



Implications of Philately in the Development of Mathematical Skills for the Primary Cycle

Mădălina Lupșe¹, Bogdan-Vasile Cioruța^{2*} and Alexandru Leonard Pop²

¹*Technical University of Cluj-Napoca - North University Center of Baia Mare, Faculty of Letters, 76 Victoriei street, 430122, Baia Mare, Romania.*

²*Technical University of Cluj-Napoca - North University Center of Baia Mare, Office of Informatics, 62A Victor Babeș street, 430083, Baia Mare, Romania.*

Authors' contributions

This work was carried out in collaboration among all authors. Authors ML and BVC designed the study, performed the literature searches and wrote the first draft of the manuscript. Author ALP managed the analyses of the entire study. All authors read and approved the final manuscript.

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ABSTRACT

The development of mathematical skills for the primary cycle is a triple challenge in the current context of education in Romania. The first of the challenges is given by the fact that education has become an activity still unstructured with political movements and decisions, implicitly with the changes that have taken place in the ministerial apparatus. The second challenge is given by the methodological changes and of the school curriculum, which comes as a completion of the first challenge, and the third challenge is given by the weight of the teachers in making mathematics an attractive discipline. In this sense, the challenge for us is to show that this triple barrier can be overcome. As such, in the present study, a mixed-method of presenting the mathematical contents in the classroom is proposed, especially for the preparatory group, class I and II, through the prism of the instruments offered by the Romanian thematic philately. The results of the study are presented in the form of worksheets, of which we present only excerpts to summarize the possibilities arising from the association of philately with notions of mathematics training for the primary cycle.

*Corresponding author: E-mail: bogdan.cioruta@staff.utcluj.ro;

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1. INTRODUCTION

Mathematics is indisputable, related to the life cycle of all other sciences, one of the most beautiful sciences. Mathematics means organized, creative, investigative and original thinking 1. It develops logical thinking and a certain kind of creativity 2, being important in the life of each person and a priority in its formation. The primary classes are decisive in the formation of the basic notions, of the concepts on which the students will operate throughout their lives, and on which the entire mathematical education system is built. During this period, the basic tools are formed (counting and calculation skills, measuring, composing and solving problems, etc.), and some skills and aptitudes of thinking are developed.

The development of mathematical skills for the primary cycle is a triple challenge in the current context of education in Romania. The first of the challenges is given by the fact that education has become an activity still unstructured with political movements and decisions, implicitly with the changes that have taken place in the ministerial apparatus 3. In turn, these changes are meant to alter, the structure and integrity of the education system 4. The second challenge is given by the methodological changes and the curriculum, which come as a complement to the first challenge.

Mathematics raises problems for most students, is considered a difficult discipline 5, or even the equivalent of a boring foreign language 6. This is how the third and final challenge is given by the weight of teachers in making

mathematics an attractive discipline. There are rare cases in which they succeed, given that the mathematical notions are not easy to manage, but especially to be nuanced, on the still unarticulated mathematical language of children.

In this sense, the challenge for us is to show that this triple barrier can be overcome. As such, the present study proposes a mixed method of presenting mathematical contents in the classroom, especially for the preparatory group, class I and class II 7, in terms of the tools offered by the Romanian thematic philately. We refer to this, as it makes the transition from the simple activity of collecting philatelic materials and studying them 8, to illustrating a certain theme. The number of themes that can be illustrated is unlimited. It depends both on the culture, the imagination, the preferences of the collector, and on the possibilities he has in procuring his philatelic material. Thematic philately has a dynamic meaning, meaning the involvement of the collector in the development of a story 9.

For a thematic collection, the philatelic material is chosen only according to the theme, regardless of the issuing country or the date of issue. A thematic collection is not limited in time 9. The current abundance of stamp issues, their diversity and other philatelic documents, as well as the requirement of exhibition organizers in providing exhibition space, require the choice of a theme as small as possible (see as an example Fig. 1) because the chosen theme to be able to be deepened and exemplified as well as possible.



(a) various stamps representing faunal species



(b) various stamps representing floral species

Fig. 1. Examples of philatelic materials grouped by topic

A thematic collection is fascinating because it allows continuous improvement. In fact, the more you become familiar with the subject, the more you discover new details to support your story and to purchase new relevant philatelic materials. The more you know about philatelic materials by consulting philatelic literature and catalogs, critically consulting the materials offered by merchants, and by studying other collections, the more you can improve the development of your collection by adding new materials.

Collections that do not develop a theme, but simply accumulate philatelic materials that have a common subject, are far from being the essence of thematic philately because they do not offer a story and contain little personal study on the chosen subject. The arrangement of philatelic materials, according to criteria such as country of issue, year of issue, etc., are only preliminary approaches to thematic philately. However, all these aspects do not give real pleasure to a thematic collection. A thematic collection is built around a major concept, freely chosen by the collector.

This choice normally refers to a personal or professional interest. There are no limits in choosing the theme. A quick examination of a catalog at a world philatelic exhibition will give you an effective perspective on the multitude of thematic options available to collectors. For example, here are some randomly chosen titles: butterfly world, tennis, computer, beekeeping, motor vehicles, photography, Olympics, Christmas, etc.

The richness of philatelic material often allows the collector to interpret the same subject in different ways, thus generating very different collections. For example, a collection of computers may be present under at least three hypostases: from abacus to laptop, computer story, or from abacus to the internet; and a collection of birds can be presented under many headings such as bird life, how to identify birds, etc.

Due to the vast content and the promises of a multivalent approach to a subject, philatelic material can also be used as a teaching method. In such a context, thematic philately based on various philatelic effects manages to fulfill a series of roles, including the following: knowledge and information, presenting an artistic vision of the past and present, and combining knowledge from the vast fields

(natural sciences, history, geography, arts, mathematics, philosophy, religion, etc.).

Strictly speaking, mathematics is a tension, a form of mobilization of the spirit that means training the intellect, thinking in the foreground, developing memory and attention. At the same time, the formation of order and punctuality skills, respectively the formation and cultivation of intuition, spontaneity, quick solution of problem situations that arise, and, last but not least, a language characterized by clarity and precision, are all the prerogative of mathematics.

For the math to turn from a nightmare into an attractive challenge, the methods applied by the teacher in the classroom are very important. Therefore, in this paper, we chose to talk about the possibilities of implementing philatelic material in the pedagogical process. Specifically, we chose to present the impact that Romanian thematic philately can have on the development of mathematical skills. Thus, starting from the current state of knowledge on the use of philately in education in Romania, we chose to bring to the fore details related to the involvement of philatelic materials in the curriculum for mathematics. Only the activities that are suitable to be performed in the preparatory class, class I and II were targeted.

From a strictly methodological view, although the present study aimed only to illustrate the possibilities of implementing philatelic materials in the classroom, as a substitute tool for the various materials that teachers often have to prepare students (drawn materials, cut materials, and other objects), we concluded that we can go a little further. Thus, without taking into account the idea of comparing the proposed educational method with the existing ones, we set out to partially investigate whether the method is loved by students. The mixed working method is being tested with the help of a small group of students (10, maximum 15). For them, a series of exercises adaptable to the classroom are prepared, both on the spot and online (through Zoom®, KnowledgeBase®, MS Teams®, where the Kahoot® application also intervenes).

The results of the proposed study are presented in the form of worksheets, of which we present only excerpts to summarize the possibilities arising from the association of thematic philatelic pieces with notions of mathematics training for the primary cycle. On the other

hand, we want this study to be equally an incentive for those who train, especially teach notions of mathematics, in finding new ways to make mathematics more attractive.

2. MATERIALS AND METHODS

The present study started from a variant of the curriculum for the discipline "Mathematics and environmental exploration" 7, issued and validated by the relevant ministry in 2013. Besides, after adapting and updating the information, the pedagogical approach achieved through philately overlapped Romanian themes.

As for the philatelic pieces that were used, strictly in the sense of exemplifying the different nuances that mathematics wears, they were "purchased online" from open-source platforms with specific content. For example, postage stamps, as presented in worksheets, as part of various mathematics-specific requirements, are collected from the Colnect® platform 10, while maximum postcards or other philatelic effects were obtained from Delcampe® platform 11.

Applicable mathematical teaching methods based on philately can contribute both to the development of students' general culture (some stamps feature personalities, relevant data in the history of the world or a country, different species of animals and plants, tourist attractions, etc.) and to the development of mathematical skills, given that there are pieces that contain the face of an intellectual, a mathematical formula or other similar elements. The school curricula for primary education (on the interval of the preparatory group - class II) allow the implementation of such materials, the way of working being explored in detail in the following.

3. RESULTS AND DISCUSSION

The usefulness of mathematics in everyday life is often questioned by students and not only, most often without a good reason. Many of the abstract aspects of this discipline may seem disconnected from everyday life, without an apparent practical basis 12. Under these conditions, the application of mathematics in a way understandable to students, carefully calibrated on its practical values and personal and creative development, has become an important personal goal, which we tried to suggest in teaching. Thus, "mathematics through philately" took shape, as a way to practically apply the information accumulated during the mathematics classes.

3.1 Recognize and Write Numbers

Recognizing and writing numbers is the first step in the whole didactic process of familiarizing students with what we generically define as mathematics. Along with recognition and writing, this stage also involves the counting operation. In this context, according to what is frequently stipulated at the methodological level, the incursion of philately is felt both by philatelic materials (as palpable objects) and by what they illustrate.

For starters, thematic philately can be mirrored and implemented in:

- recognition of numbers from 0 to 9, as conventional mathematical symbols;
- representation of different numbers with the help of signs - circles, dots, lines, etc. - or objects - chips, sticks, beads, etc. - or, in this case, philatelic pieces - mainly postage stamps, these being the handiest for used (Fig. 2);



Fig. 2. Exercise: "Identify the numerical values on the postage stamps and represent them with dashes or any other elements"

- counting the elements of a set, to highlight the fact that the number of its elements is given by the last number in the sequence 1, 2,... x, where x is at most equal to 31 (for the preparatory group), at most equal to 100 (for class I) and not more than 1000 (for class II);
 - grouping objects (postage stamps) representing animals, plants, buildings, people, means of transport, etc., according to the number of specific elements (such as: by face value in lei);
 - counting back and forth, in complete variants or from one point of the series, from 1 to 1, from 2 to 2, from 3 to 3, etc., with/without handling various objects;
 - finding a number/numbers, respecting certain conditions.
- inevitably, in addition to the activity of recognizing and writing numbers. This stage is summarized, from the point of view of the possibilities of adaptation and implementation of philately in the classroom to the following aspects:
- comparing groups of objects (postage stamps, envelopes, and maximum postcards) by figuring them one below the other, circling the common parts of the groups, and matching the elements of the groups 1 to 1;
 - coloring the elements of a set according to given criteria (eg: "Color the set that has the least / most ..."; "Build/draw a set that has as many / with more / with less ...", etc.);
 - selection of numbers/objects containing numbers according to a given criterion, for example: "Circle in red/green/blue numbers greater than 3 and less than 15", "Circle stamps with a face value of less than 12 lei" (see Fig. 3);

3.2 Comparison of Numbers

The comparison of numbers, as the second stage of the development of mathematical skills among young people, comes naturally, almost



Fig. 3. Exercise: "Circle the stamps above those with a face value of less than 12 lei"

- identification of "neighbors" less than 31 (preparatory class), less than 100 (first class) or less than 1000 (second class);



Fig. 4. Exercise: "Arrange the above stamps in ascending order"

- identifying the smaller/larger number based on the algorithm for comparing two numbers, writing the results obtained, by comparison, using the signs $<$, $>$, $=$, and placing in ascending/descending order some given numbers (see Fig. 4);
- identification and selection of even / odd numbers from a given string of objects (eg: inscription face value on postage stamps or other philatelic materials).

3.3 Order Numbers Using Axis Positioning, Estimates and Approximations

Positioning numbers on the axis, ordering given numbers, ascending or descending, as well as completing numerical series, are just some of the aspects that are further addressed through the analytical program for the mathematical discipline. Along with these, the identification of missing numbers from the number axis appears under the same working principle, in case two random numbers are given. An example in this sense is also supported by the stamps illustrated in Fig. 5. Moreover, the ascending / descending order of some natural numbers by comparing them two by two can also be included in the same category of specific requirements for classes I and II.

Other requirements, which may relate to the different nominal values of postage stamps, are summarized in:

- identification of numbers, located in a given interval (eg: "Write three numbers less than 25", "Write two numbers greater than the value shown on the second stamp");
- writing a string of even / odd numbers, given the limits of the interval;
- estimating the result of a calculation without performing the calculation;

- identifying, writing, and reading the order relation between given numbers.

3.4 Carrying out Additions and Subtractions, Mentally and in Writing, Using Counting and/or Grouping whenever Necessary

After recognizing and writing the numbers, comparing and ordering them on the axis, it is our turn to review operations with numbers. Mainly, the transition is made gradually, starting from a few pedagogical fireworks, respectively:

- counting with a given step (eg from 2 to 2, from 3 to 3, from 5 to 5, etc.), with or without intuitive support represented by philatelic materials (as objects, drawings);
- proposing role-playing games that require the composition and decomposition of sets of objects with a cardinal number of elements less than 10, then less than 31 (for the preparatory class), less than 100 (for class I), and less than 1000 (for class II).

After such training, we move on to the stage in which the performance of addition and subtraction operations enters the scene. As a result, the requirements are outlined in the format:

- adding and extracting items from a set of objects (for example, postage stamps), each operation being accompanied by object counting;
- adding/extracting elements from a given set, to obtain sets "with as many elements";
- solving addition and subtraction exercises with 1-5 units or more in the 0-31 concentration and checking the operations performed by counting objects/drawings (as shown in Fig. 6);



Fig. 5. Exercise: "Arrange the above stamps in ascending order"



Fig. 6. Exercise: "Add a value to each of the numeric values on the above postage stamps to get 20"

- using a computer for simple assembly operations and checking the results with the help of objects (in this case philatelic parts), or by the reverse operation;
 - highlighting the properties of the assembly (commutativity, associativity, neutral element), without specifying the terminology itself;
 - finding the "rule" for correspondence of type $3 \rightarrow 7, 4 \rightarrow 8, 5 \rightarrow 9$, etc.;
 - identification of the elements of a second set, given the elements of the first set and the rule of correspondence;
 - solving additions and subtractions, mentally and in writing, with and without overriding, respecting the algorithm and the correct placement of units, tens, and hundreds (as appropriate).
- activities of acquiring various mathematical skills, such as:
- games of repeated extraction of a certain number of items from a given set (eg: "How many children can receive 2 stamps from you if you have 10 stamps?" "A little boy gives 5 postcards to his 3 colleagues How much did he give in total? ", etc.), according to the example presented in Fig. 7;
 - counting with step indicated by drawing or objects, ascending and descending;
 - highlighting several ways of grouping the elements of a set to determine its cardinality;
 - solving practical situations of finding an amount/difference of equal terms (for example: "Four brothers receive two apples each. How many apples did the brothers receive?")
 - highlighting some properties of multiplication (commutativity, associativity, neutral element), without specifying the terminology;
 - performing divisions with remainder 0, in the concentration 0-100 by repeated decreases or resorting to multiplication;
 - solving problems in which operations of the same order of operations of different order are required.

3.5 Performing Repeated Addition/ Subtraction by Counting or/and Objective Representations

Probably the most effective stage in the full understanding of addition and subtraction operations is achieved by successive counts or, as the case may be, by objective representations. Philatelic pieces are special forms of object representation. Possessing several advantages with mathematics, by explicitly exposing the nominal values, the stamps can also be used successfully in



Fig. 7. Exercise: "If you give a colleague 5 stamps with nominal values like the ones above, what is your total value in each case?"

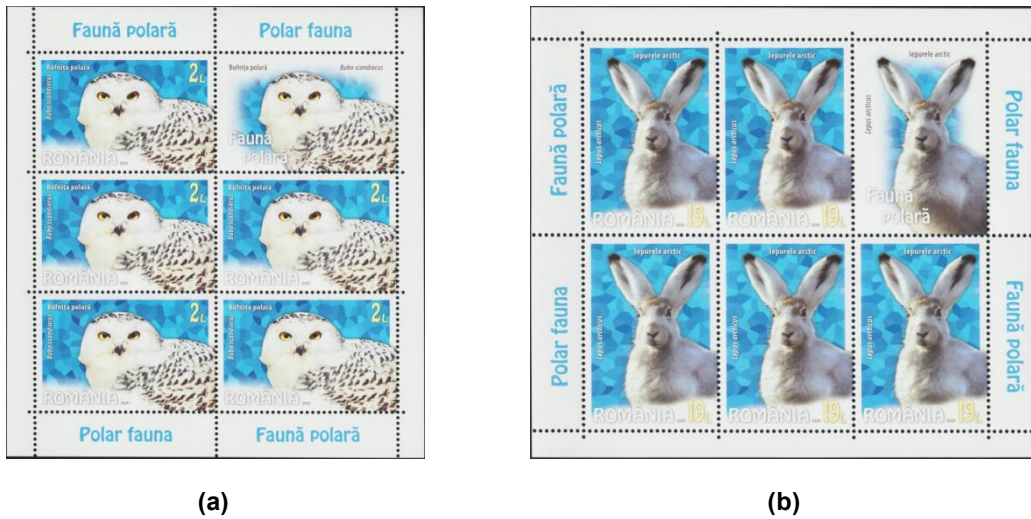


Fig. 8. Exercise: "Create and solve a problem like any of the ones mentioned above, using any of the above stamps"

3.6 Use of Mathematical Names and Symbols in Solving and/or Composing Problems

The use of mathematical names and symbols (sum, total, difference, =, +, -) in solving and/or composing problems is of course a final step that this study addresses. There is in this context a diversified range of requirements and requests, increasingly complex, of which we mention only a part, namely:

- finding the sum/difference of two numbers less than 31 (preparatory class), less than 100 (class I), and less than 1000 (class II);
- finding an unknown term, using the balance method;
- the proposal of role-playing games that require the grouping/regrouping of objects (both stamps can be used as tangible objects, as well as the nominal values represented by them) and the whole-party relationship (eg: library ", " At the market ", " At the store ", " At the walk ", " At the zoo ", etc.);
- identifying the smaller / larger number based on comparing two numbers less than 100 and writing the relationship;
- creating simple problems after given images (stamps, postcards, other philatelic elements) and/or solving some problems starting from a given theme (see Fig. 8), by changing the numbers/actions /question from a solved problem;

- changing the components of a problem (numerical data, topics, actions), without changing the type of problem;
- solving exercises such as: "Find the amount / difference / product / how much / half / quarter / double, etc.";
- finding an unknown term, using the balance method, the addition/subtraction test, or by testing;
- formulating and solving problems starting from a given topic / from given numbers / from verbs/expressions that suggest operations.

4. CONCLUSION

Through mathematical reasoning and scientific thinking, the student can more easily understand other educational disciplines and is trained and develops the ability to work organized and rhythmic. It also matters both the involvement it shows towards mathematics, in the case of the present study, and the involvement of the person(s) who train it, teachers or parents.

Through this study, we wanted to show that there is a progressive relationship between the six parts of section 3, i.e. recognize and write numbers, comparing numbers, ..., and use of mathematical names and symbols in solving and/or composing problems, each deriving naturally from the previous ones. We also wanted to show that the teacher and the parents involved in education, has access to a

diverse and extremely dynamic range of means, tools, and methods in making the child understand and love mathematics. Moreover, we want this study to stand the test of time, and to certify the need for a multidisciplinary approach with each of the disciplines to be studied. In this sense, we hope that understanding a subject (mathematical operations) is much more objective and effective.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ionica MJ. The importance of mathematics in the primary cycle. EDICT - Revista educației”, 20.01.2019. Accessed on 01.02.2021. Available: <https://edict.ro/importanta-matematicii-la-ciclul-primar> (Romanian)
2. Nedelcu ER. Cultivating students' creative thinking through mathematics lessons. “EDICT - Revista educației”, 09.03.2019. Accessed on 01.02.2021. Available: <https://edict.ro/cultivarea-gandirii-creative-a-elevilor-prin-lectiile-de-matematica> (Romanian).
3. Organisation for Economic Co-operation and Development (OECD), Reviews of National Policies for Education: Romania; 2000. Accessed on 03.02.2021. Available: <http://www.invatamant-superior.ro/wp-content/uploads/2013/08/analiza-politici-rom-rmn-t05.pdf> (Romanian).
4. Ministry of Education from Romania, Romania - Education and vocational training strategy for the period 2016-2020, 2016. Accessed on 03.02.2021. Available: https://www.edu.ro/sites/default/files/_fi%C8%99iere/Minister/2016/strategii/Strategia_VET%2027%2004%202016.pdf (Romanian).
5. Amaranda IA. Beliefs and impressions of students related to mathematics. "EDICT - Journal of Education", 03.03.2020. Accessed on 09.02.2021. Available: <https://edict.ro/convingeri-si-impresii-ale-elevilor-legate-de-disciplina-matematica> (Romanian).
6. Jinga E. Mathematics, a foreign language? "EDICT - Revista educației”, 12.02.2019. Accessed on 05.02.2021. Available: <https://edict.ro/matematica-o-limba-straina> (Romanian).
7. Anonymous. Curriculum for the subject "Mathematics and environmental exploration", Annex no. 2 to the Order of the Minister of National Education no. 3418/19.03.2013. Ministry of National Education; 2014. Accessed on 11.02.2021. Available: www.edums.ro/invprimar/25_Matematica_explorarea_mediului_CP_II_OM_EN.pdf (Romanian).
8. Anonymous. About philately. Romfilatelia. Accessed on 13.02.2021. Available: <https://www.romfilatelia.ro/ro/de-spre-filatelia> (Romanian).
9. Dobrescu DN. Thematic Exhibitor's Manual, Axa Publishing House, Botoșani; 2008. Accessed on 11.02.2021. Available: <http://philatelica.ro/met.pdf> (Romanian).
10. Anonymous. Colnect® platform. Accessed on 13.03.2021. Available: <https://colnect.com/ro/stamps/years/country/177-Rom%C3%A2nia> (Romanian).
11. Anonymous. Delcampe® platform. Accessed on 13.03.2021. Available: https://www.delcampe.net/en_US/collectibles
12. Măgdaș E. Mathematics - concrete applications in personality development, “EDICT - Education Magazine”, 08.09.2020. Accessed on 02.02.2021. Available: <https://edict.ro/matematica-aplicatii-concrete-in-dezvoltarea-personalitatii> (Romanian).

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