Comparison of Intermediate Lithuanian Mathematics Programs with the Franch Mathematics Program

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I. Introduction

The most important event that influenced mathematics curricula in Western Europe was 1905. The convention of the Society of German Naturalists and Doctors was held in the city of Merane. The initiator of this convention was the famous German mathematician Felix Klein. At the convention, a draft of the German mathematics curriculum for general education was adopted, which is now called the Merane curriculum. According to this syllabus, mathematics had to be taught using functions. First, the concept of function was introduced in algebra and trigonometry. Areas of geometric figures, volumes of bodies are suggested to be interpreted as functions of their dimensions. Merane's program envisages introducing the concepts of derivative and integral of a function in secondary school.

The idea to reorganize mathematics programs in independent Lithuania arose immediately after regaining independence. A major influence in the development of mathematics programs was France.

Sincov D.M.'s publication "Sbornik program i instrukcij po prepodavaniju matematiki v zapadnaj Evrope"[4] contains not only the programs and methodological instructions of the foreign countries France, Denmark, Italy, Austria, the German federal states of Württemberg and Baden, but also indicates the number of weekly hours, for studying the subject of mathematics. Using the material presented in this publication, a comparison of the number of lessons devoted to teaching mathematics was made in various foreign countries and in Lithuania in the 20th century. at the beginning.

The first mathematics curriculum of Independent Lithuania for primary school was prepared in 1919, published in the periodical in 1921, in the journal "Science and Life". The program is very concise. Most often, the subject that must be covered during one academic year is described in one or more sentences [3]). P. Mašiotas notes in the

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article "Mathematics programs in construction" [2] that the programs are defined too narrowly. Not every teacher who receives such a program is able to name the subjects and draw up a detailed program himself. In this article, he states that "only very well-established programs can be poorly taught." [2]

There was no common plan for secondary and higher schools, and we had to wait longer for it. According to A. Ažubalis, matters of arithmetic teaching in senior classes are discussed for the first time in S. Balčytis' article "On the mathematics teaching plan in middle school" [1].

II. Comparison of the Mathematics Program of the First Lithuanian Primary School with the One in 1912. French Primary School Mathematics Program

Before we start comparing math programs, let's look at the French curriculum. Teaching starts from primary grades. After them, preparatory classes begin. Interestingly, they start numbering from the ninth grade in descending order. Preparatory is only ninth grade. Elementary grades are eighth and seventh grade. Cycle I begin after these classes. This cycle consists of the sixth, fifth, fourth and third grades. Cycle I consist of two sections A and B. The training of the second cycle lasts 3 years. Cycle II is divided into several types of schools.

We will compare the first mathematics program of the Lithuanian primary school, which was prepared in 1919. with the French Elementary Mathematical Syllabus (1912).

Although the first Lithuanian primary school mathematics program was prepared in 1919, it was published in a periodical only in 1921.

In 1921 the primary school program in Lithuania is not much different from 1912. French primary school mathematics programs. However, there are differences, we will analyze them.

1st class. In Lithuania, the arithmetic course introduces reading, addition, and subtraction up to 20, and teaches how to count with whole tens up to 100. In the French program, already in the tenth grade (in the program, the classes are presented in descending order, the classes were also numbered) actions were performed with numbers up to 1000. Both programs introduce basic metric units of measurement: steps, meters, centimeters, liters, grams. As in the French program, as well as the Lithuanian one, it is taught to estimate sizes. The program includes exercises for guessing length, distance, width, weight and more.

If in the Lithuanian program the fractions æ and ß are introduced in the 1st chapter, then in France - in the 9th grade (in the 2 class). Intuition in evaluating things continues to develop.

At a similar level, the program presents the complexity of calculations: addition, subtraction, multiplication and division of single-digit and multi-digit numbers.

2 class. In Lithuania, a part of the geometry course is introduced, which teaches measurement of straight lines, drawing, division into equal parts, measurement and calculation of the area of a square.

In the French program, operations with decimal fractions are introduced first, followed by operations with simple fractions. The Lithuanian program examines separate composition, subtraction, multiplication of fractions and division of whole numbers of simple fractions with denominators 2, 4, 8, 16, 5, 10, 100, 3, 9. The

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Lithuanian program examines decimal fractions after learning part of the simple fractions training course.

3 class. In Lithuanian primary school, actions up to 1000 are provided. It should be noted that memory calculation exercises are also provided up to 1000, learning to determine the length and width of figures by heart.

The part of the geometry course, which includes measuring, drawing, dividing straight lines, equalizing angles, measuring angles with a ruler, and measuring and calculating the areas of squares, is already included in the Lithuanian elementary program of 3 class. In the corresponding class in the French program, only basic geometric figures and their models are introduced.

In the eighth grade of France (corresponding to the 3rd grade of Lithuania), a lot of attention is paid to the metric system.

4 class. (Respectively in the 7th grade) the French program provides for teaching to work with decimal fractions, then simple fractions. In geometry, measuring the surfaces of such figures as: cube, pyramid, prism, cylinder.

In Lithuania, 4 class also provides for teaching time tasks, calendar knowledge, simple fractions. It should be noted that simple fractions are taught first, then decimals. Both square and cubic measurements are entered. Geometry training includes measuring and calculating the area of parallelograms, triangles, polygons, rectangular pole, right prism, cylinder, surface and volume of a cylinder. Learn to plan with an ecker.

We can say that in the primary school program in 1919 more complex topics are provided than in the analogous French primary school curriculum. The analyzed programs have many similarities.

III. Comparison of French (1912) and Lithuanian (1929) Mathematics Programs

In the 1st grade of secondary school, the Lithuanian program provides for learning calculation with random numbers, solving the simplest time problems, getting to know decimal fractions and the simplest actions with them. The program covers the following topics: area and volume measurements, volumes of rectangular boxes and cubes, drawing rectangles and squares in their actual sizes using a scale. In the examined Lithuanian mathematics program, it is constantly reminded that tasks must be taken from the environment, from social life, knowledge of the region and other branches of science.

In the French mathematics curriculum, simple fractions are introduced first, followed by decimal fractions. But only after familiarizing with simple fractions, learning to name them and perform actions with them, decimal fractions and their actions are introduced. It is also mentioned here that when solving problems, especially those related to fractions, concrete examples should be used. The teacher is advised not to present any theory. The main goal is to learn to understand the meaning of each action.

In the French mathematics curriculum, the introductory course prepares students for learning simple fractions. It starts with dividing numbers by divisors, then it is planned to teach how to find the largest divisor and the smallest multiple. Next in the program are simple fractions and operations with them. Although operations with decimals were already taught in the 1st grade, after learning operations with simple fractions, we return to the teaching of decimal fractions. Taught topics "Approximated data" and "Determining the results of an approximated data". Problems about prisms,

coils, pyramids, cones, parallelograms, triangles, trapezoids, polygons, circles, circles are already solved in the 2nd grade of secondary school.

In the Lithuanian program in class III, it is planned to solve tasks encountered in practice: calculation of profit and loss, calculation of discounts and interest, concentration of milk fat and other liquids.

Comparing the Lithuanian program with the French one, we can notice a lot of similarities. The topics are very similar, only the order of the topics is different. The influence of F. Klein's ideas can be felt, as students are trained to understand the concept of function from the 3rd grade, solve and create equations with one unknown. Students are "practiced" the concept of a function sequentially - starting with the creation of tables of the size of the phenomenon.

Unlike the Lithuanian program, ordinary fractions are taught. In the fourth grade (respectively in the III Lithuanian grade) the signs of division by 2, 5, 9, 3 are studied, the greatest common divisor and the least common multiple are searched for, even though the concept of simple fraction was already introduced in the sixth grade, operations with fractions with the same denominators. However, only after 2 years, the introduction of the concept of the lowest common multiple leads to a return to the teaching of simple fractions.

When entering the concepts of positive and negative numbers, the Lithuanian and French programs are similar. Concepts are explained with concrete examples. In both programs, once the concept of positive and negative numbers is introduced, actions with polynomials and monomials are considered, and equations with one unknown are solved.

Examining the geometry course, we can also find many similarities in the mathematics programs of Lithuania and France. However, it should be noted that the first theorems, properties of triangles, parallelogram angles, sides and diagonals are proved in both programs when introducing a systematic planimetry course. The examined Lithuanian mathematics program does not specify which statements will be proved. The French math syllabus specifies which statements will be presented without proof.

When examining drawing tasks, the Lithuanian program provides for the solution of standard tasks: drawing a line through a given point, drawing a line parallel to a given point, raising, and lowering a perpendicular, dividing segments and angles into 2, 4, 8, etc. part, drawing angles 900, 450, 600, 300, etc. with the help of a ruler and a protractor. The French program does not specify exactly which drawing problems are intended to be solved, it only says that we solve simple examples and problems by drawing.

Next, we will compare the 1929 a mathematics program for higher schools with Greek and with enhanced foreign language teaching, with a French program for schools with Latin and Greek teaching.

The content of the programs is somewhat different, but in each program, there is a sense of application of functions in solving tasks. Both programs emphasize computation with approximate numbers and estimation of error.

The French curriculum emphasizes that the purpose of the first two grades (i.e., the last grades in the French curriculum) is to prepare students for learning physics, where most physical processes are written in equations, the quantities of which have a functional dependence. Also, students must be able to perform actions with fractions, decimal numbers, use the metric system of measurements.

In the Lithuanian program, when solving quadratic equations, not only real but also imaginary roots are found. The French program does not provide for finding complex solutions of the quadratic equation.

In both the Lithuanian and French programs, the concept of symmetrical points and symmetry is introduced when examining similar triangles and the areas of the simplest figures. Only this is done in the Lithuanian program in the IV th grade of the secondary school, and in the French one - in the Ist grade, completing the geometry course.

In the French program, only studies of circles inscribed and circumscribed about a triangle are provided. From this point of view, the Lithuanian program is broader. Not only circles inscribed and circumscribed into triangles are considered, but also circles inscribed and circumscribed into regular polygons. The teaching of regular polygons is not included in the compulsory curriculum, but it is in the optional (optional) curriculum, although this curriculum does not say anything about what is planned to be taught. In the Lithuanian curriculum, the concept of infinitesimal Ness and limit is provided in the VI class, and in the French only in the optional curriculum. in Lithuania in 1929 a mathematics program was created for several types of schools (with Latin and commercial schools, with reinforced teaching of mathematics and science, with Greek and reinforced teaching of foreign languages). Also in France, not only a program for schools with Latin and Greek, but also a program for schools with Latin and exact sciences was created. In the Lithuanian program, the teaching of logarithms is provided for in all three programs, and in the French one, only in schools with Latin and exact sciences. In France, the main focus is on students learning to use logarithmic tables, the teacher is given the right to present the most general features of the theory, which is based on the teaching of progressions or the study of degree indicators. The Lithuanian mathematics program also teaches how to use logarithm tables. But it is not limited to that. The use of logarithms to find roots of numbers and to calculate more complex formulas, logarithms of trigonometric functions and expressions, properties of decimal logarithms and laws of practical use are examined. In both programs, immediately after learning logarithms, the topic "Problems of complex fractions" is covered.

In the Lithuanian mathematics curriculum (the 1929 mathematics curriculum for high schools with Latin and commercial schools), the teaching of geometry in grade V is very similar to the teaching of geometry in the second (penultimate) grade of a French school with Latin and exact sciences. The topic "Circle. Diameters. Bows. Properties of strings." Analogously, this topic is also presented in the French program: "Circle. Intersection of a circle and a straight line. Tangent. Bows and Strings". Other topics of both programs are also presented very similarly. The topic of the Lithuanian program "Relation between two sections and methods of finding it. Finding the approximate ratio of two segments. Proportionality of sections" corresponds to the theme of the French program "Proportional lengths. Points that divide line segments in each ratio. The Concept of Harmonic Division'. Another topic in the program is "Similar Triangles". However, we can already find more differences here. The French mathematics curriculum describes this topic very succinctly - "Similar Triangles". The Lithuanian program under consideration also examines a separate case of similar triangles - right-angled similar triangles and their signs of similarity. Trigonometric functions: sine, cosine, tangent and cotangent are entered in both programs, but the Lithuanian program emphasizes that these functions are considered only for acute angles. Similar regular polygons and the ratios of their perimeters and areas, as well as

the calculation of the area of a regular polygon, are covered in both programs. When examining regular polygons, the concept of the number is introduced (in both programs). The length of the circle is considered as the limit of the perimeters of the inscribed and defined polygon (in both programs).

Another group of geometry topics is "Position of lines and curves in space. Planes". Both programs deal with the topics "Perpendicularity and parallelism of lines and planes. Double-walled corners. Perpendicular planes". It should be noted here that symmetry is mentioned in many topics in the French mathematics curriculum. Symmetry is mentioned both when studying planes and when studying geometric figures.

The sequence of topics remains the same in both programs. Both programs explore topics about geometric bodies: prisms, coils, pyramids, cones, spheres. The surfaces and volumes of these geometric bodies are calculated. In the study of the topic "Sphere", plane sections of the sphere, large spheres and the characteristics of their arcs are studied. It should be noted that the topic surface of the ball and its parts, volumes of the sections of the ball are presented only in the Lithuanian mathematics program (these topics are not included in the French mathematics program).

In the French mathematics curriculum, a separate course "Trigonometry" is distinguished. In the Lithuanian mathematics program, trigonometry is not singled out separately. It is taught during the lessons of the "Geometry" subject. In both programs, trigonometric function interrelationship formulas, argument sum and difference formulas, double and half argument trigonometric functions are studied. We could single out the essential differences between these programs: the Lithuanian program contains problems of practical application of trigonometry, and the French one - the theory of projections.

In the Lithuanian school, in the VIII grade and the first (last) grade, the canonical calculus course of the French general mathematics program is part of the higher analytical geometry course. Both programs deal with quadratic equations in two variables and their geometric representation. Such curves as ellipses, hyperbolas, parabolas are examined. The properties of these curves, the search for tangents and normal lines are examined.

We can compare the Algebra VII and VIII grade course with the French math program for a special grade. In grade VII, the Lithuanian mathematics program starts with compound theory and Newton's binomial formula. These topics are also covered in a special class in the French mathematics curriculum. In the French mathematics program, a special class introduces complex numbers, Moivre's formula, and after a significant part of the mathematics course, introduces the concept of imaginary roots of an equation and finding those roots.

In the eighth grade, the Lithuanian mathematics program includes the course "Analysis of infinitesimals". This course examines the theory of limits, continuity of functions, basic laws of differentiation of functions, finding extrema of a function of one argument, integration, finding areas of curvilinear figures.

Examining the mathematics program of the French supplementary class, we can find from the previously listed topics of the "Analysis of infinitesimals" course: continuity of a function, finding limits, finding the minimum and maximum value of a function, using the integral of a function to find the area of a curved trapezoid, integration. Differentiation of functions is not an additional class in the French curriculum, but it is taught in a previous math course.

Also, in the French additional mathematics class, the Analytical Geometry course deals with second-order curves. Their examination was also provided for in the previous program in the last grade, only at a much lower level (in the new program, these curves are examined much more extensively).

1912 the French mathematics program was significantly influenced by F. Klein's ideas. Comparing France in 1912 and Lithuania in 1929 mathematics programs have many similar topics, only the order of the topics is slightly different. In the analyzed programs, the application of functions for problem solving is felt.

IV. Conclusions

1. After analyzing the French mathematics program (1912), we can say that the program is strongly influenced by F. Klein's ideas.
2. Lithuanian math program for primary school (1921) has many advantages in comparison with French math program for primary school (1912).

Similarities:

- Elementary mathematical counts.
- Metric system and knowledge of initiative geometry.

Differences:

- The teaching method of the presentation of fractions differs in Lithuanian program common fractions are introduced higher than decimal fractions, whereas in French math program firstly decimal fractions and operations with them are introduced and only then common fractions.
- Lithuanian math program for primary school provides more difficult themes than analogous program for primary school in France.

3. In Lithuanian (1929) and French (1912) math programs:

- Pupils from the III form are prepared to understand the concept of function and functions used for the solution of tasks;
- The introducing of systematic plane geometry course provides the proof of the first theorems, triangle properties, properties of parallelogram angles, sides, and diagonals.
- The solution of percent tasks.
- Differentiation, integration.
- Binominal theorem.
- In geometry content is very similar in both programs, the order of the introduction of themes is the same.
- There are parts of the course of higher analytical geometry.

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Notes