Velislava Stoykova Institute for Bulgarian Language, Bulgarian Academy of Sciences

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 form 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.

XIV Conference Digitization of Cultural Heritage and Digital Humanities, Belgrade, September 29,2016

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 possesed 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 avaiable 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 – ∂ *eлимо* (dividend), ∂ *елимел* (divisor), and *частно* (quotient)) (Figure 2).

е Каранананананананананананананананананана	-5 - 5 - 5 we which chose to be called with a chose to be descent and the second state of the second st
НАУКА ЧИСЛИТЕЛНА. ЧАСТЬ ПЕРВА. Що е числителиа наука?	8 0 8 8 8 5 5 суныя. Посло нека почно их досно собщений че Ублая 8 и 6 оправот 18 и 6, 18 и 7, 25. И вознате са свят от 2 достотова в 5 сданацар.
Числитемия наума думаса онала наума, кол то право учи, да познаваляе числа та, и да правиме право в с лесиото средайло числение, сприме хесан.	нека шини 5 на сдопина под сдопина и , а 2 на депотина, мока пролего и десерина не, и шина си собори о 45х дупал 2 и 8, 10; и 8, 12; и 3, 13. И чико собловитисти запа про- ви, и про плада сухова 5 хіладра и 8 стояць- на и 5 десеть и 5.

Figure 2.Hristaki Pavlovich's book initial pages of the first chapter.

The second chapter includes definitions, examples and exercises on basic operations for *fractional numbers*. The third chapter includes definitions, examples and exercises on basic operations for *proportions*. All study materials are methodologically illustrated with related explanations, examples and tables (Figure 3). The list of subscribers includes towns of: Svishtov, Turnovo, Gabrovo, Elena, Vidin, Pleven, Plovdiv, Bucharest, Belgrade, etc.

	ТАБЛИЦА 4.	
МЪСЯЦОСЛОВ содержава снчки те в година та праздницы	Акители. Аклови числа. Иссти числа. Аклители. Аклители. Аклители. Иссти числа.	
недвижимы и движимы	4 4 5 4 4 6 6 6 ила 1 8 в 8 2 - 4 - 2 4 - 8 - 2 6 - 12 - 2 8 - 16 2 - 6 - 3 4 - 12 - 3 6 - 18 - 3 8 - 28	им
ол НЕДВИЖИМЫ ТЕ ПРАЗДНИЦЫ	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	a s s s
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8 0 0
- PARTELLE AS	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	E FULL
	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	1 1 1
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	=

Figure 3. Hristaki Pavlovich's book initial page of the fourth chapter and the table for division.

4. "Всеобща география за децата" by Ivan Bogorov (1843)

The book by Ivan Bogorov "Всеобща география за децата" published in Belgrade in 1843 [5] is a translation from Russian. Its digital copies are available both form National Library and from Central Library of Bulgarian Academy of Sciences digital collections. The book contains three chapters and only the third chapter "Математическа география" includes study materials in mathematics. The chapter was published in 1842 as a separate book [6] containing introduction to basic mathematical concepts with their definitions. Figure 4 shows book's initial page and its third chapter's title page.



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.

	— 357 —
— 353 —	Сверондъ. Сверондъ е едно тъло прилич
ината; и быватъ прави и криви: двъ прави	но на сфера, и съ това ся различава отъ сфе
инін моглать да бидить параллелни, перпенди-	рыты, че не сичкить точки на поврыхнинат
улярни и полегати; правата лиція може да	му см отдалечении еднакво отъ центрмтъ. Све
жде горизонтална и вертикална.	рондыть може да быде дылговать, като яйце
RETENDED ATTENDED	яли стиствать, като портокаль.
Права линіл. Отъ сичкыть линіи, конто	ANN CINCINUIS, MITO HOPTONAME.
югжть да ся прекарать между двь точки, най	Приблизително отношение на діаметрат
кисата сл нарича права. (И. Іф. 1).	ками околностьта на крњењтъ. Околностът
	на всякій крыть е равна на діаметрыть помно
Крива линія. Всякоя линія, която не е	женъ на 3 ¹ / ₇ . И така ако діаметрить на кри
грава, и не е направена отъ правы, наричася	гжтъ има 7 фута *) джлжина, то растворения
срива. (И. Іф. 2).	та му околность има 22 фута.
Параллелии линии. Лининть гдьто сж те-	
мени на една плоскость, така щото никога	Ось и полюси на Земный Глобусь. Зем
за не могжтъ да са сращиать, наричатся парал-	на ось е една линія умственно прекарана през-
лелии; тія въ сичкото си проджлженіе см от-	центрать на сферата до поврахнината му. Край
далеченни еднакво една отъ другя. (И. Іф. 3).	щата на тая линія ся наричать полюси
on condit namendes samendes in another of the off	(H. I. II).
Перпендикулярна линія. Перпендикуляр-	and an antiparty of the second s
на линія е тая, която пресича другж едиж.	ЗА СИЧКА ВСЕЛЕННАІ-А.
безъ да ся наведе ни на една страна. (И. Іф. 7).	
Полееата линіл. Полегата линія е тая,	Космографическо опредъление.
която пресича други едни, и е наведена по-	Космографіята описва вселеннать; сичкь
вече на една страна. (И. Іф. 5. ВС).	ть тьла, гдьто ги е сжадаль Богъ, наричато
Горизонтална линія. Една права линія,	вселенная, такива см: свътилата, които с
която можемъ да си представимъ на тихж по-	(* Гледай на таблицятя. No 2.
вржхнинж на водата, наричася горизонталиа.	

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 form 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 *Introcuction* 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: Koprivshtitsa, 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.

References

- [1] Mijajlović, Ž., Ognjanović, Z., Pejović, A. *Digitization of mathematical editions in Serbia*, Mathematics in Computer Science, 3(2010), 251–263.
- [2] Pejović, N., Malkov, S., Mitić, N., Mijajlović, Ž. Serbian and International Honors Awarded to Milutin Milanković, Review of the National Center for Digitization, 28(2016), 79–86.
- [3] Стоянов, М. Българската възрожденска книжнина, София: Наука и изкуство, 1957.
- [4] Павлович, Хр. Аритметика или наука числителна. Разположена на три части и окончавающа с един месяцослов праздничен. За болгарските деца кратко и весма ясно сочинена от сущаго из Дупница Македонска Хрисанта Павловича, учителя в Славено-елинското в Сищов училище, който и на свят сега перво издава я, помощ земав от любоученните единородни. Предстоявал и изправял негов ученик Христодул Костович С. Белград: Княжеско-Сербската типография, 1833.
- [5] Богоров, Ив. Всеобща география за децата. Преведи от руский язик Иван А. Богоев. ч. 1-3. Белград: Княжеско-Сербската типография, 1843.
- [6] Богоров, Ив. Математическа география [от В. Бардовски]. Преведена от рускийт на новобългарскийт език. Част първа. Одеса: Брауновата типография, 1842. Богоров, Ив. Всеобща география за децата. Преведи от руский язик Иван А. Богоев. ч. 1-3. Белград: Княжеско-Сербската типография, 1843.
- [7] Геров, Н. *Извод от физика*, написан от Найдена Герова. Чяст пръва. Белград: Правителствена книгопечатня, 1849.
- [8] Бозвели Хилендарец, Н. и Васкидович, Ем. Аритметическое руководство за наставление на болгарските юноши. Напечатано с одобрением его Височества князя сербскаго Милоша Теодоровича Обреновича. Благословением же Преосвященнейшаго Сербий митрополита господин Петра. Первом же издано от Неофита Архимандрита Хилендарца родом же Котлянца и Емануила Васкидовича Еслиногреческаго Сищовскаго училища учителя. Крагуевац: Княжеско-Сербска типография, 1835.

vstoykova@yahoo.com