

INTEGRATION OF THE MATHEMATICS TEXTBOOKS IN THE TEACHING/LEARNING PROCESS

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ABSTRACT. Research shows, that textbooks are important in teaching and learning Mathematics. The goal of the article is to study how teachers and their pupils use the mathematics textbook. The research tool is a questionnaire; the sample is made of 60 mathematics teachers. The results show that teachers mostly use the textbook to prepare their lessons and to assign homework for their pupils. Students mostly use the textbook to solve the given problems. There is a correlation between the teacher guidance on textbook use and how pupils use their textbooks.

Keywords: mathematics textbook, self-regulated learning

ZUSAMMENFASSUNG. Die Forschung zeigt, dass wichtige Lehrbücher in Lehre und Lernen Mathematik sind. Das Ziel des Artikels ist zu untersuchen, wie Lehrer und Schüler die Mathematik Lehrbücher verwenden. Das Recherche-Tool ist ein Fragebogen, wird die Probe von 60 Mathematiklehrer gemacht. Die Ergebnisse zeigen, dass die Lehrer meist mit dem Lehrbuch, um ihren Unterricht vorzubereiten und Hausaufgaben für ihre Schüler zuweisen. Studenten meist mit dem Lehrbuch der gegebenen Probleme zu lösen. Es gibt eine Korrelation zwischen dem Lehrer Anleitung Lehrbuch verwenden und wie die Schüler ihre Lehrbücher verwenden.

Schlüsselwörter: Mathematik Lehrbuch, selbstgesteuertes Lernen

1. Introduction

Textbooks are important in teaching and learning Mathematics. There are researches in different countries, about use of mathematics textbooks by teachers and/or pupils (for example, Pepin & Haggarty, 2001; Regis, Approva & Reys, 2006; Rezat, 2009).

The goal of this article is to present a research made among mathematics teachers from Romania about the use of the textbook by themselves and their pupils.

2. Theoretical background

Textbooks are “designed to provide an authoritative pedagogic version of an area of knowledge.” (Stray, 1994, p. 2)

Textbooks from the same country, written based on the same curricula can be very different. In different textbooks the same mathematical topic can be

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presented using different methods. Also the content of different textbooks can vary, even if they are written according the same curriculum: one textbook can emphasize a subject more than other textbook; the order of the presented topics and the logical connections between these topics could be different. Analyzing mathematics textbooks from Sweden, Johansson (2005) has concluded, that textbooks do not always follow closely the guidelines of the curriculum; this is also a source of differences.

The content and how this content is presented are also important. Research shows that usually the contents presented in textbooks are more likely to be taught by the teacher in the classroom; and teachers rarely present contents not included in the textbook (Freeman & Porter, 1989; Reys et al., 2003). As mathematics teaching should be problem-orientated, one important factor of evaluating a mathematics textbook is regarding the problems given in the book. Ceglédý and Kovács (2008) in their evaluation criteria for mathematics textbooks consider important the presents of control problems for students to evaluate their individual learning after each unit. Another important aspect is regarding the problems given in the textbooks. These problems should be enough for classroom activities and homework and the difficulty of these problems should be marked in the textbook.

Textbooks doesn't replace the teacher, he/she has an important role to mediate the content to the pupils (Love & Pimm, 1996). There are aspects of problem solving, which are difficult to be put in a textbook. For example, the textbook can't deal with pupils' incorrect solutions; can't reformulate the problem, if needed; can't give the required hints (Kang & Kilpatrick, 1992); can't check the correctness of a different solution given by the pupil. Thus it is important to know how often and how teachers use the textbooks.

Freeman et al. (1983) categorize the ways of using the textbooks by the teachers in four styles: textbook bound (progressing page-by-page in the textbook), selective omission (progressing from the beginning to the end, but omitting some parts), focus on the basics (focusing on some parts and omitted other parts), and management by the objectives (focusing on the main objectives of teaching mathematics and selecting the contents from the textbook for reaching these objectives).

Regis, Approva, and Reys (2006) have conducted a research on use of district adopted mathematics textbook in U.S. middle schools. The research took place during two years with 51 teachers in the first year and 66 teachers in the second year. Every teacher has written a textbook-use diary in which has recorded 30 instructional days. 39% of the teachers used their textbook at least 90% of the documented instructional days, 70% used their textbook 75% of the documented days, one teachers used less than half of the days. 59% of the teachers used the textbook mainly to prepare the lesson.

A study on textbooks use in France, Germany and England shows, that most of the teachers use the textbook more for the exercises than for the theoretical

part. The theoretical part is used differently in different countries: German teachers use different worked examples than in the textbook; French teachers present the rules differently than in the textbook (Pepin & Haggarty, 2001).

Another aspect to be studied is how pupils use the mathematics textbooks. In many cases teachers are influencing pupils' textbook use. For example, if the teacher asks pupils to use the textbook to study the solved problems, most of the pupils will do this. But if the teacher has never asked pupils to read and resolve the worked examples, most of the pupils will not do it.

The results of a research made in four classes of a German school shows that students do not only use the textbook, when they are told to by the teacher. When solving problems students look up for worked examples or boxes with kernels (Rezat, 2009).

Using an efficient way an adequate textbook by the pupils, their self-regulated learning skills could be developed. Self-regulated learning (SRL) is an academically effective form of learning, through which the learner set goals and make plans before starting to learn; monitor and regulate his/her cognition, motivation and behavior during the learning process; and reflect on his/her learning process (Pintrich, 1995; Pintrich, 2000; Zimmerman, 2001).

3. Research

The aim of the research is to study teachers and pupils mathematics textbook use during the teaching and learning process.

There are three research questions:

- 1) Do teachers use the mathematics textbook and for what purposes?
- 2) Do teachers use the mathematics textbook and for what purposes?
- 3) There is any correlation between teachers' and their pupils textbook use behavior?

Research design

The survey was conducted during the second semester of the school year 2009/2010 in secondary schools from the north-vest part of Romania (Transilvania region).

A questionnaire was developed for inquiring teachers how they use the mathematics textbooks and what they have observed about their pupils' textbook use. The questionnaire contained three demographical questions (sex, age and teaching experience of the respondents), six items regarding teachers' textbook use, and five items regarding how pupils' use the textbooks.

The sample of the research is made form 60 mathematics teachers, 17% male and 83% female. This distribution by sex reflects the reality in the Romanian educational system. Regarding the age of the respondents, half of them are between 31 and 40 years old, 18%-18% are between 25 and 30 respectively 41-50 years old, 12% less than 25 years old. The less represented category is the 51-60 years old teachers (Figure 1). This could be explained by the fact, that some of the teachers

from this age-group are already retired. In Figure 2 we could observe the teaching experience of the respondents. Most of the teachers have 11-15 years of experience (31% of the respondents); 20%-20% of the teachers has 2-6 respectively 7-11 years of experience (Figure 2).

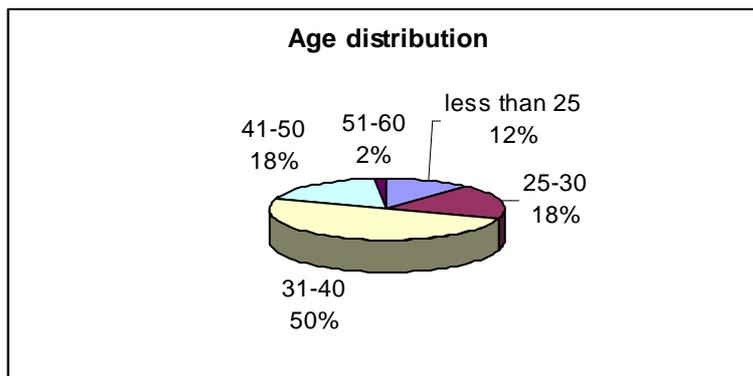


Figure 1. The age distribution of the respondents

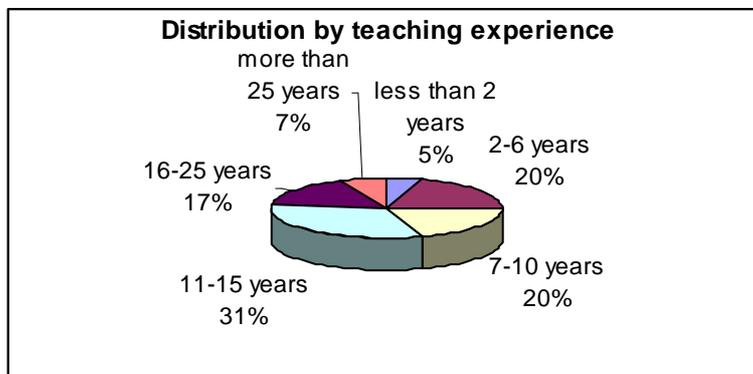


Figure 2. Distribution of the respondents by teaching experience

Results

The questionnaire contains six questions regarding teachers' textbook use. Respondents have to mark on a five step scale how typical for them the given textbook use behavior is. Teachers' responses can be found in Table 1.

Table 1.

Teachers' textbook use

	Not typical at all for me (%)	A bit typical for me (%)	Typical for me (%)	Very typical for me (%)	Totally describes me (%)
I never use the textbook.	45.00	46.67	8.33	0.00	0.00
I use the textbook to prepare the lesson.	5.00	23.33	35.00	20.00	16.67
I select problems from the textbook for the lessons.	1.67	20.00	36.67	21.67	20.00
I assign problems for homework from the textbook.	0.00	16.67	28.33	26.67	28.33
I ask my pupils to read the theory from the textbook during the lesson.	58.33	30.00	10.00	1.67	0.00
I ask my pupils to read the worked examples from the textbook at home.	45.00	25.00	23.33	6.67	0.00

Teachers were also asked about their pupils' textbook use habits. The respondents have to mark on a five step scale how many percentage of their pupils are using textbooks for the specified purpose. The responses are summarized in Table 2.

Table 2.

Pupils' textbook use observed by the teacher

	Less than 20% (%)	21%-40% (%)	41%-60% (%)	61%-80% (%)	81%-100% (%)
My pupils don't use the textbook at all.	60.00	20.00	5.00	13.33	1.67
My pupils read the theoretical parts from the textbook	68.33	8.33	6.67	16.67	0.00
My pupils study the worked problems from the textbook.	48.33	31.67	15.00	3.33	1.67
My pupils solve the problems given in the textbook.	15.00	30.00	16.67	26.67	11.67
My pupils search for the formulas in the textbook.	41.67	25.00	10.00	20.00	3.33

To get the answer for the question if there is correlation between teachers' and pupils' textbook use, we have calculated Pearson correlation coefficients (Table 3).

Table 3.
Correlations between teachers' and their pupils textbook use (df=58)

	My pupils read the theoretical parts from the textbook	My pupils study the worked problems from the textbook.	My pupils solve the problems given in the textbook.
I ask my pupils to read the theory from the textbook during the lesson.	.26**		
I ask my pupils to read the worked examples from the textbook at home.		.50*	
I assign problems for homework from textbook.			.17

* Significance level .01

** Significance level .05

Discussion

Regarding the first research question, we have found out, that most of the teachers use the textbook in their work. It is surprising, that 8.33% of the respondents said, that it is typical for them, that they never use the textbook. Textbooks offer a didactical processing of the scientific content, thus it is useful for a teacher to see this approach, even if he/she doesn't follow it closely. Textbooks also contain problems, which can be solved in the classroom or for homework.

To get a summarize view on textbook use by teachers, we have added up the first two options ("not typical for me" and "a bit typical for me") into "not typical", and the last three options ("typical for me", "very typical for me", and "totally describes me") into "typical" (Table 4).

Table 4.
Teachers' textbook use

	Not typical (%)	Typical (%)
I never use the textbook.	91.67	8.33
I use the textbook to prepare the lesson.	28.33	71.67
I select problems from the textbook for the lessons.	21.67	78.34
I assign problems for homework from the textbook.	16.67	83.33
I ask my pupils to read the theory from the textbook during the lesson.	88.33	11.67
I ask my pupils to read the worked examples from the textbook at home.	70.00	30.00

Most of the teachers (83.33%) use the textbook to give problems for homework and to choose problems for the lesson (71%). They use the textbook to prepare their lesson (71.67%), but they don't use it with their pupils in the classroom for the theoretical part of the lesson (only 11.67% of the respondents ask their pupils to read the theory from the textbook). Only 30% of the teachers ask their pupils to read the worked examples from the textbook at home.

As regarding pupils' textbook use, they mostly use the textbook to solve the given problems (26.67% of the teachers stated, that between 61%-80% of their pupils solve the given problems from the textbook, 11.67% of the respondents said, that between 81%-100% of the pupils solve the problems from the textbook). Almost half of the teachers (48.33%) said, that less than 20% of their pupils read the worked examples from the textbook. Worked examples help pupils to acquire problem solving methods. Research shows that studying worked examples it is an effective and efficient way of learning mathematics (Paas & van Gog, 2006).

68.33% of the respondents said, that less than 20% of their pupils read the theoretical part from their textbook; 41.67% of the teachers stated, that less than 20% of their pupils search for the formulas in the textbook. Usually pupils have two sources for learning the mathematical concepts, theorems, and formulas: their copybook and textbook. As in the copybook they are mostly solving problems, the main source for the theoretical part should be the textbook. Thus these results about reading the theory and searching for formulas from the textbook is surprising. Also pupils have to learn how to read a mathematical text, and reading their textbook could be a good practice.

Studying the correlations between teachers' guidance for using the textbook and pupils' textbook using habits, we observe that there is a correlation (Table 3). There is a significant correlation ($p < .01$) between teachers' guidance of reading the worked examples and pupils studying the solved problems from the textbook. There is also a significant correlation ($p < .05$) between teachers' guidance of reading the theory and pupils studying the theoretical part from the textbook.

4. Conclusions

The results show that teachers mostly use the textbook to prepare their lessons and to assign homework for their pupils. Students mostly use the textbook to solve the given problems. There is a correlation between the teacher guidance on textbook use and how pupils use their textbooks.

REFERENCES

1. Ceglédy, I.; Kovács, A. (2008). How to choose a textbook on Mathematics? *Acta Didactica Napocensia*, 1(2), 16-30.
2. Freeman, D. J. & Porter, A. C. (1989). Do Textbooks Dictate the content of Mathematics Instruction in Elementary Schools? *American Educational Research Journal*, 26(3), 403-421.

3. Johansson, M. (2005). Mathematics textbooks – the link between the intended and the implemented curriculum? The Mathematics Education into the 21st Century Project, Malaysia, 119-123.
4. Kang, W & Kilpatrick, J. (1992). Didactic transposition in mathematics textbooks. *For the Learning of Mathematics*, 12(1), 2-7.
5. Love, E. & Pimm, D. (1996). 'This is so': a text on texts. In A. J. Bishop; K. Clements; C. Keitel; J. Kilpatrick & C. Laborde (Eds.), *International handbook for mathematics education* (vol. 1, pp. 371-409). Dordrecht: Kluwer.
6. Pepin, B. & Haggarty, L. (2001). Mathematics textbooks and their use in English, French and German classrooms: a way to understand teaching and learning cultures. *Zentralblatt fuer Didaktik der Mathematik*, 33(5), 158-175.
7. Pintrich, P. R. (1995). Understanding self-regulated learning. In: Pintrich, P. (ed.), *Understanding self-regulated learning* (pp. 3-13). San Francisco, CA: Jossey-Bass Inc.
8. Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In: Boecaerts, M.; Pintrich, P. R.; Zeidner, M. (eds.), *Handbook of self-regulation* (pp. 451-502). San Diego: Academic Press.
9. Regis, T. P.; Approva, A. & Reys, B. J. (2006). What role do textbooks play in U.S. middle school mathematics classroom? *Taiwan Journal of mathematics Teachers*, 5, 10-20.
10. 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*, 34(1), 74-95.
11. Paas, F. & van Gog, T. (2006). Optimising worked example instruction: Different ways to increase germane cognitive load. *Learning and Instruction* 16, 87-91.
12. Rezat, S. (2009). The utilization of mathematics textbooks as instruments for learning. *Proceedings of CERME 6*, January 28th – February 1st 2009, Lyon, France, 1260-1269.
13. Stray, C. (1994). Paradigms regained: towards a historical sociology of the textbook. *Journal of Curriculum Studies*, 26(1), 1-29.
14. Zimmerman, B. J. (2001). Theories of self-regulated learning and academic achievement: An overview and analysis. In: Zimmerman, B. J. & Schunk, D. H. (eds). *Self-regulated learning and academic achievement: Theoretical perspectives* (pp. 1-39). Mahwah, NJ: Lawrence Erlbaum.

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