

# THE ALTERNATIVE FOURTH - GRADE CALCULUS BOOKS A CRITICAL ANALYSIS

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**Abstract:** *Mathematics as a study discipline is not one of the most attractive subjects for the majority of students. The rejective attitude of the human being, when dealing with the unknown, is a natural reaction of self-defence. But for some, it is precisely this lack of initial understanding that is appealing as a challenge for further discoveries and development. In this article we have analysed three fourth-grade calculus books, both in printed and digital version, in order to establish a proper hierarchy in accordance with fourth grade national curriculum. A complex evaluation grid was used in analysing three of the most used calculus books for the fourth grade. The highest result was obtained by the calculus book proposed by Intuitex Publishing House Bucharest. For further developments we aimed to elaborate our own calculus book for fourth grade. A shorter version, for two content units, was developed and tested by the authors.*

**Keywords:** *formal education; alternative text/calculus books; digital text book; mathematics, primary education, evaluation criteria.*

## **1.Introduction**

The text books/calculus books are one of the pillars of the formal education of the student. This topic is a very trendy one, given the technological era we are going through. We cannot overlook the efforts of education to keep up with it. On a quick review of a text book/calculus book currently used in Romanian primary school, we can observe a new attachment, namely the presence of a CD pasted on the inner cover. This is

the digital text/calculus book, or an attempt of an e-book, summarizing several practical exercises, educational animations, teaching tales, educational songs and not in the least educational games. Education without play is like "soup without salt" if we make an analogy with the fairy tale written by Petre Ispirescu. Through the game the young students are most likely to acquire new knowledge, and to evolve in terms of skills, becoming valuable members of the society.

According to the Explanatory Dictionary of the Romanian Language (2016), the term "alternative" has two meanings that can be applied in the present context: which alternates and the possibility to choose between two solutions (DEX 2016).

Mihai Mitrica, Executive Director of the Romanian Publishers Association, says in an interview with the radio station Rfi: "The printed textbooks market represents a third of the total book market. Specifically, publishers sells of alternative and ancillary manuals worth 30-35 million euros, while the total book market reaches 100 million euros. The decision to ban alternative textbooks will seriously affect the education system in Romania" (Pietroşel, 2017).

In spite of these statistics, we cannot refer to alternative textbooks only at the level of turnovers, the textbooks must mean more than that.

Alternative text/calculus books have emerged as a necessity, the process of their elaboration have stimulated initiative and creativity of the authors and publisher. The single/unique text/calculus book accepted in Romania for tens of years during the communist regime for teaching the national curriculum, could not faithfully and correctly render the image of a field of knowledge. A diverse offer of calculus books was desperately needed hoping that the „alternative” calculus books would have had the capacity to satisfy any demands of the national curriculum, the scientific rigour of the discipline and students’ particularities. (Oltea, 2019).

Taking into account these aspects, we aimed to analyse the differences between the calculus books made available by the Ministry of Education and Research for the fourth graders. Even if each calculus book follows the same national curriculum, the degree of difficulty of explanations and exercises is different from one publishing house to another.

## **2. Aim of the research**

The purpose of this research is to identify the functionality of the present education system as related to the textbooks, specifically the mathematics calculus book for the 4th grade. There are many issues and questions that arise if we think about this subject. How does a text / calculus book end up on the student's bench? Who chooses this calculus book? Is it possible to use any text/calculus book in the class? Once chosen as a class

calculus book, is this instrument enough to develop the necessary skills envisaged by the national curriculum? How a calculus book should be designed? Do these calculus books contain suitable contents and learning activities for achieving the maximum potential of the student as related the development of their mathematical skills?

### **3. Analysis criteria**

For making the analysis more objective, we have chosen as the main evaluation instrument the official document made available by the Ministry of Education and Research called:

” Methodology for the methodological-scientific evaluation of school textbooks for pre-university education”. The following rejection criteria are presented in the methodology: compliance with the national curriculum/syllabus and non-discriminatory approaches. At the same time, it is necessary for a text/calculus books to comply with general criteria of quality involving:

Criterion I - the validity of scientific content;

Criterion II - the didactical approach of scientific content;

Criterion III - contribution to the optimisation of the teaching-learning-assessment process; Criterion IV - the organization of content for the training of competences in accordance with the curriculum;

Criterion V - the quality and accessibility of language;

Criterion VI - the quality of the printed format (fonts, page organising, images, graphs etc);

Criterion VII - the style and unity of the school textbook.

Particular attention should be paid by the evaluators to Criterion IV. The conformity of the proposed text/calculus book with the national curriculum requirements is measured by analysing the specific contents and learning activities included in the text/calculus books and their impact on the students ‘competencies development. If the concordance with the national curriculum-syllabus is not achieved any text book draft submitted to evaluation is rejected.

Another eliminatory criterion in the text/calculus book is its non-discriminatory nature of the content, texts, images or learning activities. Any text/calculus book should present its content without making any distinction between people according to their nationality, ethnicity, religion, language, gender, belief, social category, chronic non-contagious disease, disease, age or membership of a disadvantaged category. It also involves the elimination from the text/calculus book of any racist, xenophobic or nationalist-extremist ideologues. Subsequently, if the text/calculus book does not meet these requirements, it will be excluded from the evaluation process, but will be

able to included again after the deficiencies have been rectified. The evaluation methodology provides information on the entire process of text book evaluation, by offering details on the organisation of evaluation sessions, the evaluation of the translations' quality of textbooks, the evaluation of school textbooks for special education. At the same time, the evaluators are provided with all the necessary details for drawing up the catalogue of certified text/calculus books, structured according to the criteria and the official standard documents required in annexes placed in the last pages of the document. The assessor should fill during and after the evaluation process the following documents: "Note on the quality of the textbook". "Privacy commitment", "Standard evaluation grid of the textbook draft", "List of changes to be made in order to obtain the opinion of the "Good to be printed" (ibidem).

#### **4. Analysis of the 4th grade calculus books**

Using the same official, "Standard evaluation grid of the textbook draft" we have conducted our own evaluation of the calculus books available on the market for the 4<sup>th</sup> grade. Following the analysis we have provided a ranking of these calculus books aproved by the Minsitry of Education and Research.

**Research sample:** For our analysis we have chosen the following calculus books for the 4<sup>th</sup> grade:

- "Mathematics, 4<sup>th</sup> grade, semester I and semester II", author: Mogoş Mariana, ART Publishing House.

- "Mathematics, 4th grade, semester I and II", authors: Mihăescu Mirela, Pacearca Ştefan, Dulman Anita, Alexe Crenguţa and Brebenel Otilia, Intuitext publishing house.

- "Mathematics, 4th grade, semester I and II, authors: Chiran Rodica and Radu Mihaela Ada, Aramis Publishing House.

The evalutaion grid that have been used contains all the seven criteria named above. For each criterion a set of indicators have been included. Each indicator could obtain a maximum score of 10 points, signifying that the specfic indicator is fulfilled at optimal level.

The score for each criterion is determined by the average arithmetic result of the scores for each indicators: average score of the evaluated criterion = (score for indicator 1 + score for indicator 2 + score for indicator3) divided by 3; the final score for the general quality criteria is calculated as following: 2 x (score for criterion I + score for criterion II + score for criterion III)+ score for criterion IV + score for criterion V + score for criterion VI + score for criterion VII; the final score for the general quality criteria is a maximum of 100 points.

Table 1. Analysis grid of math calculus books for the fourth grade.

I Criteria and indicators	Score by publisher		
	4th grade		
I. Scientific content of the calculus book -validity of scientific information	Intuitext	Aramis	Article
Scientific correctness and up-to-date information provided by text/ images in implicit or explicit manner	10	10	10
2. Relevance of information provided through images and text	10	10	10
Assessment/self-assessment items designed correctly	10	10	9
Criterion I average score	10	10	9,60
II. Scientific content of calculus book - didactical approach	10	9	9
1. Logical coherence of the content units of the calculus book			
2. Practical activities and appropriate examples according to national curriculum, scientific discoveries and even life situations	9	8	7
3. Visual media scientific content and message appropriate to the level of development/age of the students and to the specific of the subject matter	9	9	8
Criterion II Average Score	9,30	8,60	8
III. Teaching - learning - evaluation, optimization	9	8	7
1. The existence, weight and quality of the review exercise or review themes			
2. Content of the discipline balanced with the items of the evaluation tests, the applicability of the complementary evaluation items	9	9	8
3. Degree of use of students' previous knowledge in new contexts	10	9	9
Criterion III average score	9,30	8,60	8
IV. Skills training opportunities according to national curriculum-organisation of content	9	8	8
1. Effective learning by text systematization			
2. Objectives and competences developed and valorised from an intra, inter, multidisciplinary perspectives as well from a life experience perspective	10	9	8
3. Degree of use of active -participative methods/techniques/strategies	9	8	7
Criterion IV average score	9,30	8,30	7,60
V. Language: quality and accessibility	10	10	10
1. Linguistic coherence and development of specialized language according to le creative contexts			
2. Balanced use of new information / concepts	9	8	8

3. Titles/subtitles - relevance	10	9	8
Criterion V average score	9,60	9	8,60
VI. Calculus book formatting – quality			
1. <i>Technical elements – compliance</i>	10	10	9
2. Visual media - technical quality	10	9	9
3. Appropriate and attractive appearance specific to the level of development/age of the students and in accordance with the specific of the subject matter	10	10	10
Criterion VI average score	10	9,60	9,30
VII. Style and originality of the text/calculus book			
1. Promoting aesthetic, ethical, moral and educational values in the elaboration of the textbook	10	10	10
2. Detailing level of the contents, specified bibliographic references, mention of objectives/competences and practical objectives grouped by chapters and themes	10	9	10
3. Text correlation - visual support and correct positioning	10	10	9
Criterion VII average score	10	9,60	9,60

Source: Ministry of Education and Research.

#### **Arguments specific to each criterion in the analysis of calculus books for fourth grade.**

I. Scientific content of the calculus book - validity of scientific information. The information included in the analysed calculus books for the fourth grade is scientifically correct, relevant to the specific competences included in the national curriculum for fourth grade and to the content set out in the curriculum. According to the evaluation criteria set out in the "*Evaluation Guides*" the evaluation items included in the calculus books are designed according to the objectives.

II. Scientific content of calculus book - didactical approach. In the analysed calculus books for the 4<sup>th</sup> grade one can find practical activities and examples from everyday life, all of which are directed towards achieving the skills specified in the mathematics' curriculum. At the same time, scientific content and visual media provide age-specific messages. Overall, the three analysed calculus books comply with the requirements of the subject matter.

III. Teaching - learning - evaluation, optimization. The review themes should be distributed evenly throughout the learning units, but we can see a difference in the mathematics calculus books. Intuitext Publishing House's calculus book has a much more unified structure being very easy to identify the recap and evaluation areas, while the calculus books published by Aramis and Art publishers propose for students' evaluation the sections: "What do I

know? How much do I know?" and "What do I know? How much do I know? How do I know?". At the same time, another very important aspect is the self-assessment section present only in the calculus book proposed by Intuitext and Aramis Publishing Houses.

IV. Skills training opportunities according to national curriculum-organisation of content. Text systematization requires the analysis of elements such: borders, paragraphs, tables, consistency, clear expression, bookmarks and colours. At the same time, it is very important that practical activities, objectives and competences to be predicted/explained at the beginning of each learning unit. For a more effective understanding of the content, the students need a visual support adapted to their developmental level. Explanations and captions are welcome throughout the text to increase the didactical value of the calculus books. Art Publishing House's calculus book was developed by a single specialist, this aspect could be one of the causes for the identified gaps. Nevertheless, this calculus book can be used in a class with a lower level in terms of skills of the students. We identified the learning outcomes in terms of objectives presented at the beginning of the learning units, but we have very few legends and explanations inserted into the lessons' content.

V. Language: quality and accessibility. In all 3 calculus books for to the second semester, especially within the learning units about the elements of geometry, we can find an approach centred on the applicability of the new mathematical concepts into the daily life of the students. Interdisciplinary connections are presented, for example, in order to understand the angle the students are asked to analyse the sketch of a park (Intuitext publishing house calculus book) or the location of schools on the city map (Art publishing house calculus book). The new notions are being rendered by a language adapted to their age, but still retaining the terminology specific to geometry.

VI. Calculus book formatting – quality. From the point of view of text interline spacing, we can see major differences between the calculus book of Intuitext publishing house and the calculus book of Art publishing house. ART Publishing House's calculus book for 4<sup>th</sup> grade has a lot of untapped space, providing a more visually "simple" calculus book, the fonts being larger compared to the other 2 manuals.

VII. Style and originality of the text/calculus book. Each publisher and each authors of the three analysed calculus books for the 4<sup>th</sup> grade promote the originality of their proposed calculus book. Our analysis revealed that in terms of complexity, the Intuitext Publishing House's calculus books has obtained the higher score, as it ensures the development and exploitation of the objectives and the correlation with the national curriculum. Strategies, techniques and methods are diverse: it includes self-

assessment sections, portfolio realization, teamwork opportunities, problems based on suggestive images, problems that end with a product, environmental projects, identification exercises, multi-choice exercises, graphs, tables and didactic games. Truly this calculus book is a learning instruments for the 4<sup>th</sup> grade students and an important resource for the teachers.

### 5. Final ranking

Ranking	Final score	4 <sup>th</sup> grade Calculus books for Mathematics
First Place	96,1	Mihăescu Mirela, Pacearca Ștefan, Dulman Anita, Alexe Crenguța and Brebenel Otilia, (2016) "Mathematics calculus book, 4th grade, 1st and 2 <sup>nd</sup> semester", Intuitext Publishing House, Bucharest
Second Place	90,9	Chiran, R., Radu, Mihaela-A., (2016)"Mathematics calculus book, 4th grade, semester I and II ", Aramis Publishing House, Bucharest.
Third place	86,3	Mogoș, M., (2016), "Mathematics calculus books, 4th grade, semester I and II", Art Publishing House, Bucharest

### Conclusions

The 4<sup>th</sup> grade calculus books for mathematics accredited by the Ministry of Education and Research are prove to have a very good quality. The contents are very well structured, the objectives are pursued according to the curriculum developed by the Ministry of Education and Research, and the practical application exercises are structured in several forms, namely: individual exercises, pairs exercises, team exercises, multidisciplinary projects, recapitulation, evaluation and self-assessment sections. One cannot expect perfection. When a teacher chooses not to use the textbook certified by the Ministry of Education, can he/she still be sure that he/she covers the entire curriculum? Or have the students been able to acquire all the skills necessary in order to be active citizens or accomplished adults? We consider that a teacher that totally rejects the learning resources provided by the Ministry of Education and Research risks to end up in having a chaotic and unstructured teaching style, in which case the students no longer understand what the purpose of the textbooks is during the classes.

The Romanian students are obliged to carry their printed text/calculus books each day, for each subject matter. It is a considerable effort with consequences on the students' health. If the students are not required to use these textbooks, which is the point in carrying them each day? Could the digital text/calculus book solve this problem? Constantin Cucos presents the digital manual as a real challenge for the Romanian education system because there are many sociological and economic impediments. The process



it has to go through is a long-term one, namely virtualization and cultural digitisation. Arrived in this point, the digital text/calculus book should be understood as a distinct education product, not as a duplicate of the classical printed version of the text book. The integration of the contents presented in a digital manual has a complexity that does not exist in the classic manual. Here we can refer to multimedia, auditory, visual animation technologies, practically applicative games, interactive exercises etc (Cucos, 2013).

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