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DIGITIZATION OF BULGARIAN NATURAL SCIENCE SCHOOL BOOKS PUBLISHED IN BELGRADE DURING THE PERIOD OF NATIONAL REVIVAL (1806-1878)

Abstract. The school books used for teaching natural sciences like mathematics, physics, etc. during the period of Bulgarian National Revival were not very well studied and analysed with respect to their concepts content and to their overall relations to educational system. Recently, a great number of that books is offered in digitized format from several sources which present a structured digitized archive. The paper offers a survey and analysis of Bulgarian natural science school books published in Belgrade during the period of Revival (1806-1878) from digital collection which includes several linked sources. The structure of meta-data scheme of encoding and linking of data which support evaluation of study content and related analysis are presented. The study of three natural science school books published in Belgrade in Bulgarian language during the period of Revival is presented by using their digital copies. The results of that analysis show inconsistency between mathematical concepts and the use of their subsequent terms. Finally, the conclusion about the multi-disciplinary structure of curricula and related subjects studied in natural science school education during period of Revival is presented.

Keywords: Digitization of Bulgarian early printed books, meta-data representation, linked digitized data, digital content analysis.

1. Introduction

Recently, a lot of research efforts have been made toward digitizing works in mathematics, whether it is a national project [1] or legacy of a certain author [2]. School books from different periods of time are reliable sources to study both cultural and educational achievements to evaluate advancements in related subject area.

The Bulgarian school books from the period of National Revival are the major sources to study and describe structure, content and relations of natural science subjects studied in schools during that time. Moreover, the great part of that books were published abroad. At the same time, the school books used for teaching natural sciences like mathematics, physics, etc. during the period of Revival were not very well studied and analysed with respect to both teaching methodologies used and related studying concepts presented.

Further, we shall give a survey and analysis of three Bulgarian natural science school books published in Belgrade during the period of National Revival (1806-1878) from digital collection which includes several linked sources.

2. Digitization of Bulgarian old printed, early printed and rare books - sources and approaches

The Bulgarian literature from the period of National Revival is described, presented and classified in [3]. However, Bulgarian natural science school books from that period usually exist in small number (often unique exemplars possessed by major Bulgarian libraries) and are not accessible for a wider audience. Recently, the majority of them were offered in digitized format from several sources which present a structured linked digitized archive.

The main library sources are St. St. Cyril and Methodius National Library's digital collection (Bulgarian Old Printed Books 1806-1878) and the Central Library of Bulgarian Academy of Sciences' digital collection (Collection Old Printed Books 1806-1878). Both collections are available for electronic search through EUROPEANA platform and through National Academic Library and Information System (NALIS) repository which links all national academic catalogues and digital collections resources.

However, the both major library sources use their own meta-data representation of the digital content. Thus, the National Library's digitization approach uses meta-data encoding oriented toward representation of layout of digitized book by offering options for *Navigation* (forward and backward), *Tools* (print, copy, send, download) and *Display* (zoom in, zoom out). The Central Library of Bulgarian Academy of Sciences' approach uses meta-data encoding oriented toward representation of content of digitized book allowing both options for *Navigation* (forward and backward) and for *Display* (zoom in, zoom out), and options for *Search* the book's content (preface, chapters, tables, illustrations, appendices, etc.). Both meta-data approaches are linked to EUROPEANA meta-data standards by using, also, common representation of book's *Title, Creator, Properties, Time, Provenance, References and Relations*, etc. allowing common faceted search.

3. “Аритметика или наука числителна” by Hristaki Pavlovich (1833)

The book with author Hristaki Pavlovich “Аритметика или наука числителна” published in Belgrade in 1833 [4] is considered as a first printed school book to study mathematics written in Bulgarian language. It is available in digitized format from both National Library and Central Library of Bulgarian Academy of Sciences digital collections. Figure 1 shows first and second page of the book from both digital sources, respectively.

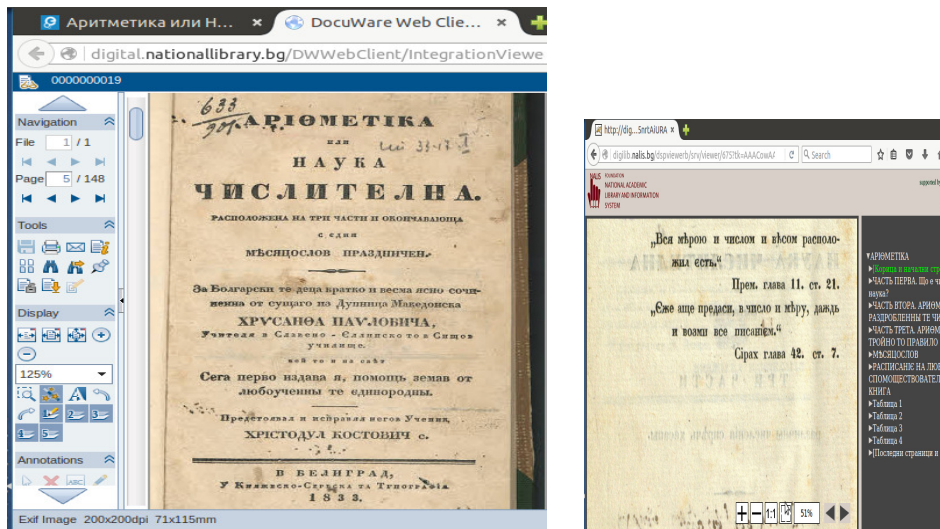


Figure 1. Hristaki Pavlovich's book title page and second page from two digital sources.

The book contains three chapters related to studying mathematics, one chapter related to Eastern Orthodox Liturgical Calendar (with lists and explanations of every Christian feast commemoration associated with its related date), tables and list of subscribers. The mixed study content of the book shows a transition from old religious education to modern education as well as new methodological approaches.

The first three chapters include study of basic mathematical concepts (like *numbers*) and related operations for them. The first chapter (Figure 2) starts with definition of mathematics as a science about numbers and operations for them. Then, the definition of *whole numbers* and the way they are assigned with digits are introduced. The related operations with whole numbers like *addition*, *subtraction*, *multiplication* and *division* are included.

The teaching methodology is to introduce first the definition of related operation and then examples with explanations and practical tasks for mastering related mathematical operation. Thus, the rule for addition (Figure 2) is illustrated with example which shows the technique how to receive the sum of numbers $5437 + 324 + 86 + 8$, so to get the result of 5855. The example, also, shows related to that mathematical operation terms. The practical exercises which are given to students for mastering the operation of addition are supported with explanations and the received results.

The same methodological approach is used to study subtraction, multiplication and division. It is interesting to note, that some of the terms introduced are still used nowadays (as for division – *делимо* (dividend), *делител* (divisor), and *частно* (quotient)) (Figure 2).

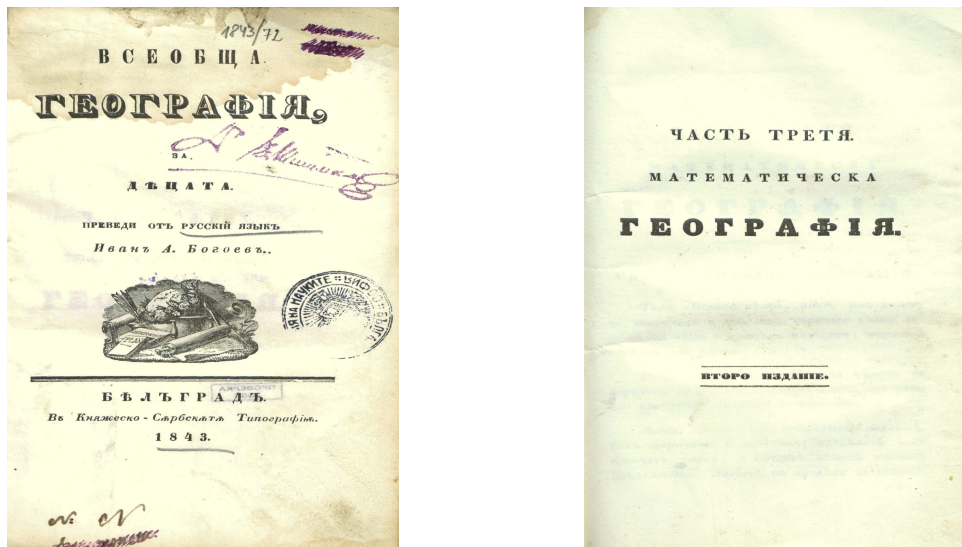


Figure 4: Ivan Bogorov's book initial page and initial page of the third chapter.

The chapter offers definitions mainly of basic geometric concepts like *geometric shapes*, *surface*, *lines*, etc. and their related subsequent types. The introduced terms cover only several geometric concepts like *diameter*, *spheroid*, etc. and are from Greek origin (Figure 5). Except definitions of some basic geometric concepts, that chapter does not offer any exercises or resolving of geometric problems. It, also, does not contain any formulas. The list of subscribers includes towns of: Odessa, Galati, Karlovo, Belgrade, etc.

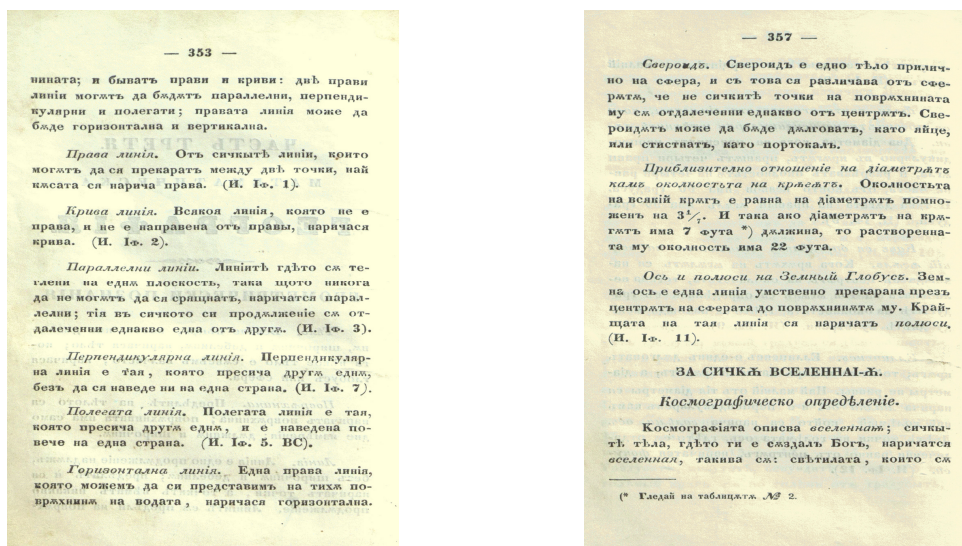


Figure 5 Ivan Bogorov's book pages with geometric concept definitions.

5. “Извод от физика” by Naiden Gerov (1849)

The book “Извод от физика” with author Naiden Gerov [7] was published in Belgrade in 1849. Its digital copies are available both from National Library and from Central Library of Bulgarian Academy of Sciences digital collections. Figure 6 shows title page from both digital sources. That edition is a first printed school book in physics published in Bulgarian language.



Figure 6: Naiden Gerov's book title page from two digital sources.

The book contains *Preface*, *Introduction* (consisting of three chapters), *First part* (consisting of ten chapters), *Second part* (consisting of three chapters), *Third part* (consisting of three chapters), *List of subscribers* and *Tables*. The first chapter of *Introduction* includes definitions of some basic geometric concepts like *space*, *volume*, *shape*, etc. Figure 7 shows its first page. The chapter does not include examples, exercises or formulas.

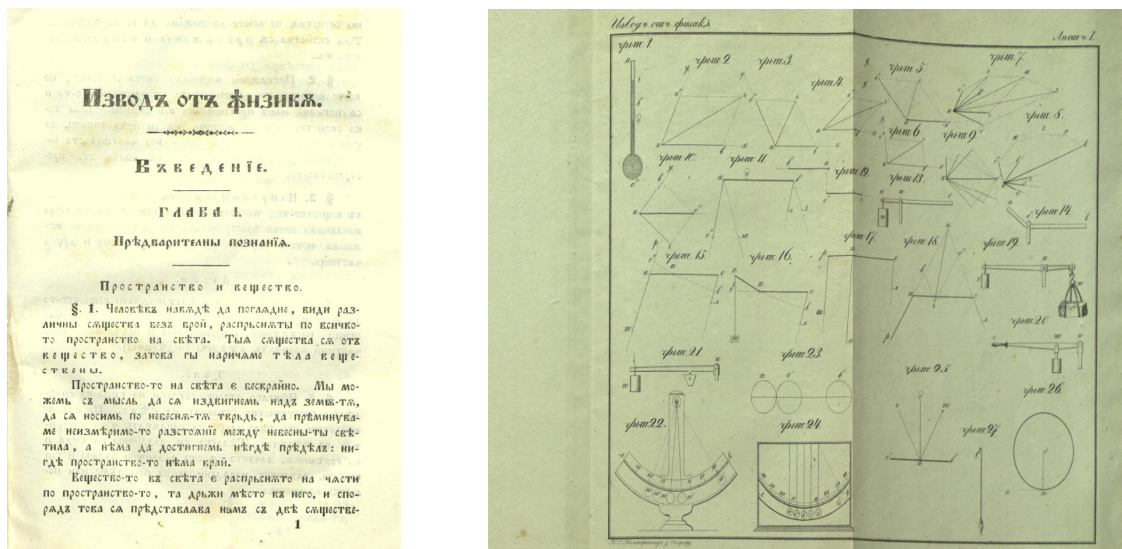


Figure 7: Naiden Gerov's book title page of the first chapter and the tables.

The other chapters include examples which use geometric concepts of *angle*, *triangle*, etc. for resolving problems in physics. The related illustrations of that examples are given at the *Tables* (Figure 7). The list of subscribers includes towns of: Koprivshitsa, Tryavna, Karlovo, Kalofer, Plovdiv, Pazardzhik, S. Zagora, Pirot, Belgrade, etc.

6. Conclusion

The presented analysis of digital copies of natural science school books published in Belgrade in Bulgarian language during the first half of XIX c. shows that related books are among the first published for studying school subjects of mathematics, geography

and physics. Their study content presents a transition from religious to modern educational system. The methodological approaches used for teaching mathematics are oriented toward acquisition and practice to work with basic operations for whole and fractional numbers and for proportions.

The related abstract knowledge and some basic geometric definitions are introduced to support explanation of concepts from geography and physics. The terminology used for related concepts are both from Greek origin and from Bulgarian but is inconsistent. The presented analysis, also, shows that curricula and related subjects studied are not well separated since they include mixed multi-disciplinary knowledge.

Taken together with the school book of N. Bozveli and E. Vaskidovich [8] published in Kragujevac in 1835, the analysed school books present basic methodological approaches, concepts and related mathematical terms which are significant for the beginning of Bulgarian education in mathematics.

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