims, a table with the main observation categories was designed in advance (Table 1). During the lesson observations, we made notes and comments on every question from the table, but also we made additional notes on the time component (in minutes) and the classroom organization and management. The researchers were familiar in advance with the textbook contents to be taught in a particular lesson. This helped in making comments and answering the questions from observation table.

Table 1.
Questions for lesson observation

A. Measured time of using textbooks during lesson unit
1. How much time are textbooks open in front of students? 2. What is the proportion of time when textbooks were directly used by students?
B. Impact of the textbook on instruction
1. What is the influence of textbooks content and structure (title, language and symbols, order of worked examples, definitions and rules, didactic intentions) on instruction? 2. Does the instruction follow the textbook page by page? What is taken from the textbook?
C. The use of textbook
1. For what purposes is the textbook used during this lesson? 2. How is new content introduced? Is the textbook used during teaching new mathematical content? 3. Which sources are used for practicing and homework? Is the textbook used during practicing and reviewing? 4. Did the teacher point out any specific figure, frame or picture from the textbook? For what purposes?

Interviews. In addition to classroom observations, we conducted interviews with all the participants. The aim was to get a better picture of the textbook use and to compare their answers with the observation results. The interview was semi-structured with a set of open-ended questions and outlines which were specified in advance and are shown in Table 2.

This kind of interview approach enables flexibility and the rich collection of data (Cohen et al., 2007). The interviewers could ask additional questions based on the observed lessons or could expand upon an interesting point arising during the interview. This provides quantitative, as well as qualitative interview potentials, so called prompts and probes (Morrison, 1993, in Cohen et al., 2007). "Prompts enable the interviewer to clarify topics or questions, while probes enable the interviewer to ask respondents to extend, elaborate, add to, provide details for, clarify or qualify their response, thereby addressing richness, depth of response [and] comprehensiveness…" (ibid, p. 361).

Table 2.
Questions and outlines for semi-structured interview

1. Impact of the textbook structure on instruction
Describe how you usually prepare for a mathematics lesson. Does the textbook, in your opinion, influence the structure of your instruction? (Title, definitions, language, symbols, sequence, didactical approach, worked examples, figures) Give reasons for that.
2. Use of textbook
Describe a typical lesson with teaching new content. Describe a typical lesson with emphasis on practicing. (Sub-questions: use of textbook and other materials) Describe a typical revision lesson before a test. Describe how you choose homework activities and from which sources. Do you use textbooks when composing the test? Explain why. Do you use ready-made tests provided by textbook publishers? Do you significantly change your teaching principles when you change the textbook? Explain.
3. Textbook pros and cons
What do you consider the negative aspects of textbooks? What do you like and what is helpful about textbooks? Which criteria do you find the most important in choosing a textbook? (Exercises set, didactical principles, design and color, thickness, figures and pictures etc.)

The interview and observation questions were pre-designed in order to ensure consistency between the two researchers in the interviews and observations.

Data analysis

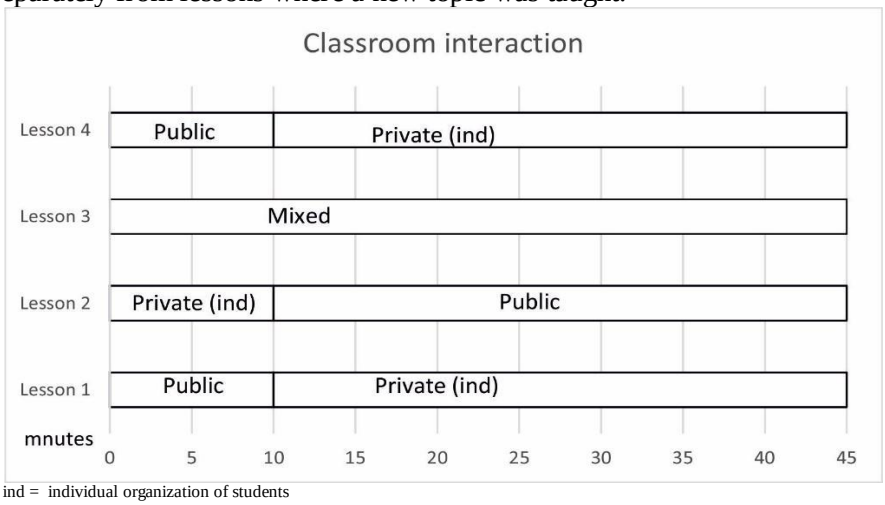
The first part of data analysis involved Classroom Observation Report Tables. The data were analyzed based on the framework given by Johansson (2006), using similar coverage codes (Table 3). Her coverage codes (Classroom interaction, Organization of students, Textbook influence, Mathematical organization) were built upon the TIMSS Video study 1999 coverage codes, which parsed the entire lesson, or a specified part of the lesson, into non-overlapping segments. So every moment of the lesson, or specified part, can be covered by one of the mutually exclusive and exhaustive categories.

Table 3.
Classroom Observation Report Table for Teacher 1

Teacher 1	**Lesson 1**	**Lesson 2**	**Lesson 3**	**Lesson 4**
Lesson type	**Teaching new content**	**Teaching new content**	**Exercising**	**Exercising (Reviewing)**
Textbook use* (minutes)	Absence (10) Direct (20) Indirect (15)	Direct (10) Indirect (30) Direct (5)	Direct (45)	Direct (45)
Classroom interaction* (minutes)	Public (10) Private (35)	Private (10) Public (35)	Mixed (45)	Public (10) Private (35)
Organization of students	Individual	Individual	Individual	Individual

*throughout the lesson progression

Our coding procedure captured following aspects of the classroom discourse: a) type of classroom interaction and organization of students (Figure 1), b) the use of textbook (Figure 2) and c) the role of textbooks in teaching and in other activities. We then generated a report that listed the frequency with which the codes were assigned. This process allowed us to report on those aspects of textbook use that were emphasized and those that were underrepresented in the observed lessons. Also, this enabled us to examine exercise lessons separately from lessons where a new topic was taught.



* ind = individual organization of students

Figure 1. Classroom interaction throughout the lessons for Teacher 1

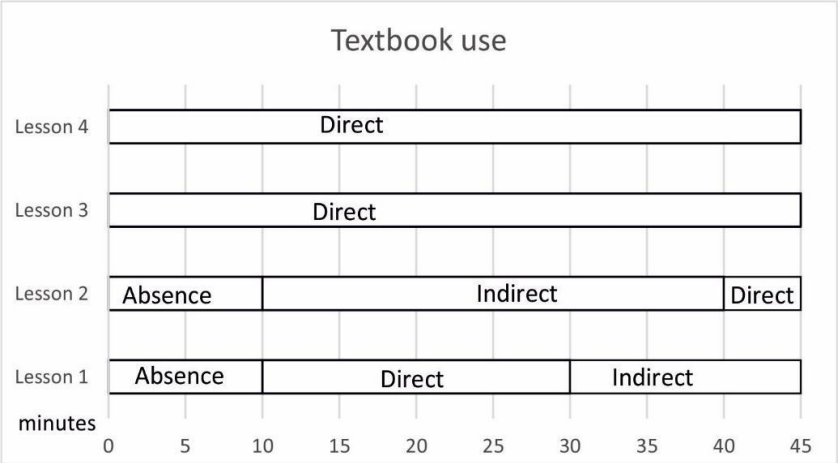


Figure 2. Textbook use throughout the lessons for Teacher 1

In the next stage of data analysis, we analyzed transcribed interviews. Interviews were studied separately from observation data for recurrent themes and patterns, using the constant comparative method (Corbin & Strauss, 1994, in Cohen et al., 2007). Coding and categorizing were done independently by each researcher with the full set of interview data before we agreed on the best categories. When themes and patterns were identified, we returned to the data to find further evidence and conflicting information. The coding captured how teachers described and understood their use of textbooks in lesson preparation, teaching new topics, exercising and reviewing. In assigning a code, we selected a full interviewee response, in order to maintain the full context that would give meaning to the code. The interview data were also studied to support and conflict evidence in relation to patterns identified from the observation.

Results

Impact of the textbook on instruction

Results show that the textbooks are used to a great extent in the observed lessons. In more than half of the observed lessons, the textbook was used directly and followed page by page blindly. The teacher used the same title, terminology, definitions, rules and order as presented in the textbook. In an

additional 16% of the observed lessons, the textbook only partly influenced the instruction. This denotes using textbook directly for some smaller part of the lesson or using it indirectly. Some teachers said: "Open the textbook on page… Look at the title. Copy it into your notebooks" and some even suggested copying the definitions and rules from textbooks. Thus, students were not given the opportunity to explore any issues or particular rules, or to propose a title during the motivational part of the lesson.

In line with the observations, the interviewed teachers mostly acknowledged that they follow the textbook in the classroom, and gave reasons why that is the case. One of the main reasons, according to them, is a concern for students who are absent. By following the textbook, such students can fully learn the subject matter at home.

> Teacher 11: "We follow it [the textbook]. Its structure. If someone was absent, they can catch up." (Original in Croatian, translated by the authors)

One teacher stated that she intentionally uses textbooks so much because she wants to encourage students to learn how to use textbooks properly. She thinks that knowing how to use a textbook in the right way is of benefit in upper secondary education. Another reason that was given by some teachers, is related to any questions and dilemmas that students might have after the lesson. The teachers believe that the textbook can help students work things out.

> Teacher 8: "We do the textbook examples in the classroom. Sometimes I skip them. I mostly have in mind that if someone didn't understand the subject matter in the lesson they can open the textbook and have a look. It's mostly the average students that do that…"

However, some teachers emphasize that they do not follow the textbook blindly. Rather, they combine the main textbook content with other materials. For example, one teacher complains about incorrect or inappropriate definitions given in textbooks.

> Teacher 2: „Well, I like the title to be the same as in the textbook. The definition doesn't have to be the same, but since we have a textbook

> that is appropriate for the students, in my opinion, I think it is very good for children. I always tell them at the beginning of the school year that the textbook is written for them, not for me, you know. And that we won't dictate or write down all the definitions in their exercise books, especially not the long ones... And that they, of course, should use the textbooks for revision, doing exercises and studying at home. I also like to use other textbooks. Because, sometimes, I don't agree with some of the definitions, you know. As an expert, I think they are inaccurate or incomplete, and so on."

Interestingly, in spite of the extensive use of textbooks, the pictures and photos in the textbooks related to the mathematical content were not used to a significant extent in the observed lessons. Three pictures were pointed out by two teachers with the purpose of emphasizing important mathematical facts and relationships. However, the students must notice them because the textbooks are directly used most of the time.

The additional reason for extensive usage of the textbooks in classrooms lies in their economical and social dimension. For instance, parents bought the textbooks in order to be used, so they should be used.

> Teacher 12: "We use the textbook because it has been bought."

Most teachers said that their school chooses the same textbook series every time. In this way "many generations of students can use it". However, two of the participants did not rely heavily on textbooks. They stated that above all, they follow the curricular outcomes for a particular topic, and the textbook for them is just a resource for doing exercises and homework. Those statements were confirmed when we observed them teaching. In their lessons, the textbook was absent.

Learning new mathematical content

Twenty of the 45 observed lessons were focused on the learning of new mathematical content. Most of these lessons (18 out of 20) had public interaction; the teacher was standing in front of the class, and students participated occasionally. This method encompassed presenting information, classroom discussions about the new content, writing on the board, and, in some cases, using presentation software and other materials, e.g. newspaper

ads. The teachers also used structured questioning in some parts of the lesson, where their aim was to lead students to certain conclusions.

In the acquisition phase, teachers used the worked examples in combination with classroom discussion. In a half of the observed lessons, the worked examples were exactly as they are given in the textbook, and the teacher explicitly referred to those examples in the textbook, showing the direct textbook influence on the lesson. The reason for such an approach was elaborated on in the interview:

> Teacher 6: "Well, I follow the textbook, I don't invent any new examples…because they [students] don't pay much attention during the lessons, and they don't copy down everything they should. So in the textbook they can find everything, we did in class… Or if someone was absent because of illness and so on, they can get everything from the textbook."

Some participants used the worked examples in lessons, but here the textbook influence was indirect:

> Teacher 7: "I don't use the worked examples [from the textbook] because students immediately and automatically copy them out without really thinking what they are doing… So I think there's not much point doing these examples in class…That's why I think it is better not to use them, maybe one, but with modified values."

Only two of all the observed lessons had private interaction in the acquisition phase. In one case, the new content was introduced through individual work, and in another lesson it was introduced through group activities. The statements from the interviews correspond with the observation results.
The interviewed participants described the teaching of new content as teaching where they stand in front of the class, and use structured questioning so that students can reach valid conclusions:

> Teacher 6: "The acquisition phase… We always start from something that they already know, or we have done before, something familiar. And then we start talking, this is how we start."

> Teacher 7: "The acquisition phase, well, I take a look what we need to learn and through the stories I lead them to make their conclusions. I present examples from everyday life, and I connect them to familiar content. Students write down everything we do in their exercise books so they know what they should learn."

Exercises, revision and homework

The observations encompassed 25 lesson units with an emphasis on exercise activities. Some of them were revision lessons. Classroom interaction in the exercises was mostly private, using tasks from textbooks, but some lessons had public interaction where the teacher occasionally gave explanations, writing them on the board. When it comes to organization of students, individual seatwork for doing exercises was predominant in the observed lessons, but some teachers also used pair and group activities.

Other materials provided by the teacher were also used as a resource for practicing (worksheets, exercises from other textbooks, web material, etc.). However, they were not used to such an extent as textbooks. The observation results showed that the textbook was used directly as a source for exercises, particularly after learning new content (in 85% of such lessons). This is confirmed in the interviews:

> Teacher 7: "After the new content has been presented we do exercises from the textbook."

Lessons where the emphasis was just on doing exercises (without the teaching of new content) were combined with the direct use of the textbook and other materials. The teachers emphasized this in interviews:

> Teacher 10: "I use many different resources… I use a variety of textbooks."

> Teacher 3: "Today we did the exercises from worksheets... I also use other textbooks and other resources for doing exercises, you know. Not just this [official] textbook."

Still, the textbook was predominant in more than half of the lessons, where students were mainly doing exercises. Here, the textbook was used mainly

directly, and in some cases indirectly, because the tasks on the worksheets were similar to those tasks written in the textbook. Only one of the participants had not used the textbook as the primary source for exercises. On the selection of textbook exercises she said:

> Teacher 4:"The sources for practicing are… from everywhere. A lot from worksheets, very few from textbooks because I can't find… It would be messy, one exercise from this page, another from that page, another from ten pages on …"

However, even this participating teacher used the textbook for homework, as we observed. The textbook seems to be the main source for homework activities. It was used for homework in 71% of all observed lessons. The interview statements confirm these findings:

> Teacher 11: "Homework is from the textbook. So that they can work on things we've done."

> Teacher 9: "I mostly give homework from the textbook, but I also direct my students to exercises from other sources, for example from the internet."

The findings suggest that the textbook is the main source for exercises and homework in mathematics education. Accordingly, the textbook content influences the test content. Some teachers use ready-made printed tests provided by the textbook authors. Others compose their own tests with the items influenced by textbook content. For problem-solving-oriented test items, teachers reach for other materials, as well.

Use of other materials

The findings from the previous subsection reveal that, in spite of the predominant use of textbooks, other materials are used as well. In the interview, most participants stated that they use many sources for lesson preparation, not just textbooks.

> Teacher 11: "I use the textbook, I use other textbooks, I use the internet."

> Teacher 10: "I use a variety of resources in lesson preparation, textbooks by different authors and publishers, teachers' books, encyclopedias, the internet. Many sources."

Although the survey participants in the past study (Glasnović Gracin, 2011) stated that they prepare lessons from different sources, the observations in this study showed that the textbook plays the central role in classrooms; we felt the presence of textbooks during most of the observed lessons. In 31 out of 45 lessons, textbooks were directly used by students for more than 15 minutes. Textbooks were used directly by students for 53% of the total time in the observed lessons. They were open on the desks in front of students for 60% of the observed lesson time. Other materials were also used, but not to such an extent. These were worksheets made by the teacher, exercises from other textbooks, web material, journals, e-material (usually presentations), worksheets from the teacher guide, etc. They were mostly used for practicing. One teacher used authentic newspaper ads as a way of presenting new mathematical content.

Discussion and Conclusion

The observation and interview results extended the results of the past study (Glasnović Gracin, 2011). We wondered if teachers in the past study (survey) gave socially acceptable answers that differed from their real teaching practice. The teachers' self-reports of their teaching practice cannot be assumed to correspond exactly with what they do in the actuality of the classroom (Bretscher, 2014). The interviews and classroom observations helped in clarifying our understanding of how and why the textbooks are being used in classrooms. We were able to examine how the textbook actually influences the teaching instruction, learning new content, exercising and assigning homework.

Impact of the textbook on teaching instruction

The results of the present study show that teachers design their instructions using textbooks as the main source for classroom activities. Other sources, such as other textbooks, web and e-material, worksheets, teachers' guides, are used, but not as a main resource for teaching. These results correspond to the findings of the past study (quantitative survey) in Croatia (Glasnović Gracin,

2011) as well as to research results from other countries (Bromme & Hömberg, 1981; Schmidt et al., 2001; Zhu & Fan, 2002).

In their lesson preparation, teachers decide what content, order, methods and pedagogical intentions to use and follow from the textbook. During the classroom observations, most of the participants used textbooks directly, following them as closely as possible, which can be seen as "offloading" (Brown, 2009), i.e. using the textbook in a literal fashion. In the interviews, the participants explained that they follow the textbook so rigidly because they want to help any absent students to follow what was done in school, as well as students who may need to read the textbook at home to clarify what was done in class. Also, some participants explained that textbooks are extensively used because they are bought to be used; parents expect the textbooks to be used.

Since teachers heavily rely on textbooks in their preparation, these results raise the question whether the textbook is written for the teacher or the student. Textbooks are presented as students' books, but the instruction is carried out according to the teacher's intentions and is often strongly influenced by textbook content. Van Dormolen (1986) discussed whether it is really possible to write "a teacher-proof-text" (p. 141). It seems that the teacher's presence as mediator of the text is always one of the teacher's tasks.

A further question related to a teacher's preparation refers to mistakes in textbook content. In spite of the authors' competence and good intentions, mathematical and other mistakes are always possible in textbooks. How do teachers identify and handle possible textbook mistakes? This is an interesting question, particularly regarding the authority of textbooks (Johansson, 2006; Pepin and Haggarty, 2001). Two of the interviewed teachers mentioned some *problematic* textbook content. They refer to mathematical incorrectness, but also to content that is not appropriate to the students' age. In cases such as these, the teachers say that they consult other sources and change or adjust the content.

However, two of the participants did not rely heavily on the textbook, and one participant improvised her strategies. In the case of these teachers, the textbook influence was minimal, used only for assigning homework, and the textbook was absent from the lessons. These teachers claimed they rather follow the curricular outcomes, and the textbook for them is just a resource

for doing exercises and homework. These could be seen as "adapting and improvising with curriculum materials" (Brown, 2009), i.e. teachers adapted various curricular materials in a way that reflected contributions of those materials and their personal resources. However, these teachers explain that they do not want to change the selected textbook for social reasons: so that many generations of students can use the same textbooks without having to buy new ones. Buying new textbooks can be a financial strain for parents in Croatia; in this way a social aspect is apparent in classrooms.

Use of textbooks

The observations and interviews helped in examining in-depth the past (quantitative) study results about the use of textbooks in classrooms: public interaction dominates in teaching new content with direct textbook influence, and private individual interaction dominates in exercising with direct textbook influence as well. This means that the presentation of new content and doing worked examples are mainly teacher-led on the board, influenced by textbook content, and supplemented with structured questioning. Moreover, these activities are further followed by individual practicing, mostly from the textbook. The textbook package is the main source for mathematics exercises in Croatia and other countries (Hopf, 1980; Pepin & Haggarty, 2001; Johansson, 2006). The interviewed participants claimed that is so because the textbooks contain a wide selection of exercises: from simple to complex ones, and students can follow the textbook easily.

The mathematical requirements in Croatian textbook exercises are given in the analysis by Glasnović Gracin (2011): the findings showed an emphasis on procedures, reproduction and intra-mathematical requirements in Croatian textbooks. Still, some teachers, interviewed in the present study, complained about the predominance of reproduction and the lack of problem-solving tasks in textbooks. This was the reason for reaching for other resources. So, teachers conduct constant and dynamic interplay between curriculum resources and the teacher's personal resources (Brown, 2009).

The extensive use of textbooks raises questions about educational traditions and their influence on contemporary instruction. According to Pepin and Haggarty (2001), this presents one of six aspects that affect textbook use. According to Ewing (2004, p. 231) "teachers who rely on teaching mathematics from a textbook also learned mathematics this way". Further he

stated that that is because "the pedagogical approach that has informed the teaching and learning of mathematics is framed largely around the transmission of knowledge; changing this tradition has been met with strong resistance, despite commitment to reforms in mathematics classrooms" (p. 231). In addition to that, one of the questions in our interview was "Do you significantly change your teaching principles when you change the textbook?" All the participants answered negatively. This means that beliefs and the way of teaching are strongly incorporated into educational traditions.

As well as the method of teaching, educational traditions encompass textbook content, too. Textbooks reflect the goals of the national curriculum and the cultural and educational traditions of a particular country (Pepin & Haggarty, 2001). Mathematics textbooks have preserved and transmitted mathematical knowledge, skills and some fragments of educational traditions through the centuries (Love & Pimm, 1996). Croatian textbooks should be studied from this approach as well. These issues illuminate the complexity of the relationship between teachers and textbooks in classroom settings (Mesa & Griffiths, 2012).

Final Remarks

The present study, reported in this paper, has enabled us to gain a deeper understanding of textbook utilization in Croatian classrooms. The results of the study, conducted with qualitative methods, support the results of an earlier (past) large-scale study, conducted via questionnaire (Glasnović Gracin, 2011). But rather than looking at the results as validation or verification of previous findings, we should approach them from another aspect. This study is a more complete, holistic and contextual portrayal of textbook use in the classroom. The (official) textbook is a vital and important curriculum resource, used for lesson preparation, teaching, assigning homework and practicing, regardless of its deficiencies and other existing curriculum resources. But the reasons for using the textbook go much deeper than the usual understanding that the textbook is used because of teachers' discomfort with the subject matter or lack of pedagogical content knowledge. These issues should be examined further in another study.

Finally, we have to address some limitations of the study. We investigated teaching practice among 12 teachers working in city schools. The question is whether our results would be different if we investigated teachers from rural schools. We believe that there would be no significant differences, since the results of this study match previous findings. Another possible problem could be the time lag between studies. However, the same textbooks were being used in the Croatian schools at the time both studies were conducted, and the teachers in this study were teaching in the schools when the earlier study was conducted. Therefore, we believe that the time lag did not have an effect on our findings.

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Authors:

Dubravka Glasnović Gracin (corresponding author: dubravka.glasnovic@ufzg.hr), Faculty of Teacher Education, University of Zagreb, Savska cesta 77, 10 000 Zagreb, Croatia. **Ljerka Jukić Matić** (ljukic@mathos.hr) Department of Mathematics, University of Osijek, Trg Ljudevita Gaja 6, 31000 Osijek, Croatia.