Josef Úlehla (1852–1933)

Summary

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SUMMARY

Josef Úlehla (1852–1933) was an important Czech teacher, teaching mathematics and natural sciences at primary and lower secondary schools in Moravia. He wrote a number of monographs, textbooks, articles and translations of foreign language publications. This monograph describes Úlehla's life, brings the analysis of his mathematical publications and mentions his other works. Some historical connections are included, giving the text an interdisciplinary character. There are attached two factual supplements called *Seznam publikací Josefa Úlehly* (List of publications of Josef Úlehla) and *Přehled pozůstalosti Josefa Úlehly* (Inheritance of Josef Úlehla).

The presentation of Úlehla's life, studies and teaching is primarily based on secondary and tertiary sources. Nevertheless, his publications in the field of mathematics and its history have not yet been described in more detail in the literature. The created inquiry is completely original. Apart from Úlehla's works it provides a view of the situation of Czech elementary education and the mathematical environment in the period of Úlehla's life.

Josef Úlehla

Childhood and studies

Josef Úlehla was born on March 16th, 1852 in the south Moravian town of Podivín near Břeclav, as the son of a miller and merchant Ludvík Úlehla (1821–1882) and his wife Rosalie Úlehlová, born Soglová (1822–1900). He was a strange child. He was very enquiring and bright, but did not speak until he was four years old. He attended the primary school in Boršov near Kyjov between 1855 and 1858 and also in Huštěnovice near Uherské Hradiště from 1858 to 1862. He studied at the lower secondary school in Kyjov from 1862 to 1864.

His parents moved to Břeclav in 1864 and they worked there as innkeepers and J. Úlehla started studying the Piarist Grammar School in Strážnice. He did not finish the school and studied at home as an autodidact in the school year 1867/1868. Then he went to Brno and attended the *c. k. Slovanské gymnasium* (Slavic Grammar School). Not agreeing with the concept of "humanities grammar school"(specialising in classical languages, such as Latin and Greek), he did not like Latin and preferred mathematics and natural sciences, which he learned easily. He wanted to become a teacher, so he moved to the *c. k. Slovanský ústav ku vzdělávání učitelů* (Slavic Teacher College) in Brno in 1871. While having completed the studies successfully next year, he had to repeat the final examination, which he passed in 1873.

Teaching

J. Úlehla was teaching at primary schools (in Czech *obyčejné obecné školy*) located in the area of south and middle Moravia for twenty years. He started in Tvrdonice near Břeclav (in the school year 1872/1873) and then he taught in Bystřice pod Hostýnem (1873/1874), Rozvadovice near Litovel (1874/1878),

Vsetín (1878/1882), Bilany near Kroměříž (1882/1888) and Oslavice near Velké Meziříčí (from 1888 to 1892). His lessons were always carefully prepared and his work was important for school development, specifically procurement of school equipment or books for school libraries. J. Úlehla also had a lot of out-of-school activities, organising amateur theatres, study circles for adults or private tutoring.

Self-education was very important to J. Úlehla. He spent plenty of time reading books on natural and social sciences and studying foreign languages, especially English, French and Russian. He published articles in Czech pedagogical journals (for example *Komenský*, *Paedagogium*, *Česká škola*, etc.). He paid great attention to foreign literature and translated it into Czech. He was influenced by books written by Herbert Spencer (1820–1903), an English philosopher, anthropologist and sociologist. He translated his *Education: Intellectual, Moral and Physical* in 1879. Nevertheless, this book as well as the Spencer's philosophy was not accepted by the catholic church which, together with the state, participated in the organization of the school. Therefore the priests did not support Úlehla's work at school and set up obstacles to his teaching. It should be also noted that he renounced the faith, left the church and proclaimed himself a rationalist and an agnostic.

He then took the opportunity to work at lower secondary schools (in Czech *měšťanské školy*). After teaching in Příbor between 1892 and 1897, he became the director of the lower secondary school in Klobouky u Brna and stayed in that position until 1905. This was one of his most prolific period. He published the tome called *Listy paedagogické* (Pedagogical sheets, year 1899), where he recapitulated previously printed journal articles. He wrote and published his first textbook *Přírodopis pro měšťanské školy* (Biology for Lowes Secondary Schools, three volumes, years 1898–1901). His interest in the history of mathematics was also very important and resulted in the first volume of his monograph *Dějiny matematiky* (History of Mathematics, year 1901). Last but not least, he worked a lot on the development of teachers associations.

It is possible to suspect that J. Úlehla wanted to come back to his native region of south Moravia at the end of his career. That could be the reason why he left Klobouky u Brna and became the director of the lower secondary school in Jaroměřice nad Rokytnou in 1905. He spent only half a year there and moved to Strážnice, working at the samo position, where finished the textbooks *Počet infinitesimální* (Infinitesimal Calculus, year 1906) and *Početnice pro měšťanské školy* (Arithmetic textbooks for lower secondary school, three volumes, year 1909).

J. Úlehla retired in 1912. Nevertheless he served as an inspector of Czech schools in Vienna from 1912 to 1914, after the First World War, in time of the First Czechoslovak Republic, he helped to set up a new school in Lipov near Hodonín. His writing was still abundant. His work from the period contains the second volume of the *Dějiny matematiky* (year 1913) and many texts on pedagogy, anthropology and school organisation. For example *Úvaha o budoucí volné škole československé* (Essay on the future Czechoslovak Free School, year 1920), *Zkoumání o výchově člověka* (Exploration of Human Education, ten volumes, years 1922–1926) or *Rozpravy metodické* (Methodical Essays, year 1925). J. Úlehla died in Lipov on 22$^{\text{th}}$ December 1933.

Úlehla's commemorative plaque

We do not know exactly the building in the town Podivín where J. Úlehla was born. One possibility is the house number 199 according the record in the register of births. This building does not exist today. Úlehla's birthplace can also be the house of present day number 352, which is located in Komenského street and has an orientational number 4. There the Úlehla's commemorative plaque is placed on the facade of the house. It is a bronze relief the size of 50 to 85 centimetres, with Úlehla's portrait from the profile with the text below, *Zde se narodil 16. března 1852 Josef Úlehla, český filosof a pedagog*, and *Desku tuto zřídilo r. 1922 svému vůdci moravské učitelstvo* (Josef Úlehla, a Czech philosopher and pedagogue was born here on March 16th, 1852. The Moravian teachers established this plaque for their leader in the year 1922). These words closely capture the circumstances of making the plaque and also prove that J. Úlehla was already renowned among teachers community during his life.

The plaque is situated approximately two meters above the pavement, so it is prone to damage or stealing. Therefore, an exact copy of the relief was made by author of this work, according to which it will be possible to replace the original in case of loss of the plaque.

Početnice

Arithmetic Textbooks for Lower Secondary Schools

J. Úlehla had a lot of teaching experience in the first decade of the 20$^{\text{th}}$ century. When he published his *Početnice pro měšťanské školy* in 1909, he was already in the 36$^{\text{th}}$ year of his pedagogical practice, having written dozens of papers and the textbooks *Počet infinitesimální* and *Přírodopis pro měšťanské školy*.

Úlehla's *Početnice* is a series of textbooks of arithmetic and basic algebra for so-called *měšťanské školy*. These were the lower secondary schools, established at the time of Austro-Hungarian Empire (more precisely since 1883) as a three year schools for children approximately from the age 11 to 14 (children had to attend a five years of primary school before). They were not mixed schools, just those for boys or girls (single-sex schools). Education of mathematics at *měšťanské školy* was divided into two subjects: *počty spolu s jednoduchým účetnictvím* (arithmetic with elementary financial mathematics) and *měřictví a rýsování* (geometry and technical drawing).

There were four arithmetic textbooks for *měšťanské školy* written in Czech, which were published before Úlehla's *Početnice*. Their authors were Franjo Močnik (1814–1892), František Kneidl (1855–1928) and Michael Marhan (1851–1928), Mikuláš Benda (1843–1925), Josef Horčička (1970–1939) and Jan Nešpor (1879–1931). The first one, F. Močnik, was Slovenian. His textbooks written in German were translated to national languages of Austrian monarchy, so also to Czech.

Arithmetic Textbooks for Boys' Schools

J. Úlehla wrote arithmetic textbooks for all three grades of *měšťanské školy* and creating separated versions for girls' and boys' schools. He derived the version for girls from the one for boys. The textbook for boys for the first and the

second grade of *měšťanské školy* called *Početnice pro měšťanské školy chlapecké, stupeň I. a II.* (Arithmetic Textbook for Lower Secondary Boys' Schools, Grades I and II) forms the first single volume. The book *Početnice pro měšťanské školy chlapecké, stupeň III.* (Arithmetic book for lower secondary boys' schools, grades III) represents the second volume. The chapters of the works are listed in the following tables.

Stupeň I. Grade I.

Chapter			Page
I.	*Počítání*	Counting	3
II.	*Základní čísla, společná míra, společný násobek*	Natural numbers, greatest common divisor, least common multiple	4
III.	*Soustava desetinná*	Decimal numeral system	5
IV.	*Číslice římské*	Roman numeral system	10
V.	*Základní úkony početní*	Numerical operations	10
VI.	*Počítání s čísly vícejmennými*	Counting with plural numerals	24
VII.	*Počítání zlomkové*	Counting with fractions	27
VIII.	*Počítání úsudkové*	Counting by judgement	31
IX.	*Počet procentový*	Percentages	34
X.	*Jednoduchý počet úrokový*	Simple interest	36
Total			38

Stupeň II. Grade II.

Chapter			Page
I.	*O poměru a srovnalosti*	On proportion and comparison	38
II.	*Trojčlenka jednoduchá*	Simple cross-multiplication	39
III.	*Trojčlenka složená*	Compound cross-multiplication	42
IV.	*Umocňování a odmocňování dvěma*	Second power and square root	43
V.	*Počet procentový*	Percentages	47
VI.	*Jednoduchý počet úrokový*	Simple interest	54
VII.	*Počet diskontový*	Discount calculus	59
VIII.	*Počet lhůtový*	Periodical calculus	62
IX.	*Počet průměrný, směšovací a spolkový*	Average, mixing and associational calculus	64
X.	*Příklady k opakování*	Revision problems	69
	Míry, váhy a peníze	Measures, weights and money	72
Total			37

Stupeň III. Grade III.

Chapter			Page
I.	*Umocňování a odmocňování třemi*	Third power and third root	3
II.	*Složitý počet úrokový*	Compound interest	7
III.	*Výpočty pojišťovací*	Insurance counting	13

IV.	*Počet mincovní*	Coin calculus	17
V.	*Cenné papíry*	Securities	25
VI.	*Řetězový počet*	Chain calculus	30
VII.	*Obchod a knihy obchodní*	Trade and accounting books	33
VIII.	*O číslech protivných*	On opposite numbers	39
IX.	*O číslech obecných*	On general numbers	42
	Rovnice	Equations	44
X.	*Příklady k opakování*	Revision problems	46
	Tabulky	Tables	62
	Kursovní list	Exchange rates	67
	Míry, váhy a peníze	Measures, weights and money	69
	Ukázka obchodních knih	Excerpts from accounting books	72
Total			91

Arithmetic Textbooks for Girls' Schools

The textbook *Početnice pro měšťanské školy dívčí, stupeň I. a II.* (Arithmetic Textbook for Lower Secondary Girls' Schools, Grades I and II) is similar to the version for boys. It contains the same chapters in the same order. There are no differences in explanation of various topics, it contains the same examples. The number of exercises is lower. Only some simple examples were used on the problems were substituted for those more suitable for girls. Typical exercises for girls are about sewing, housework and cooking.

The book *Početnice pro měšťanské školy dívčí, stupeň III.* (Arithmetic book for lower secondary girls' schools, grades III) contains fewer chapters. The following sections are missing: *I. Umocňování a odmocňování třemi* (Third power and third root), *II. Složitý úrok* (Compound interest), *VI. Řetězový počet* (Chain calculus), *VIII. O číslech protivných* (On opposite numbers), *IX. O číslech obecných* (On general numbers) and *Rovnice* (Equations). The topics included in the girls' textbooks are entirely in line with the curriculum. Girls had fewer mathematics lessons.

New editions of Úlehla's *Početnice* and its translations

Úlehla's *Početnice* were printed again under the same name in the years 1912–1915. Then the books were published as *Početnice pro občanské školy* (Arithmetic Textbooks for Civic Schools) in the years 1920–1923. These are similar to the textbooks for boys' schools and intended for both sexes. The reason for this change is that boys and girls had been allowed to study together since 1919. The title of the books probably reflects the effort to change the name of that type to school from the Czech *měšťanská škola* to *občanská škola*, which, however, was not successful.

J. Úlehla wrote another arithmetic textbook for the fifth year of elementary schools in 1922 originally named *Početnice pro 5. školní rok*. The book was printed only once. It is possible to consider that it was written because of demand for textbooks in Slovakia. There was a significant development of secondary schools in the period of the First Czechoslovak Republic stressing the lack of teaching aids. In this situation the Slovak translation of Úlehla's *Početnice pro 5. školní*

rok was published in 1923. The same year, the Slovak version of the first grade of *Početnice* for lower secondary schools was printed, followed in 1924 by the second grade of the book. This translations corresponds to the edition named *Početnice pro občanské školy*, but there was no translation of the third grade.

Evaluation of Úlehla's *Početnice*

Úlehla's arithmetic textbooks for lower secondary schools are carefully written. Their tasks are formulated in a clear way and they press the reader to think. The exercises included are closely connected with real life. They are in a way unusual and sometimes introduce original humour into teaching.

The book represents some of the last textbooks of the period of the Austro-Hungarian Empire. It is austere, without sophisticated typography. The textbooks, which were published after the First World War, are more detailed and they are accompanied by many illustrations. They are also better suited for self-study. There is a possibility that Úlehla's *Početnice* may not have been that widespread. Even so, J. Úlehla probably influenced later authors of arithmetic textbooks. These were Kamil Buzek (1874–1950) and Josef Krůta (1874–1950), Karel Jon (?–?) and Antonie Maxová (1889–1954), Jan Zlámal (1886–?), Josef Vlček (1889–?), Jaroslav Komárek (?–1968), Karel Rakušan (?–?) and Vladimír Dubský (?–?). The friendly voice has been developed in their books as well as emphasis put on self-discovery by pupils. This character of explanation of mathematics is already in Úlehla's textbooks.

Arithmetic Tasks

In the archives of the Moravian Museum in Brno Úlehla's manuscript called *Příklady početní, metodický doplněk k učebnicím pro měšťanské školy* (Arithmetic Tasks, Methodology Supplement to the Textbooks for Lower Secondary Schools) is kept and it has never been published.

The manuscript contains 24 parts, which overlap the chapters of the textbooks. Each part is provided with several solved exercises followed by forty-eight problems to solve. There is the information about the plan to print eight test papers with six exercises mentioned in the manuscript. It can be therefore regarded as a collection of tasks for written tests or for practising mathematical problems. Nevertheless, there are some ambiguities, evidently some parts are missing. The manuscript seems incomplete. In any case, it is a loss this work has not been printed. Otherwise, it would have been one of the oldest of its kind in the Czech region.

Počet infinitesimální

Infinitesimal Calculus

The second Úlehla's mathematics textbook *Počet infinitesimální* (Infinitesimal Calculus, year 1906) is devoted to the basics of mathematical analysis. It is designed for autodidact. J. Úlehla published it because he missed a simple Czech textbook on calculus and he thought that the existing ones were too short or difficult for beginners. The first Czech textbooks of mathematical analysis are shown below placing the Úlehla's work into the historical context.

The first Czech textbooks of mathematical analysis

Fixing the Czech language in Czech countries in the 19th century benefited from the "success"of the Czech national revival and became an important prerequisite for the publishing of mathematical textbooks in the Czech language. Writing Czech study texts at the university level was requested, because professors could start lecturing in our national language against the standard German. The teaching in Czech has been running at the upper secondary schools from the 1860s, at the Technical College in Prague since 1864 and at the University in Prague since 1871.

The oldest Czech study text on the basics of calculus is *Přídavek k algebře pro vyšší gymnázia* (The Addition to Algebra for Higher Grammar Schools, year 1864). It was written by Václav Šimerka (1819–1887), the professor at the grammar school in České Budějovice. He published the work as an appendix to his textbook *Algebra čili počtářství obecné pro vyšší gymnasia* (Algebra or General Arithmetic for Higher Grammar Schools, year 1863). He described the basics of differential and integral calculus, focusing on counting skills more than on the theory. He did not work with precise definitions of mathematical analysis terms, he understood them intuitively. J. Úlehla considered this book to be excessively brief.

František Josef Studnička (1836–1903) was an important Czech mathematician and professor at the Technical College in Prague (from 1864 to 1871) and at the Czech University in Prague (1871 to 1903). He is the author of the first Czech university level textbooks of mathematical analysis. He published *Vyšší mathematika v úlohách* (Higher Mathematics in Tasks, year 1866) and *Základové vyšší mathematiky* (Introduction to Mathematical Analysis, three volumes, years 1867, 1868 and 1871). These works were designed for the Technical College students. They are much more detailed than Šimerka's book, but also formulated intuitively. The epsilon-delta arithmetic is not used in definitions, theorems or proofs, which was already common in mathematical analysis in the last third of the 19th century.

Later textbooks *Všeobecné tvarosloví algebraické čili nauka o konečných i nekonečných součtech čili řadách, součinech a podílech čili řetězcích* (General Algebraic Accidence of Finite and Infinite Sums, Series, Products and Quotients or Chains, year 1880) and *Výklady o funkcích monoperiodických neboli o nižších funkcích transcendentních* (Exposition on Monoperiodic Functions or Lower Transcendent Functions, year 1892) were written during Studnička's work at the Czech University. They are more precise in mathematical expression. Together with the previous textbooks, they contain practically all mathematical analysis that was taught at the university level in Prague at that time.

At the turn of 19th and 20th centuries *Jednota českých mathematiků* (Union of the Czech mathematicians) asked Eduard Weyr (1852–1903), professor at the Czech University and Czech Technical College in Prague, for preparation of new mathematical analysis textbooks. Ed. Weyr dealt primarily with other parts of mathematics and he probably lacked the energy to write the desired textbook. He published just one work called *Počet differenciálný* (Differential Calculus, year 1902). It is more accurate than before mentioned Studnička's books, but it

is rather a compilation of foreign textbooks and contains some mistakes. It was sharply criticized by Jan Vilém Pexider (1874–1914). What occurred after this was a great quarrel, which was also known outside the mathematics community. Ed. Weyr died a year after publishing his *Počet differenciálný* and hence did not write any other textbooks.

Úlehla's *Počet infinitesimální*

J. Úlehla considered Studnička's and Weyr's textbooks to be difficult and he believed that the education of mathematics at the teacher colleges was inadequate. He wrote his *Počet infinitesimální* for primary or lower secondary school teachers or for anyone else, who would like to study the basics of mathematical analysis.

On the one hand, the atmosphere of the text is warm, contains a lot of motivation for study and is very clear. On the other hand, J. Úlehla wrote it according to historical understanding of infinitesimal calculus. He did not work with epsilon-delta arithmetic and precise introduction of terms at all, which was ordinary at the beginning of the 20$^{\text{th}}$ century. He placed *A*) *Úvod* (Introdiction) at the beginning of the book and then he divided the text into two main parts called *B*) *Diferenciální počet* (Differential Calculus) and *C*) *Integrální počet* (Integral Calculus).

In the first of them are described the derivatives of real function of one variable, the counting rules with the derivatives, the result of the derivation of basic functions, the Maclaurin's, the Newton's and the Taylor's series, the derivatives of logarithm, trigonometric and hyperbolic functions or searching for the maximum, minimum and asymptotes of the functions. In the second one J. Úlehla wrote many specific examples of calculation the indefinite integrals and explained the substitution method and the integration by parts. He described the definite integral and its use with the calculation of the length of a curve, the area under a graph, the surface area and volume of a solid of revolution etc. The chapters focusing on differential equations are brief. They present the first order non-linear and linear equations and their use. The last one named *Příklady z fysiky* (Physical problems) was written by František Nachtikal (1874–1939), professor at the Czech Technical University in Prague). It contains some notes on applications of infinitesimal calculus in physics. The textbook ends with a short section called *Přídavek* (Supplement), which describes solution of a cubic equation by Cardano's method and contains a list of analytic expressions of curves. The names of the chapters are summarized in the following table.

Part, chapter		Page
A) *Úvod*	Introduction	1
B) *Počet diferenciální*	Differential calculus	
I. Diferenciál a diferenciální poměr	Differential and Differential proportion	2
II. Logaritmy	Logarithms	12
III. Funkce trigonometrické	Trigonometric Functions	18
IV. Funkce hyperbolické	Hyperbolic Function	28

V. Které úkoly se řeší počtem diferenciálním?	Which problems to solve by differential calculus?	36
VI. Křivky a jejich geometrie	Curves and their geometry	49
C) Počet integrální	Integral calculus	
I. Integrování daných integrandů	Lists of integrals	52
II. Které úkoly se řeší počtem integrálním?	Which problems to solve by integral calculus?	76
III. Diferenciální rovnice	Differential equations	105
II. Které úkoly se řeší diferenciálními rovnicemi?	Which problems to solve by differential equations?	112
V. Příklady z fyziky	Physical problems	117
Přídavek	Supplement	123
Total		130

The second edition of the textbook and its evaluation

The importance of *Počet infinitesimální* for self-study has been documented by its second edition. It was prepared after Úlehla's death by Miroslav Litomiský (?–?) and František Navara (1901–1973) in 1944. This year, respectively durring the Second World War, the Czech universities were closed. This unpleasant situation is reflected in the new title of the book *Vyšší matematika bez učitele* (Higher Mathematics without Teacher). The second edition of the work is practically no different from the first one. There are just some mistakes corrected and the original mathematical terminology is replaced by more modern one. Overall, the textbook concept is not changed.

Generaly speaking, the work *Počet infinitesimální* reflects Úlehla's pedagogical skills and experiences as well as his ability to introduce the mathematics or other natural sciences in an engaging way. It filled an empty space in the Czech mathematical literature and it was timeless. It is possible to compare it with popularization works or polytechnic brochures, which have been published in our country since 1930s. There are also certain downsides that need to be noted. The textbook has an encyclopedic character and is mathematically inaccurate. No responses to the Úlehla's work from the Czech mathematicians was detected. It is possible to consider that Úlehla's textbook was not well known or it was not so widespread in professional public. It is difficult to answer, for whom the *Počet infinitesimální* was helpful. Last but not least, it should be said that the book was surpassed by the later similar works. They are mentioned in the following paragraph.

Textbooks of the first half of the 20$^{\text{th}}$ century

Already mentioned Studnička's and Weyr's works, university level textbooks of mathematical analysis were written by Karel Petr (1868–1950). He was an important professor at the Charles University in Prague. He published *Počet integrální* (Integral Calculus, year 1915) and *Počet differenciální* (Differential Calculus, year 1923). Both books were very well prepared and would, from the mathematical point of view, it meet current requirements. Another valuable textbooks were written by Jan Vojtěch (1879–1953), professor at the Czech Technical College in Brno and later at the Czech Technical College in Prague. He published

two works titled *Základy mathematiky ke studiu věd přírodních a technických* (Fundamentals of Mathematics for the Study of Natural and Technical Sciences, year 1916) and *Přehled vyšší matematiky* (Overview of Higher Mathematics, year 1926), in which he focused on the applications of differential and integral calculus. However there were two study texts of mathematical analysis not reaching such standards. The first of them was the *Základy vyšší mathematiky* (Fundamentals of Higher Mathematics, two volumes, years 1915 and 1918) by František Čuřík (1876–1944). He worked at the Mining University in Příbram, aiming to briefly cover Petr's textbooks, he made mistakes and restricted the explanation to high school level mathematics. The author of the second one was František Rádl (1876–1956), professor at the Czech Technical College in Prague. He wrote more detailed mimeographed *Učebnice matematiky pro vysoké učení technické* (Mathematics textbook for Technical College, year 1931). Nevertheless, there are also mistakes and imprecisions in the work. It was not successful. On the other hand some, very interesting and high quality texts on the basics of mathematical analysis were written in the period discussed by Czech mathematicians Miloš Kössler (1884–1961), Vladimír Ryšavý (1889–1950) and Eduard Čech (1893–1960). They published these books, respectively: *Úvod do počtu diferenciálního* (Introduction to Differential Calculus, year 1926), *Řešené úlohy z vyšší matematiky* (Solved Problems of Higher Mathematics, year 1939) and *Co a nač je vyšší matematika?* (What and what for is Higher Mathematics?, year 1942). Their works primarily motivated to further study of mathematical analysis and they did not consider their books to be a full detailed textbooks.

Finally, it is necessary to mention the books written by Vojtěch Jarník (1897–1950), professor at Charles University in Prague and renowned mathematician even outside the Czechoslovakia. He was an excelent and favorite teacher, he wrote brochures *Úvod do počtu integrálního* (Introduction to Integral Calculus, year 1938) and *Úvod do počtu diferenciálního* (Introduction to Differential Calculus, year 1946). After the Second World War he published more superb textbooks of mathematical analysis, which influenced two generations of Czech mathematicians.

Dějiny matematiky

History of Mathematics

Úlehla's monograph *Dějiny matematiky* (History of Mathematics) can be considered the culmination of his mathematical work. The book is the evidence of his erudition, his understanding of interdisciplinary relationships as well as his writer skills. For contextualization some Czech works on the history of mathematics are mentioned in the following paragraphs.

Czech works on the history of mathematics

Texts written by the following authors were published from the 1860s to the first decade of 20^{th} century. They formed a trend in literature on the history of mathematics, which was characteristic in our country during Úlehla's life.

Josef Smolík (1832–1915) is considered as the first Czech historian of mathematics. He was the teacher of mathematics, physics, Czech and French at a gra-

mmar schools in Bohemia and had wide interests. He was concerned with history of astronomy, numerical algorithms, numeral systems and the history of Czech mathematics. One of his significant work is the monograph *Mathematikové v Čechách od založení university pražské až do počátku tohoto století* (Mathematicians in Bohemia since the Foundation of the University of Prague until the Beginning of this Century, year 1864).

F. J. Studnička was of the opinion that knowledge of history of mathematics is inspirational for professional studies. He supported to the convergence of history of mathematics with its didactics and popularization. His work in the field of history of mathematics is rather extensive, it is focused on the ancient mathematical problems, the history of areas of mathematics or the lives and works of mathematicians. Important Studnička's publications are, for example, *A. L. Cauchy als formaler Begründer der Determinanten-Theorie. Eine literarisch-historische Studie* (A. L. Cauchy as a Formal Founder of Determinant Theory. A Literary-historical Study, year 1876) or *Prager Tychoniana zur bevorstehenden Säcularfeier der Erinnerung an das von 300 Jahren erfolgte Ableben des Reformators der beobachtenden Astronomie Tycho Brahe* (Prague Tychoniana on the Occasion of the Upcoming Annual Celebration of the Memory of 300 Years of the Death of the Reformer of Observing Astronomer Tycho Brahe, year 1901).

Augustin Pánek (1843–1908) was a professor at a grammar school and later at the Czech Polytechnical College in Prague. He was probably influenced by Studničkas' works, he wrote biographies of significant Czech grammar school and university professors of mathematics. He published, for example, *Život a působení p. Václava Šimerky* (Life and Activities of priest Václav Šimerka, year 1888) or *Dr. František Josef Studnička. Nástin jeho života a činnosti* (Dr. František Josef Studnička, Summary of his Life and his Activities, year 1904).

Noteworthy and significant mathematical historiographies were written by Czech grammar school professors in the period. They published their texts usually in *Časopis pro pěstování mathematiky a fysiky* (Journal for Cultivation of Mathematics and Physics) or in annual reports of their schools. These are the works of professors František Fabinger (1863–1938), Ladislav Peprný (1875–1945), Václav Lavička (1846–1911), Martin Kuchynka (1843–1900), Josef Sylvestr Vaněček (1848–1922) and František Hromádko (1831–1911).

Úlehla's *Dějiny matematiky*

The book *Dějiny matematiky* has two parts, published in the years 1901 and 1913. It is the first Czech monograph summarizing the history of mathematics. It is not original or based on primary sources. J. Úlehla wrote it by secondary and tertiary literature on general history and history of science. He designated the book for primary and secondary school teachers and formulated it in popular way.

The first part is dedicated to the oldest arithmetic and geometric considerations, mathematics in ancient Mesopotamia, Egypt, Greek, Rome and Indian, Chinese and Arabic mathematics. Its content is shown in the following table by the names of chapters.

Chapter		Page
I. Úvod	Introduction	1
II. První počátky věd počtářských	Beginnings of mathematics	5
III. Údolí mesopotamské	Mesopotamia	8
IV. Egypt	Egypt	16
V. Malá Asie, Řecko a Itálie	Anatolia, Greek, Italy	40
VI. Řečtí mudrcové	Greek sages	49
VII. Euclid	Euclid	76
VIII. Archimedes	Archimedes	85
IX. Mathematikové alexandrinští ve III.–II. století	Alexandrian mathematicians in 3rd–2nd century	99
X. Heron z Alexandrie	Hero of Alexandria	110
XI. Menelaus a Ptolemaus	Menelaus and Ptolemy	122
XII. Škola filosofů alexandrinských	Alexandrian philosopher school	129
XIII. Diofant z Alexandrie	Diophantus of Alexandria	137
XIV. Theon z Alexandrie a Hypatia	Theon of Alexandria and Hypatia	145
XV. Mathematika byzantská	Byzantine mathematics	149
XVI. Mathematika v Římě	Mathematics in Rome	152
XVII. Indové	Indians	160
XVIII. Indická algebra	Indian algebra	171
XIX. Indická geometrie	Indian geometry	178
XX. Číňané	Chinese	188
XXI. Arabové	Arabs	195
XXII. Alchwarizmi	Musa al-Khwarizmi	202
XXIII. Východní říše arabské	Eastern Arabian empire	208
XIV. Západní říše arabské	Western Arabian empire	235
Total		245

The main Úlehla's source was the monograph *Vorlesungen über Geschichte der Mathematik* (Lectures on the History of Mathematics) written by Moritz Benedikt Cantor (1829–1920), the German historian of mathematics. The first part of *Dějiny matematiky* is written according to the first part of Cantor's book called *Von den ältesten Zeiten bis zum Jahre 1200 n. Chr.* (From the Oldest Times to the Year 1200 AD, year 1880). J. Úlehla considerably abridged his literary pattern, but he interestingly "complemented"it by information from dozens of other books. The list of them is included in *Předmluva* (Preface) of his work. These are foreign monographs written by Bernardino Baldi (1553–1617), August Eisenlohr (1832–1902), Ferdinand Hoefer (1811–1878), Austen Henry Layard (1817–1894), Gaston Maspero (1846–1916) and others. It is captivating how broad knowledge of international books J. Úlehla had, but it quite surprising that he probably did not know the Czech works on history of mathematics at that time, which are mentioned above.

The first part of *Dějiny matematiky* is characterized by the fact that it is directed against ancient Greek and Arab countries. J. Úlehla strongly denied the importance of mathematics there and in this respect, argued with Cantor's monograph and the books of other authors. The premise for it can be found

in his assurance that mathematics originated in the development of agriculture, handicrafts and civil engineering. For that reason he uncritically prioritized the mathematics as well as culture of Mesopotamia and Egypt. He deprecated the classical ancient world probably because he was also not successful at studying at grammars school.

The second part of *Dějiny matematiky*

The second part of the monograph *Dějiny matematiky* is focused on the European mathematics from the beginning of Middle Ages to the half of 19$^{\text{th}}$ century and on the curricula vitae of important world mathematicians. It it written more objectively than the first part and it does not contain as many polemics against the sources. J. Úlehla also referred more precisely to the used literature. Moreover, he also read a number of books to write the second part. Their list, printed also in *Předmluva* (Preface), is larger than the one in the first part.

The chapters included in the second part are presented in the following table. J. Úlehla wrote them again according to the Cantor's texts. He used the last chapter of the first part of *Vorlesungen über Geschichte der Mathematik* and then its second part titled *Von 1200–1668* (From 1200 to 1668, year 1892) and the third part titled *Dritter (Schluss-) Band, von 1668–1758* (Third Final Part, from 1668 to 1758, year 1898).

Chapter		Page
Úvod	Introduction	1
Počátkové matematiky v střední Evropě	Beginnings of matematics in Central Europe	8
Leonardo Pisánský	Leonardo of Pisa	12
Jordanus Nemorarius	Jordanus de Nemore	21
Středověk	Middle Ages	24
Matematičtí spisovatelé od XIII. do XVI. století	Mathematical writters from 13$^{\text{th}}$ to 16$^{\text{th}}$ century	30
Algebra	Algebra	37
Rovnice třetího stupně	Cubic equation	48
Aritmetika	Arithmetic	52
Překlady řeckých matematiků	Translations of Greek matematicians	66
Geometrie	Geometry	68
Kruh, jeho rektifikace a kvadratura	Circle, its rectification and squaring	72
Trigonometrie	Trigonometry	80
Nauka o číslech	Number theory	90
Skladna, úvahy o pravděpodobnosti	Considerations of probability	97
Nový věk	New age	104
Logaritmy	Logarithms	110
Analytická geometrie	Analytic geometry	120
Tangentový úkol, hodnota největší a nejmenší	Searching for tangent, the largest and smallest value	128

Infinitesimální úvahy	Infinitesimal ideas	138
Leibnizův počet infinitesimální	Leibniz's infinitesimal calculus	147
Počet infinitesimální a jeho rozvoj do roku 1727	Infinitesimal calculus and its development until 1727	165
Newtonův počet fluxionový	Newton's method of fluxions	171
Spor o prvenství	Dispute about the primacy	183
Další vývoj vyšší analyse	Further development of higher analysis	198 198
Počet variační	Calculus of variations	210
Nekonečné řady	Infinite series	227
Životopisy	Biographies	264
Ukazatel	Index	311
Total		337

Regarding to the textbook *Počet infinitesimální*, it is interesting to have a look at the chapters dedicated to the beginnings and development of mathematical analysis. More merits credited to Gottfried Wilhelm Leibniz (1646–1716) can be observed there. He was a German mathematician and philosopher and he made the discovery of infinitesimal calculus independently of Isaac Newton (1643–1727), an English mathematician and physicist. Both gentlemen are today considered to be the founders of mathematical analysis, but J. Úlehla believed that G. W. Leibniz was the original discoverer. Úlehla's understanding was subjective and it was probably influenced by the elegance, clarity and purpose of Leibniz's mathematical symbolism that is still used today. It is true that simple manipulation with the differential symbols gives useful results. More precisely, however, it gave useful results at the turn of the 17$^{\text{th}}$ century. The difficulties resulted in the more precise (ϵ, δ)-definition of fundamental terms of infinitesimal calculus. J. Úlehla did not describe the further development of mathematical analysis in the 19$^{\text{th}}$ century and he did not work with (ϵ, δ)-convention in his work *Počet infinitesimální*.

Evaluation of *Dějiny matematiky*

From today's point of view, it is possible to view deficiencies of *Dějiny matematiky* negatively or, on the ground of these, to criticize Úlehla's historiography more strongly. Nevertheless, the book is adequate to look through the optics of the first decades of the 20$^{\text{th}}$ century. It is necessary to perceive it as the work of a village and small-town teacher and to recognize in its primacy in Czech literature and its potential importance to the teachers.

Nowadays it is possible to recommend to study Úlehla's monograph, but it must be regarded carefully. Reading it allows the encounter with its author, his approach to mathematics, history, culture and philosophy. The book can be seen as an appeal to our education or the discovery of the development of the mathematics with a variety of interdisciplinary contexts.

Finally, it is important to note that the level of study of the history of mathematics was very high in our country in the period of the First Czechoslovak Republic. It is represented by the works of above mentioned K. Petr and a professor at the Czech Technical University in Prague, Karel Rychlík (1885–1968). Our most important historian of mathematics was professor Quido Vetter (1881–

1960). He was the first to regularly lecture the history of mathematics at the Charles University in Prague. His professional work was known abroad.

Other works

Úlehla's work comprises a whole lot of publications. Apart from his textbooks and the work *Dějiny matematiky*, he wrote another twenty four books, in which he dealt with popularisation of natural sciences, pedagogy, teaching methodology, philosophy or anthropology. He wrote more than one hundred journal articles focused on the disciplines as well as on organisation of school. Generally speaking, his texts are not a professional scientific papers. They were important mainly for education of teachers or well-suited to the interested laymen. They also documented the extremely wide range of Úlehla's interests, which were obviously influenced by his study of world literature. Overall, J. Úlehla translated eleven foreign works dedicated mainly to pedagogy and philosophy.

Úlehla's activities in teachers associations as well as his publications on pedagogy and didactics were described in detail in earlier publications. For example, Emanuel Havelka (1873–1956), who can be considered the Úlehla's biographer and who is the author of the work *Josef Úlehla, Život a dílo* (Life and Work of Josef Úlehla, year 1912). In the second half of the 20$^{\text{th}}$ century, Jaroslav Kopáč (1898–1987) engaged in Úlehla's pedagogical works. He was the historian of Czech education, he wrote the book *Josef Úlehla a moravské učitelstvo* (Josef Úlehla and Moravian Teachers, year 1967), in which he focused on Úlehla's works in the context of the region of Moravia as well as co-called Czech reform pedagogy.

Conclusion

It cannot be doubted that J. Úlehla was an excellent teacher. He was friendly and his publications prove that he was gifted for teaching and popularization of natural sciences, mathematics and history of mathematics. Fascinating was his great deal of insight, his erudition, the sense of finding interdisciplinary relationships, and the ability to express them in readable and engaging texts. His education was admirable, because he he had gained it by self-study. It is also necessary to appreciate his organizational skills, enthusiasm for work beyond the school and his evident sociability and practicality.

It is a great shame that J. Úlehla did not study at the university. Otherwise, his works might have been better from a professional point of view, because he would gain important incentives to acquire expertise. Perhaps the confrontation with the intellectual elite might have not be easy for him, just as it was difficult for him to overcome the classical grammar school environment.

There remains to be a few words of the importance of Úlehla's publications for the present time. It is possible to say that today it makes sense to read his works, study his life and search for his teaching methods. They are extremely inspirational in many respects, even though it is necessary to be cautious to accept or them as a whole. Úlehla's works are allure and they can inspire primary and secondary school teachers as well as any other interested persons for their own erudition.