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EXAMINATION OF MATHEMATICS TEXTBOOKS IN USE IN HUNGARIAN PRIMARY SCHOOLS IN ROMANIA

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Abstract: A good textbook must meet a number of pedagogical, psychological, scientific, esthetical, and other requirements. The presented research examines whether the mathematics textbooks in use in Hungarian primary schools in Romania meet those requirements. We used documentation, contents analysis and surveys as research methods. We examined the mathematics textbooks against requirements in appearance, style and language, editing, approach and contents material. Following contents analysis we can state as a positive result that the textbooks provide a great variety of problem solving tasks, while meeting the principle of progressivity. Nevertheless, they contain mathematical mistakes, scientific inaccuracies, are not in total agreement with the curriculum and their language is inappropriate. These findings are supported by the results of our survey. The hundred and two teachers asked in the survey gave a medium qualification to the primary school mathematics textbooks. The most often quoted flaws are the lack of differentiated, layered and task based teaching material, as well as the inappropriate language owed to bad translation of the textbooks originally written in Romanian.

Key words: textbook, curriculum, mathematics teaching

1. Introduction

According to Pólya György mathematics is the least popular subject (Pólya, 2005). Mathematical concepts should be taught inductively, with the discovery teaching approach, instead of choosing the 'Here you are! Just learn the rules!' method (Skemp, 2005). Nobody can be a good consumer in the knowledge based modern society, unless they possess an appropriate level of technical and computer skills (Andras et all, 2010). Based on research, the European Council recommends that mathematics, and natural sciences in general, should be taught with their practical application in mind (Ambrus, 2007; Baranyai – Tempfli 2010; Dienes, 2005).

Subsequently, the roles of a good mathematics textbook are fostering discovery by the learner, containing life-like tasks and problems to solve, as well as popularizing mathematics among the children. In order to fulfil those tasks the textbook writers should not only be keen mathematics scientists, but also very well informed on pedagogy. They must be aware of the functions of textbooks (Ábrahám, 1993; Manolescu, 2004; Karlovitz, 2005; Kojanitz, 2005), and of the requirements they have to meet (Ábrahám, 1993; Karlovitz, 2005), so that the primary school children would have really good mathematics textbooks to use.

2. Textbook features

Mathematics textbooks, as all textbooks, have to be in accordance with the subject curriculum. The subject curriculum contains the pedagogical content on offer for each subject for a school year. It is at the basis of the work schedule design.

The subject curricula from Romania have a unitary structure built up of the following blocks: general and detailed design requirements, learning activities, learning content, output descriptors, and, possibly methodological suggestions, assessment methods.

The textbook is the document that conveys information, processes and lets information processed (Fodor, 2005). To the teacher it gives direction and guidance while to the learner it is the main tool for scientific learning and discovery. Alternative textbooks have spread in Romania owing to a reform in

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education. Unfortunately, it is not always possible to choose from several mathematics textbooks in Hungarian as there are study years for which only one such mathematics textbook has been designed.

In specialized bibliography there are several functions attributed to textbooks. We highlight the most important ones as follows (Manolescu, 2004; Karlovitz, 2005):

- Motivation -illustration, problem posing, other means of, and interesting things, for fostering thinking.
- Knowledge transfer: life-likeness, intelligibility, scientific correctness.
- Classification: structure.
- Coordination: harmonization with other textbooks.
- Differentiation: subject matter adjusted for different levels.
- Learning coordination, teaching learning strategies: using the tools that can direct the learning process in class and at home.
- Triggering self-assessment: number and variety of questions and tasks for revision and practical application of knowledge.
- Values education: number and variety of means of triggering emotional effects.

For the textbooks to fill their real function, they need to meet certain requirements. Let us sum up the criteria that textbooks should meet according to the special bibliography. Five important criteria groups could be highlighted: appropriate look/design, (esthetical criterion) -style, correct and high-quality language use-, structuring, content and approach, that materialize in the conveying of values and developing character (Karlovitz, 2005; Kojanitz, 2005).

In our research, we have focused on the language and scientific content of the mathematics textbooks, as well as on the degree in which they meet the subject curriculum. Nevertheless, we present other characteristics of the textbooks, as well.

3. Research presentation

This research paper presents the mathematics textbooks written in Hungarian, in use in elementary schools in Romania.

The research question: Do elementary school mathematics textbooks meet the requirements imposed on them?

Researching methods used were documents and content analysis and surveying with questionnaires. The questionnaire we have designed was answered by 102 teachers.

The research hypotheses:

1. The mathematics textbooks meet the requirements imposed on textbooks halfway.
2. The mathematics textbooks translated from Romanian language are of a lower quality as compared to the textbooks originally written in Hungarian.
3. Mathematics textbooks are harmonized only halfway with the subject curriculum.
4. The textbooks contain scientific mistakes and errors.
5. They do not contain enough practice material, tasks to solve.
6. The language of the mathematics textbooks translated from Romanian is on lower standards as compared to the language of the textbooks written in Hungarian.
7. Most of the primary school teachers would like to co-operate in textbook writing projects.

4. Presentation and interpretation of the results of the documents and content analysis

During the documents and content analysis we examined the mathematics textbooks in use in elementary schools, while studying the subject curricula for each year of studies, and, at the same time comparing the two.

As most of the primary school teachers surveyed use the textbook of the Aramis Publishing House from Bucharest in the 1st and 2nd years and the textbook of the T3 Publishing House from Sfantu Gheorghe in the 3rd and 4th year, we examined those in our research.

The title of the 1st year mathematics textbook: *Mathematics, Textbook for the 1st year of primary school*, its authors: Victoria Pădureanu, Tudora Pițilă, Cleopatra Mihăilescu, translated by: Szőcs Csilla, publishing year: 2004. With respect to the appearance of the textbook, its binding is durable; its cover is made of thicker cardboard, corresponding to the age level of the children. On comparing the textbook with the subject curriculum we have found that there are differences in the adaptation of the contents, but there are no major differences or missing content parts. Generally speaking the examined textbook conforms to the subject curriculum.

With respect to the language used in the textbook, there are very many grammar and spelling mistakes, which probably emerged from translation. There are a number of mathematical terms appearing in Romanian, which prevents the learners from acquiring accurate mathematical terminology. In addition, the riddles that can be found in the first part of the book do not really suit the age of the children.

The title of the 2nd year mathematics textbook: *Mathematics, Textbook for the 2nd year of primary school*, its author: Rodica Chiran, translated by: Füleki Katalin, publishing year 2004. With respect to its appearance the textbook has durable binding and thicker cardboard cover, suitable for the children of the corresponding age. The textbook conforms to the subject curriculum. It contains many grammar and spelling mistakes, but, what is more serious matter, there are scientific content mistakes, as *e.g.* on page 22: 'term – term = total', page 60: 'term – term = difference'.

The title of the 3rd year mathematics textbook: Mathematics, *Textbook for the 3rd year of primary school*, its author: Szitai Tünde-Klára, publishing year: 2005. Concerning its appearance, the textbook can be said to have durable binding, thicker cardboard cover, corresponding to the age group of the children. As compared to the textbooks used in the first two years of study, it contains much fewer grammar and spelling mistakes. While comparing it to the subject curriculum we find that it does not present some of the prescribed mathematical concepts, *e.g.* the double and triple of natural numbers. The language of the textbook does not always suit the children's age, *e.g.* it uses the term 'demonstration'. It uses foreign terminology for the properties of the four fundamental arithmetical operations even though that is contrary to recommendations in the subject curriculum, while forgetting to introduce one of the properties, although it is prescribed by the curriculum. A positive feature of the textbook is its pictures, which are grouped around certain subject matters and lead the children into 'Numbersland'.

The title of the 4th year mathematics textbook: *Mathematics, Textbook for the 4th year of primary school*, its authors: Nemes Emil, Nemes Ildikó, publishing year: 2006. As far as its appearance is concerned, the textbook could be said to have durable binding, hard cover and that it suits the children of the corresponding age. The textbook does not totally conform to the subject curriculum, it omits compulsory material, while dealing excessively with optional material (*e.g.* trapezium). The geometry chapter contains many scientific mistakes. There are several conceptual misinterpretations: 'The rectangle is the polygon in which the opposite sides are parallel, its parallel sides are equal'. A positive feature is that it contains a variety of problems to solve, obeying the principle of progressivity, as well as a great number of logical problems highlighted with a different letter font.

5. Presentation and interpretation of the results of the questionnaire survey

The mass of people for the survey was provided by the primary school teachers of the Hungarian schools in Satu Mare County. From among them, 102 teachers were selected with layered sampling.

The sample was divided in several different groups according to education level, experience, didactic degree, place of teaching and age level taught. The sample distribution plotted against the different variables can be seen as follows:

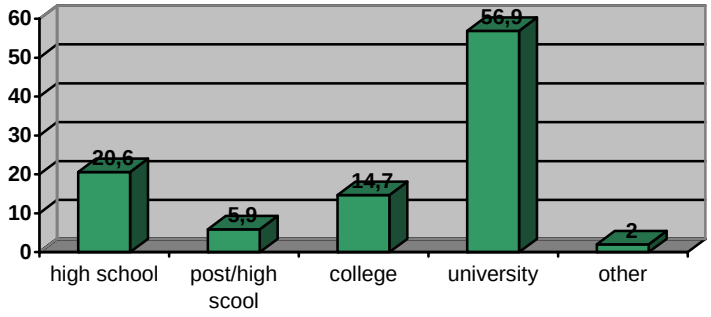

Figure 1. *Sample distribution plotted against education level*

As seen in Figure 1. more than half of the sample possess a University Degree in primary school teaching (56.9%), the number of teachers with a pedagogical high school Diploma and a Teacher Training College Degree is low. The data in Figure 1 show the tendency that most of the teachers pursue or complement their education to get a degree in the Bologna system.

Sample distribution against experience – as shown in Figure 2 – favoured teachers with 11-20 years experience from among the selected layers (0-2 years, 3-5 years, 6-10 years, 11-20 years, over 20 years).

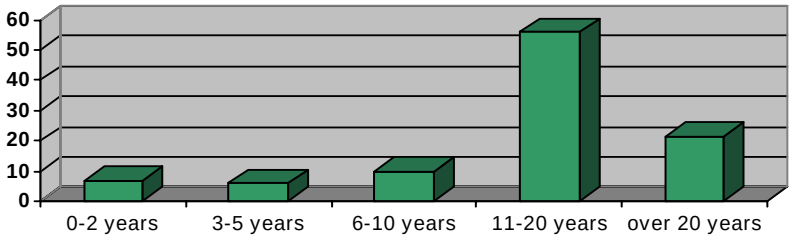

Figure 2. *Sample distribution plotted against work experience*

We selected in the sample mostly (55.9%) teachers who were teaching their third cycle of primary classes, so that they had had the opportunity to use different textbooks, thus possessing a reference for comparison in examining the textbooks presently in use. Nevertheless, beginner teachers and teachers close to a retiring age are also found in the sample, though in a smaller number.

As far as the sample distribution according to didactic degree is concerned (Figure 3) it can be stated that the largest part of the sample is made up of teachers holding a first grade didactic degree (48%), as we considered they had more competence in evaluating mathematics textbooks owing to their greater professional experience.

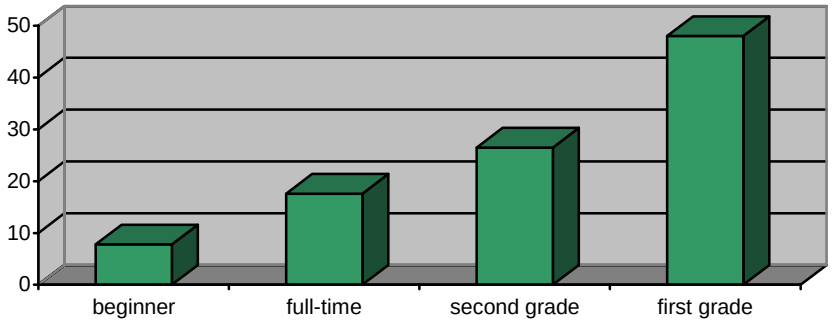

Figure 3. *Sample distribution according to didactic degree*

Also in the sample there can be found beginner teachers (7.8%), full-time professional degree holders (17.6%), as well as second grade didactic degree holders (26.5%).

As far as place of teaching is concerned teachers from urban areas are over represented (64%).

Concerning the age level taught the teachers are grouped in homogeneous layers. As seen in Figure 4, there are an almost equal number of teachers working with each age group in the 1st, 2nd, 3rd, and 4th year of studies of the primary school.

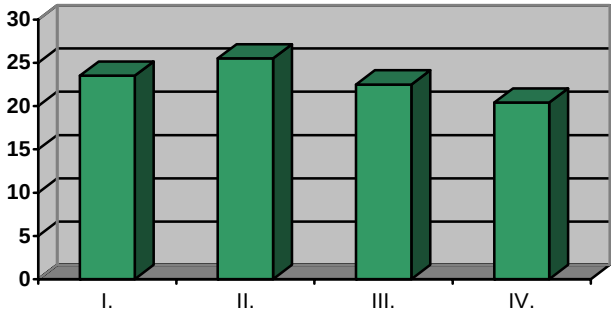

Figure 4. *Sample distribution according to age level taught*

We followed closely the textbook examination process according to the background variables, but found no significant differences, so we can state that during the research the evaluation of the textbooks was not influenced by the teachers' prior education, their teaching experience or by the place of teaching.

Subsequently, we present the teachers' opinions about the elementary school mathematics textbooks. Teachers evaluated the textbooks on a five grade scale (1- I am not at all contented, 5- I am fully contented) according to 30 criteria which were grouped in categories for the evaluation. The category groups were devised based on the functions and requirements for textbooks presented earlier in the theoretical introduction. The main categories were the following: general contentment, mathematical scientific accuracy, task orientation, harmonization, systematization, language, usability, psycho-pedagogical requirements, appearance, as well as self-assessment fostering (see Table 1). For category evaluation we counted mean, examined dispersal and evaluated significance.

Table 1. *General opinion on textbooks*

Category	**Mean**	**I.**	**II.**	**III.**	**IV.**
General contentment	2.84	2.75	2.08	3.35	3,21
Mathematical scientific accuracy	3.62	3.77	3.12	3.71	3.90
Task orientation	2.59	2.49	2.15	2.74	2.96
Harmonization, co-ordination	3.35	3.34	3.16	3.41	3.52
Systematization	3.58	3.95	3.35	3.56	3.47
Language	3.52	3.44	2.85	3.70	4.07
Usability	3.04	2.98	2.48	3.33	3.36
Psycho-pedagogical requirements	3.46	3.61	3.05	3.64	3.55
Appearance, esthetical requirements (motivating function)	3.36	3.83	2.78	3.59	3.30
Self-assessment fostering	2.61	2.71	2.15	2.65	2.90

On examining general contentment we can state that the textbooks were appreciated as 'low medium' (m=2.86), the least appreciated being the 2nd year textbook, while the 3rd year textbook being the most appreciated one. Globally, the teachers are contented with the mathematical scientific accuracy of the textbooks (although the question arises whether the teachers are able to appreciate that in the appropriate degree, as with the occasion of mathematics skills testing most of the teachers do not obtain very good results). Teachers are also pleased with the systematization of the textbooks, while pointing out the lack of task orientation, and failure in fostering learners' self-assessment.

As follows we present the chosen categories in details. Table 2 shows the criterion of mathematical scientific accuracy:

Table 2. *Mathematical scientific accuracy in textbooks*

Category	**Mean**	**I.**	**II.**	**III.**	**IV.**
Mathematically correct figures, diagrams	3.77	3.96	3.27	3.65	4.18
Scientific accuracy	3.44	3.54	3.04	3.35	3.79
Accurate mathematical terminology	3.79	3.79	3.35	3.87	4.14
Mathematical concepts correctly defined	3.97	4.17	3.58	4.04	4.11
Examples to reinforce mathematical concepts	3.15	3.38	2.35	3.65	3.28
Partial field mean:	**3.62**	**3.77**	**3.12**	**3.71**	**3.90**

The primary school teachers appreciated the primary school mathematics textbooks as being 'good' from the point of view of mathematical scientific accuracy. They were pleased most with the 4th and

1st year textbooks' mathematical scientific accuracy and less pleased with that of the 2nd year textbook. What the teachers find most wanting are the examples to reinforce the mathematical concepts.

Table 3 shows that as far as task orientation is concerned, teachers are much less pleased with the textbooks.

Table 3. *Task orientation in mathematics textbooks*

Category	**Mean**	**I.**	**II.**	**III.**	**IV.**
Variety of tasks and problems to solve	2.89	2.71	2.08	3.22	3.52
Optimal amount of tasks	2.29	2.08	2.23	2.22	2.59
Differentiated tasks, layered material	2.09	1.96	1.77	2.26	2.34
Optimal amount of logical tasks	2.47	2.42	1.77	2.77	2.90
Life-like tasks	3.21	3.29	2.88	3.22	3.43
Partial field mean:	**2.59**	**2.49**	**2.15**	**2.74**	**2.96**

The 4th and 3rd year textbooks are more task-oriented than the 1st and 2nd year ones. Primary school teachers are generally pleased with the life-like character of the tasks to be found in the textbooks, but consider the textbooks weak concerning differentiating, layering the subject material (especially the 2nd year and 1st year textbooks). The absence of layering of subject material entails a huge amount of additional work on the teachers, in order to provide sufficient and suitably difficult tasks to the fast or slow learners at the same time. The absence of layered material can be balanced with specially tailored worksheets or workbooks.

Table 4 shows that the majority of the teachers consider the mathematics textbooks to be harmonized with the subject curricula. Nevertheless, we can conclude that the textbooks are less in accordance with each other from year to year, and even less with other subject textbooks for the same years.

Table 4. *Co-ordination, harmonization*

Category	**Mean**	**I.**	**II.**	**III.**	**IV.**
Structured according to subject curriculum	4.17	4.04	4.08	4.35	4.21
Harmonized with the other years' textbooks	3.30	3.40	2.88	3.17	3.69
Harmonized with other subjects' textbooks	2.59	2.58	2.52	2.70	2.66
Partial field mean:	**3.35**	**3.34**	**3.16**	**3.41**	**3.52**

Table 5 shows the partial field of systematization. According to the results, the surveyed teachers consider the 1st year textbook as being the most systematically structured. In the case of other criteria that textbook did not obtain good results, but as far as systematization is concerned it is highly appreciated. From the point of view of learning management it is important to get children acquainted with a systemic approach starting from their 1st year of study.

Table 5. *Systematization*

Category	Mean	I.	II.	III.	IV.
Optimal subject material structuring	3.10	3.54	3.50	3.04	2.41
End-of-chapter summaries	4.09	4.67	3.44	4.04	4.21
Logical content structuring	3.54	3.65	3.12	3.61	3.79
Partial field mean:	**3.58**	**3.95**	**3.35**	**3.56**	**3.17**

As for the language of the textbooks, according to the teachers, the 4th year textbook is written in highly appropriate language (m=4.17), while the 2nd year textbook, which was translated from Romanian obtains a much lower (2.85) score with respect to both its general language use and its use of accurate mathematical terminology, thus lagging behind the other years' textbooks (see documents and content analysis results!). We think that authors and translators of textbooks for the primary school should pay maximum attention to accurate language use irrespective of the subject matter.

While looking at the partial field of usability we can state that teachers find primary school mathematics textbooks usability medium (m=3.04). They are good learning tools for the learners, but less good teaching tools for the teachers. Reasonably, the textbooks are only guiding tools to the teacher and the main knowledge providers to the learners. Once again the 2nd year textbook obtained the lowest score for usability- as many teachers stated, they had to design a new book, but at least a full workbook to be able to teach mathematics effectively, as the textbook proved almost unusable.

As we have mentioned in the theoretical introduction, the textbooks need to meet psycho-pedagogical requirements as well. Table 6 shows the degree in which mathematics textbooks meet those requirements in the opinion of the primary school teachers.

Table 6. *Psycho-pedagogical requirements*

Category	Mean	I.	II.	III.	IV.
Age group specifics	3.42	3.63	2.96	3.61	3.52
Prior knowledge level	3.60	3.58	3.42	3.61	3.76
Comprehensibility	3.35	3.63	2.77	3.70	3.38
Partial field mean:	**3.46**	**3.61**	**3.05**	**3.64**	**3.55**

Most primary school teachers consider that mathematics textbooks generally meet the psycho-pedagogical requirements. The 3rd, 1st and 4th year textbooks obtained good medium results, while the 2nd year textbook was again considered weaker as compared to the other year's textbooks. The biggest problem of the 2nd year textbook is its comprehensibility owing to bad translation.

From the point of view of the children, the appearance of the textbook, its esthetical design is also important. The cover can be the first thing to influence the child whether to use the book with pleasure or to avoid using it. Our survey focused on the scientific content of the mathematics textbooks. Nevertheless, we did not overlook to examine them against esthetical requirements, as well.

Table 7. *Appearance, esthetical requirements*

Category	**Mean**	**I.**	**II.**	**III.**	**IV.**
Esthetic design	3.02	3.63	2.35	3.17	3.00
Good paper quality	3.56	3.75	2.96	3.78	3.76
Appropriate use of colours	3.59	4.13	3.15	3.87	3.31
Appropriate size	3.78	3.96	3.16	4.04	3.97
Appropriate illustrations	3.35	4.13	2.85	3.48	3.07
Intriguing cover	2.83	3.38	2.19	3.17	2.68
Partial field mean:	**3.36**	**3.83**	**2.78**	**3.59**	**3.30**

Table 7 shows that from the point of view of the esthetical requirements, primary school teachers valued the 1st year textbook most (m=3.83), and again the 2nd year textbook least. On examining the partial field of appearance, attention is drawn to the cover of the textbooks, as they are not considered intriguing enough by the teachers. Textbook designers and editors should note that primary school children pay often as much attention to the esthetical design as to the content of the textbooks. They care for the intriguing cover, appropriate use of colours, appropriate illustration, good paper quality, etc. In order to be able to fulfil their motivating function textbooks should meet the esthetical requirements, as well.

As most of the teachers uttered their negative critique to the mathematics textbooks presently in use, we surveyed their willingness to take part in a textbook writing project.

As shown in Figure 5, more than half of the teachers (54.9%) consider that a real good textbook for the primary school could mostly be designed by the primary school teacher.

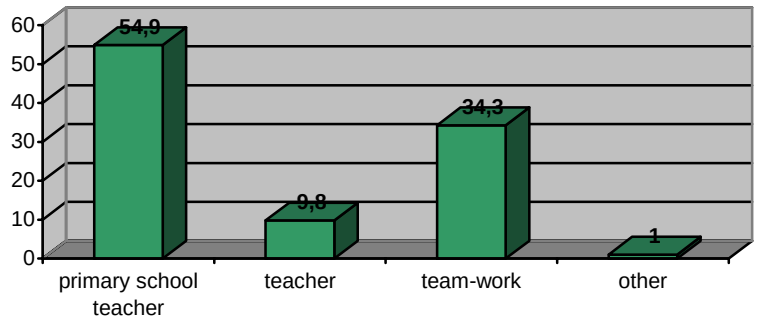

Figure 5. *Textbook authorship*

One third of the surveyed teachers (34.3%) emphasize the importance of team-work, stressing that a really good textbook could be written through the common effort of the primary school teacher, the mathematics teacher and the pedagogy teacher. Only a small number of the surveyed consider that only a mathematics teacher could write a good mathematics textbook.

Figure 6 shows the primary school teachers' willingness for textbook writing. Most of the surveyed teachers (60%) would attend a course in textbook writing, and almost half of them would take part in a writing project if an appropriate team were formed.

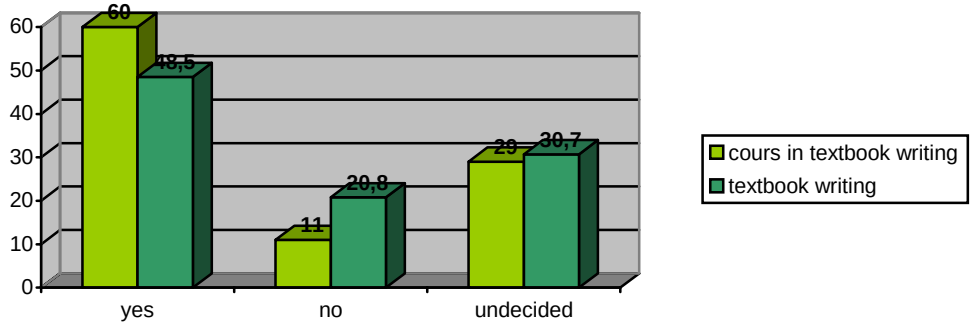

Figure 6. *Textbook writing*

Generally, there are a small number of teachers willing to face the challenge of writing a textbook. However, our research has shown that there is a need for much better, scientifically more appropriate, more esthetical textbooks for the primary school, and the most appropriate people to carry out that task would be those who work with the primary school age group, thus best knowing their psychological character.

6. Conclusion

Based on the results of the documents and content analysis and the questionnaire survey, our first and second hypotheses have been demonstrated, as we can conclude that the mathematics textbooks used in Hungarian primary schools in Romania are of a medium quality, the 2nd year textbook being substandard. Should we want to range them, we could say that the ones originally written in Hungarian (the 3rd and 4th year textbooks) are better than the ones translated from Romanian (1st and 2nd year textbooks).

Our hypotheses that stated that the textbooks contain mathematical scientific mistakes and errors, as well as that they do not contain enough tasks and problems to solve have also been demonstrated. Further negative critique is that they lack differentiated tasks and layered material, are not task oriented and do not trigger learner self-assessment.

As positive critique, we could mention harmonization with the subject curriculum. We hypothesized that the textbooks are not in accordance with the subject curriculum, but that assumption has been proved wrong by the results of both the contents analysis and the questionnaire survey.

Our hypothesis that the language of the mathematics textbooks translated from Romanian is less accurate than that of the textbooks originally written in Hungarian has also been demonstrated. That is why we suggest that the textbooks originally written in Hungarian should be preferred to the translated ones. In addition, we recommend setting up a committee for evaluating textbooks that would not consider primarily the economical, cost reduction criterion, but the criteria of meeting the requirements for textbooks, so that appropriate books could be used in reality by the primary school children.

Furthermore, we recommend setting up teams of textbook writers/textbook editors. As we have stated earlier, truly effective teams would be made up of primary school teachers, mathematics teachers and pedagogy or methodology teachers and linguists. The primary school teacher would be responsible for adjusting the information to the age group, so that it would be comprehensible. The mathematics teacher would be responsible for the mathematical scientific accuracy, and the pedagogy teacher would oversee the content harmonization with the subject curriculum, and would also be responsible

for the appropriate methodological design concept. The work of the team would be supervised by a language expert, who would be responsible for the language and terminology style and accuracy. Such textbooks, -designed by teams of competent specialists-, could fulfil their real function, as well as partake in the teaching of mathematics more efficiently.

References

[1] Ambrus Gabriella (2007), *Valóságközeli matematika-Munkafüzet*, Műszaki Kiadó, Budapest.

[2] András Szilárd, Csapó Hajnalka, Nagy Örs, Sipos Kinga, Szilágyi Judith, Soós Anna (2010), *Kíváncsiságvezérelt matematika tanítás,* Státus Kiadó, Csíkszereda.

[3] Ábrahám István (1993), A tankönyv funkciói, szerkezeti elemei. Tankönyvműfajok. In: *Kiadói ismeretek tankönyvszerzők és szerkesztők számára*, Korona kiadó, Budapest.

[4] Baranyai Tünde, Tempfli Gabriella (2010), *A kooperatív módszer bevezetésének lehetőségei a matematika órákba* , Státus Kiadó, Csíkszereda.

[5] Dienes Zoltán (1973), *Építsük fel a matematikát*, Gondolat Kiadó, Budapest.

[6] Fodor László (2005), *Általános és iskolai pedagógia,* Stúdium Könyvkiadó, Kolozsvár. 258 – 263.

[7] Karlovitz János (2005), *Tankönyv – elmélet és gyakorlat.* Nemzeti Tankönyvkiadó, Budapest.

[8] Kojanitz László (2005), A tankönyvkutatás szerepe és feladatai, *Új Pedagógiai Szemle,* 127-141.

[9] Manolescu, Marin (2004), *Curriculum pentru învătământul primar si prescolar,* Editura CREDIS, Bucuresti.

[10] .Pólya György (2005), *Gondolkodás iskolája,* Edge 2000 Kiadó, Budapest.

[11] Skemp, Richard R. (2005), *A matematikatanulás pszichológiája,* Edge 2000 Kiadó, Budapest.

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