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Natural Sciences in the Education of Protestant (Evangelical and Reformed) Higher Schools in the Hungarian Kingdom in Early Modern Age *A Comparison*[2]

Abstract.

The Reformation, being one of the most significant streams of thought in the early modern age, was closely associated with considerable changes exhibited in various facets of life, including education. Placing schools under Protestant management had a significant effect on the curriculum to some extent also in the use of innovative methods in education. The aim of this study is to highlight an important quality of Protestant education, which started in the early modern ages in the areas of Upper Hungary and manifested itself by strengthening the status of natural sciences in curriculum. The article focuses on a number of related problems. In the first place, I focus on a time horizon for implementing individual natural science courses in Protestant schools and their status in relation to other

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courses. In addition, I pay attention to discussing the teaching method adopted used at the time, the use of new methods and teaching aids, and then mention the distinguished personalities that were essential during the process of development and implementation of these courses in schools, as well as further related issues.

Keywords: Protestantism, education, natural sciences, curriculum, teaching methods, Hungarian Kingdom

The Reformation, being one of the most significant streams of thought in the early modern age, was closely associated with considerable changes exhibited in various facets of life, and its consequences are observable to this day. Apart from the many changes that occurred in the religious and spiritual life of the society, the far-reaching effect of the Reformation extended to education and its curriculum as well – overall, it impacted the question of knowledge in society. Protestant reformers realized that schools and their educational role were essential in gaining a more thorough understanding of faith with a view to deepening and strengthening faith in religious people. The changes that occurred in education at the time were reflected at two levels.

Firstly, Protestantism started to take a different view of the role of schools and the relationship between education and society. The majority of reformers were not averse to the idea that a good and religious Christian was not compatible with education. In fact, they realized the significance that both schools and learnedness played a crucial role in the strengthening and deepening of faith. In the Protestant theory and practice of education, schools were beginning to be perceived as "imaginary gates or church halls" the primary role of which was not merely instruction but also the education of deeply religious believers.

Secondly, Protestantism brought a new perspective on curriculum and the relationship between education and academic knowledge. In general, the medieval system of education that ranged from parish schools to universities put theology on top of educational priorities. Not only was theology the highest science but at the same time it defined the boundaries of academic research or other sciences. All the knowledge that was outside of the static understanding of the world, the knowledge that was transgressing the boundaries of medieval theology and its interpretation of universe was

understood as dangerous, often heretical, and deplorable. Such an environment was not open to natural sciences, the discoveries of which were understood as a disruption of the leadership assumed by theology and its interpretation of world order. Along with a frequently emphasized philosophy of humanism, there was also another philosophical stance – however, very often left forgotten or ignored – that had a considerable bearing on the change of perception of natural sciences and their status in the educational system.

Calvinism under the influence of its founder, John Calvin, brought new perspectives on natural sciences for Protestantism. Although it is generally assumed that John Calvin had a difficult personality and was inapproachable, he showed he was capable of innovative thinking in many respects. According to his biographer, Alister McGrath, Calvin expressed his attitude about questions regarding natural sciences in his work *Institutes of the Christian Religion* (1559). The reformer's opinions are based on his elementary theological theses, i.e. the teaching about predestination and his understanding of the absolute sovereignty of God. Just like the entire fate of a human being, as well as the whole of universe, the world is determined from the beginning by the omniscience of God. Laws of nature subdue to His power and will, and the universe has been created according to this, as well as individual human beings since they are part of nature. For this reason, the unearthing of these laws, the exploration of macrocosm and microcosm and its order is nothing else but a deeper exploration of God and His power. Therefore, what follows form this is the second fundamental statement, i.e. there is not and should not be any barriers no limits of human knowledge. "Calvin by virtue gave to knowledge a religious perspective, and with a religious reasoning he supported sciences to start researching and learn about nature."[3] Such opinions of Calvin's translated also into, for instance, the lowland confession of faith, *Confesio Belgica* (1561), in which nature is compared to the most remarkable book in the world where every living being from the smallest to the largest is a piece of writing through which the invisible hand of God can be read. Therefore, the exploration of all parts of nature is the exploration of God himself.

Calvin's second fundamental achievement with respect to natural sciences was his refusal of a verbatim interpretation of the Bible. According to him, when conducting

[3] MCGRATH, E. Alister (1996): *Calvin*. Budapest, Osiris. 271.

academic research, it is not possible to follow the Bible word by word or to understand it as a textbook of natural sciences. The Bible is the mediation of Jesus Christ's life, it is a work about him, and therefore it gives answers to questions about faith and religion and not about internal behaviour and laws of the world.[4] According to Calvin, God became man in all respects in order to have a better understanding of his mental and visual abilities. In this sense, the content of the Bible is simplified, including the interpretation of the creation of God and its functioning, and tailored exactly to the extent to which man is capable of understanding it. Due to this, the role of natural sciences is to discover such real natural laws and unearth a more difficult structure of the world. According to McGrath, Calvin's ideas were the ones that influenced the development of thought in the 17th century predominantly in the western countries.

The significance of Calvinism – or of Calvin himself – regarding its later development is overestimated; however, it is important to admit that his ideas were one of several other stimuli towards a more dynamic development of natural sciences. A large number of sociological research studies that investigate a religious affiliation and relation to natural sciences showed that the majority (in relation to the overall population) of natural scientists came from a Protestant background. For instance, Alphonse de Candolle conducted a research between 1666 and 1883 in which he was investigating an interest in natural sciences amongst members of the Académie des Sciences in Paris, and which confirmed a predominance of Protestants despite the fact that they were in minority in comparison to Catholics. A similar situation was encountered in London Royal Society, in which again Puritans dominated. Many important physicists or biologists in the 16th–17th centuries came from Calvinist background (e.g. a large ratio was recorded in the Netherlands).[5]

The Hungarian Kingdom belonged to the countries that were dramatically affected by the Reformation process with all of its consequences. Reformation ideas from abroad found appropriate internal political, religious, and societal conditions for a quick spread among and acceptation by large masses in the Hungarian Kingdom between the 1500s and the 1530s. After the initial spread of the Lutheran Reformation,

[4] Op. cit. 272.
[5] Op. cit. 270.

other reformation ideas were spreading across the country starting with the 1550s, of which Calvinism was the most prominent one. A wide acceptation of the Reformation ideas caused that the vast majority of people (90%) in the country had turned Protestant by the end of the 16th century. The new confessional situation in the country required changes in many areas of life, among others in education. As mentioned above, Protestantism strengthened the relationship between school and church. Schools did not serve only as advocates of strengthening a religious confession through the education of large masses of people, as an even more important role of – predominantly – higher education institutions was the training of ensuing generations of learned young priests or intelligentsia serving as a firm support for the Protestant churches found in their formation period. The Protestant schools were established either by the transformation of Catholic schools or by the support of secular patrons (town magistrates or secular landowners). In the majority of the church congregations – be it in villages or small towns –, according to a dominating Protestant faith (Lutheran or Calvin), elementary schools were founded with a view to promoting the adoption of elementary skills and literacy, i.e. reading, writing, counting, and catechism. In more prominent towns – either larger landowning towns or free royal towns –, schools of greater importance were established (grammar schools),[6] which provided higher education that served as a preparation for university studies abroad.[7]

Placing schools under Protestant management had a significant effect on the curriculum to some extent also in the use of innovative methods in education. The aim of this study is to highlight an important quality of Protestant education, which started in the early modern ages in the areas of Upper Hungary and manifested itself by strengthening the status of natural sciences in curriculum. The article focuses on a number of related problems. In the first place, I focus on a time horizon for

[6] For more information about the list of Protestant schools in the territory of today's Slovakia, see: REZIK, Ján – MATHEIDES, Samuel (1971): *Gymnaziológia Dejiny gymnázií na Slovensku* [Gymnaziologia. The History of Grammar Schools in Slovakia]. Bratislava, Slovenské pedagogické nakladateľstvo.

[7] HÖRCSIK, Richárd (2023): *A magyar protestáns iskolakultúra európaisága: a peregrináció* [The Europeanization of Hungarian Protestant School Culture: The Peregrination]. In: Hörcsik, Richárd: *Fejezetek a magyar és egyetemes egyháztörténetből.* Sárospatak, Hernád. 329–332.

implementing individual natural science courses in Protestant schools and their status amongst other courses. In addition, I pay attention to discussing the teaching method adopted at the time, the use of new methods, teaching aids, and mention the distinguished personalities that were essential during the process of development and implementation of these courses in schools, as well as further related issues.

The topic has already been tackled by earlier works of Hungarian historiography; however, it remained outside the focus of Slovakian researchers, be they historians, teachers, or church historians. The backdrop for this study draws on articles written by domestic and foreign researchers, which is completed by new archive materials such as school regulations, registers of collections of school artefacts, natural science textbooks, etc. As there was an extensive network of Protestant institutions of higher education with a rich history and a wide range of materials in the Hungarian Kingdom, I primarily concentrate on selected schools, i.e. the Reformed College in Sárospatak (HU), the Evangelical College in Prešov (SK), and – for its critical importance in natural sciences – the Reformed College in Debrecen (HU).

The Reformed College in Sárospatak

According to tradition, the Protestant school in Sárospatak was founded in 1531 and continued the work that a previous parish school had begun.[8] The school was founded during the Perényi dynasty. After the dynasty's rule had ended, the school came under the patronage of the Rákóczi dynasty. Owing primarily to their support, the school gained importance and became the bastion of Protestantism, more precisely, a Calvinist church on the territory of the Upper Hungarian Kingdom. During its existence, many distinguished reformers, scholars of those times worked at the school, and owing to their activities, the school quickly transformed into a higher education institution in which, besides the seven liberal arts, theology was taught in higher grades. Many of the students who graduated from the school went on to pursue their university studies abroad, and upon their return, they continued to work for the school as teachers.

[8] DIENES, Dénes – UGRAI, János (2013): *A Sárospataki református Kollégium története* [The History of the Reformed College in Sárospatak]. Sárospatak. 8–11.

Owing to such peregrination, new thought-provoking ideas reached Sárospatak, along with the latest knowledge and discoveries in various sciences.[9]

The Reformed school in Sárospatak was at its peak in the first half of the 17th century when Jan Amos Komensky, a renowned educator, elaborated and implemented his educational theory.[10] It is from this period, viz. 1621, that the first well-preserved school regulations document comes from. It stipulates the duties of the individual school officials, specifies the entire teaching process, covers all areas of student life, and determines punishments and penalties. Article 11 mentions that the courses offered were theology, philosophy, Latin language, Greek language, useful Latin features, poetics, rhetoric, and logic;[11] however, natural sciences were not mentioned. It is understood that in accordance with the custom of that period it was permissible to assume that the basics of natural sciences were taught as well although as part of philosophy courses. An important quality of Protestant schools was autonomy in school administration as well as in the teaching process, which included teaching methods and curricula. Hence, schools or individual teachers could decide what to study and how to study. Such academic freedom enabled a quicker implementation of new knowledge, particularly in natural sciences, in the teaching process in Protestant schools.

With regard to the curriculum, the Reformed College in Sárospatak provided classic education based on philosophy, theology, and languages. As mentioned above, as part of schooling, students were acquainted with the basics of natural sciences. The knowledge from mathematics, astronomy, and geometry were part of philosophy. Similarly, physics was not taught separately, yet it was notable for in the context of most innovations in the teaching process. During the entire 17th century, the College in

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[9] KÓNYOVÁ, Annamária – KÓNYA, Peter (2010): *Kalvínska reformácia a reformovaná cirkev na východnom Slovensku v 16.–18. Storočí* [Calvinist Reformation and the Reformed Church in Eastern Slovakia during the 16th–18th Centuries]. Prešov, Vydavateľstvo Prešovskej univerzity. 75–79.

[10] KOMLÓSI, Sándor (2000): Lórántffy Zsuzsanna iskolákat támogató tevékenysége [Activities Supporting Schools by Zsuzsanna Lórántffy]. In: Tamás, Edit (ed.): *Erdély és Patak fejedelemasszonya Lórántffy Zsuzsanna I* [The Princess of Transylvania and Patak Is Zsuzsanna Lórántffy I]. Sárospatak, Sárospataki Rákóczi Múzeum. 151.

[11] SZENTIMREI, Mihály (1996): *A Sárospataki református kollégium 1618-as rendszabályai és 1620-as törvényei* [The Orders of 1618 and School Laws of 1620 of the College in Sárospatak]. Sárospatak, Sárospataki Református Kollégium Tudományos Gyűjteményei. 25.

Sárospatak hosted professors who significantly contributed to the separation of physics and helped it become a subject of its own. The first important step to achieve this was taken when a first textbook on natural sciences was published at home (*Phisophiae Naturalis. Sive Introductio in theatrum naturae*, 1667) by János Pósaházi.[12] During his trips abroad, to England and Germany, he learned about new scientific theories that he would spread upon his return home. Pósaházi and his successors refused to teach physics using the traditional method, according to the Aristotelian physics, and tried to spread novel theories (particularly Galilei and Newton). They were also the proponents of the teaching method based on experience and examples rather than on philosophical and theoretical approaches.

The most important breakthrough in teaching physics not only in Sárospatak but generally in the entire Kingdom of Hungary was during the tenure of Professor István Simándi. When he returned from his foreign studies in 1707, he accepted the position of professor in Sárospatak, where he persuaded the principal of the school about the need to innovate teaching physics by using demonstrations, making observations, and experiments. He was the first professor to start teaching experimental physics (*Physica experimentalis*) using physical aids and performing various experiments. Unfortunately, the exact content of the course, or what was taught in experimental physics, remains unknown due to the insufficient number of preserved artefacts. The school's council was open minded with regard to Simándi's idea and approved the financial aid of 800 Rhenish gold coins to make a foreign purchase of teaching aids for a course in physics. Upon his return in 1708, Simándi brought 57 items (teaching aids) to support his courses in physics, which became the basis for a physical collection, and which is nowadays part of the school's museum in Sárospatak. Some of the most precious and most interesting items of the Simándi Collection are as follows: a vacuum cleaner manufactured in Leyden, with the help of which it was possible to make various experiments that required a vacuum; an optical device termed *laterna magica*; a machine that was able to set the exact time: *horodictum meridionale*.[13] It is interesting to note

[12] SZINNYEI, József (1908): *Magyar írók élete és munkái XII.* [Life and Works of Hungarian Writers XII]. Budapest, Hornyaszky Viktor könyvnyomdája. 1028–1029.

[13] BIGUS, Imre (2011): *300 éves a kísérleti fizika oktatása Sárospatakon* [300 Years of Teaching Experimental Physics in Sárospatak]. In: *Fizikai Szemle*. 61, 7–8. 272–277.

while Simándi's activities were welcomed by one group of people, they were viewed negatively by others, to the extent of even being accused of performing black magic through the physical experiments he was conducting with his machines. His prolific work in physics was discontinued because of his death from plague in 1710.[14]

The importance of István Simándi did not lie in his being the first professor who implemented a novel teaching method of physics or in his establishing the collection but especially in the fact that he inspired his successors to continue and develop his work of teaching natural sciences. In 1774, Professor Márton Szilágyi compiled a list of all aids and items that were used in the course of teaching physics to students at that time, a list that also reveals information about lesson plans and topics presented to students. During the past seventy years, the collection has been further expanded by another 132 items, which were divided in the list according to the various branches of physics: *Mechanica, Hydrostatica, Hydraulica, Aerometrica, Optica, Astronomica et Geographica, Magnetica et Electrica, Expansionis Corporum ab Igne et Calore*. This classification shows a very advanced level of teaching physics, as well as a vast knowledge offered drawing on the latest European scientific results. What is missing from the list is a separate section for acoustic courses, which are classified together with what is known as aerometric courses, since at the time the knowledge and phenomena related to sound were observable in air or gas. In addition, it is interesting to note that magnetic and electric items on the list were included in the category of items termed *instrumenta subtilium effluviorum*, as physics at the time recognized magnetic and electric phenomena to be immaterial liquids dissolved in matter.[15]

The 18th century saw an important progress in other natural sciences as well, especially in chemistry. This had an impact on the Reformed College in Sárospatak in the sense that the school included thirty types of chemicals and chemical machines in the collection. The number of items related to natural sciences in the school was growing. The school acquired telescopes, microscopes, and geographic globes, which served as proof that the school did not want to lag behind with in terms of astronomy,

[14] SZINNYEI, József (1909): *Magyar írók élete és munkái XIII*. [Life and Works of Hungarian Writers XIII]. Budapest, Hornyaszky Viktor könyvnyomdája, 1029.

[15] ELLEND, József (1899): A sárospataki főiskola kétszázados multja [The Two-Hundred-Year-Old Past of the College in Sárospatak]. In: *Magyar Pedagógia* [Hungarian Pedagogy]. 8. 456–468.

biology, and geography, and that, in fact, the school wanted to stay on par with the progress that European and world science was experiencing at the time. Professor Mózes Kézy (1781–1831), who had been professor of mathematics and physics since 1813, added further items to the collection. During the years he spent in the school, he enriched the collection by his own constructions of many machines, e.g. an electric machine, or he had local tradesmen who would manufacture items for him.[16]

Textbooks and academic articles written by professors who were teaching natural sciences document the high quality of natural science items, as well as the items used in teaching. A majority of the articles were written in Latin, but research articles and textbooks written in Hungarian were becoming more frequent starting the end of the 18th century. The first natural science textbook was written by János Pósaházi *Philosophia Naturalis* [Natural Philosophy] in 1667. In the following centuries, the number of natural science works was increasing, e.g. professor István Emődy's textbook (1770–1823) *Természeti história I*. [Natural History I] written in 1809 (2nd edition in 1818), in which he described various animals, offered a classification of the animals, and included at the end of the textbook their Latin, Hungarian, and German variants. The continuation of his work was the textbook written by József Vadnay, *Természeti História. II. A plánták országa* [The Natural History II. The World of Plants], published in 1811 and the textbook written by József Geleli, *Természeti história III. Az ásványok országa* [The Natural History III. The World of Minerals], published in Sárospatak in 1818. The above-mentioned Mózes Kézy wrote in 1818 *Elementa physicae. In usum praelectionum suarum* [The Basics of Physics – As Used in Lectures] for the purposes of teaching physics, and he later published the work titled *Short Outline of Physics* in Hungarian (1830), *Elementa algebrae* [Basic Algebra] in 1830, and *Elementa geometriae purea* [Basics of Pure Geometry] in 1831.

Mathematics was significantly developed in the Reformed College as well, although it cannot be fully considered as a natural science – rather it is "the language of natural sciences". In the period under scrutiny in this article, it belonged to the group of the so-called *reál* [science] courses. Mathematics was the first to start down the path towards independence from natural philosophy in the teaching context, and so it was

[16] Ibid.

becoming a separate course. From the beginning of the 19th century, mathematics was taught in each year and was completed with algebra and solid geometry. The most credit for the development of mathematics at the Reformed College in Sárospatak is attributed in fact to the first professor of mathematics, Pál Sipos (1759–1816).[17] As a recognition of his scholarly work, as well as his discovery of the so-called isometric curve in geometry, the Royal Scientific Academy in Berlin awarded him a gold medal in 1795.[18]

Geography took a similar path in terms of its development. It had been taught since the 17th century; however, it became a separate course only in 1786 when it started to be taught in the first 7 grades and from 1804 up to the ninth grade.[19]

The Reformed College in Debrecen

In science teaching, a very similar development took place in the equally significant Reformed College in Debrecen. The Protestant school was established in 1538 by transforming the original urban school. The school administration and its financing were administered by the city itself as well as by the Reformed Church, together with its generous donors, who were the princes of Transylvania. Thanks to erudite teachers, the Reformed College of Debrecen became another important centre of Calvinism and Calvinist education in the Hungarian Kingdom, which is evidenced by the number of students. At the beginning of the 17th century, there were about a thousand students enrolled in the College. From its early years of its existence, the College in Debrecen was open to new tendencies and always quickly reacting to the latest scientific outcomes.[20]

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[17] SZINNYEI 1908, 1165–1166.

[18] WESZELY, Tibor (1995): Sipos Pál, az első aranyérmes magyar matematikus [Pál Sipos, the First Hungarian Gold Medallist Teacher of Mathematics]. In: *Természettudományok Világa* [World of Natural Sciences]. CXXVI, 5. 207–209.

[19] UGRAI, János (2001): *Felvilágosodás kori változások a Sárospataki Református Kollégiumban* [Changes in the Reformed College in Sárospatak in the Period of Enlightenment]. In: *Egyháztörténeti Szemle* [Church History Review]. II, 1. 94–111.

[20] For more information on the history of the College, see: BARCZA, József (1988): *A Debreceni Református Kollégium története* [The History of the Reformed College in Debrecen]. Budapest, Református Zsinati Iroda.

Because of the missing sources of the exact content of education or the number of lessons taught in this school, the only possible way how to draw conclusions is the indirect approach – for example, by studying the scientific activities of the teachers, analysing the textbooks and scientific works used in the teaching process. Mathematics was the first subject to become independent from philosophy at the College in Debrecen. A work titled *Debreceni aritmetika* [Debrecen Arithmetic], probably written by a scholar named János Laskai, was published in 1577. The work was a summary of basic mathematical operations, and it was used as a textbook in the following one hundred years.

In 1674, a new textbook of arithmetic written by Ferenc Tolvaj Menyői (?–1710) was published multiple times (for example, in Levoča or Bratislava), and it became one of the most widely used textbooks of mathematics in the country for several decades. Topics of dissertations and other scientific works written by other scholars in the 17th century (György Tóth Martonfalvi, Márton Tonko Szilagyi, Pál Kovacs Lisznay) point out that quite a strong centre for the development of mathematics was created in Debrecen, including also logic or geometry based on the latest knowledge and discoveries from abroad. In 1743, the "third" *Aritmetika* [Arithmetic], written by the scholar György Maróthi (1715–1744) was published. It was based on the famous work of Johann Friedrich Weidler, the professor from Wittenberg. The major progress in the status of mathematics within other subjects was the establishment of the separate Department of Mathematics in 1798. A professor named Ferenc Kerekes (1784–1850) was the only one from the entire Hungarian Kingdom to participate actively in the European scientific debate on integrals and differentials in the 19th century.[21]

In addition to arithmetic, we come across geography as a relatively new subject in the educational curriculum, which concentrated the contemporary knowledge of the country, but also of the "heavenly bodies", namely astronomy. In the 17th century, the development of geography was associated with the names of three scholars. The first one was György Csipkés Komáromi (1626–1678),[22] who wrote *Judicaria Astrologia* (1665) in the topic of comets. Then there was Martin Tönkő Szilágyi, who described physical

[21] OLÁHNÉ ERDÉLYI, Mária (1976): A protestáns iskolák középszintű matematika-oktatása 1777–1848 között [The Education of Mathematics in Secondary Protestant Schools between 1777 and 1848]. In: *Magyar Pedagógia* [Hungarian Pedagogy]. 76, 3. 278–281.

[22] SZINNYEI, József (1893): *Magyar írók élete és munkái II.* [Life and Works of Hungarian Writers II]. Budapest, Hornyaszky Viktor könyvnyomdája. 380.

geography in his work *Physica specialis*, and Pál Lisznay Kovács (1630–1695), who – thanks to his studies in the Netherlands – began to use maps in his geography lessons. Moreover, he created those maps himself. Besides using maps in the teaching process, globes started to appear as well. In the first half of the 18th century, geography was integrated into the teaching process as a separate subject by György Maróthi, who was committed to both physical and human geography in his lectures. A high standard of geography was reached by Ezaiás Budai (1766–1841), the author of four school atlases. The students were required to have their own maps. In 1856, the separate Department of Natural Sciences and Geography was established.[23]

A significant development of physics in Debrecen can be seen in the second half of the 17th century. In 1678, the first work about Cartesian physics written by the above-mentioned Márton Tönkő Szilágyi (1642–1700)[24] was published. It described physical phenomena such as gravity, the structure of liquids, air, temperature, pressure, minerals, etc. His work showed the need for teaching physics based on demonstrations and experiments that was later developed by his successors György Maróthi (1715–1744), Samuel Szilágyi Piskárkosi (1718–1785), and mainly István Hatvani (1718–1786), the latter being considered a true pioneer of experimental physics in Debrecen. In his lectures, new knowledge was demonstrated in experiments using physical devices; the most valuable ones were as follows: an "electric device", an electrophorus, and an "odometer" (a device for measuring the distance). All these devices and equipment became part of the school museum similar to the one in Sárospatak. According to the register of 1839, the collection of physics equipment included 221 pieces; however, most of them were minerals and geometric models. At that time, in the context of physics, the lectures were dedicated to the following areas: statics, mechanics, electricity, magnetism, galvanism, chemical elements, meteorology, and physical geography, indicating that in those times, other scientific fields, such as chemistry, were also part of physics.[25]

[23] GAÁL, Botond (1988): A természettudományok oktatása és művelése a Kollégiumban [The Education of Natural Sciences in the College]. In: Barcza, József (ed.): *A Debreceni Református Kollégium története* [The History of the Debrecen Reformed College]. Budapest, Magyarországi Református Egyház Zsinati Irodája. 592–626.

[24] SZINNYEI 1909, 904.

[25] GAÁL 1988, 592–626.

Although chemistry was on its way to becoming an independent scientific discipline from the second half of the 18th century, it represented a completely separate subject in the teaching process much later. As mentioned earlier, István Hatvani, who performed chemistry experiments during his physics classes, is considered a pioneer of chemistry at the College in Debrecen. This is all evident from his orders of chemicals (mainly various acids) for experimental physics. Even his minor work (*Therme Varadienses examini physica et medico subjectae...De natura salium nominatim vero de salibus, qui circa Debrecinum colliguntur,* 1777) devoted to the analyses of mineral water and salt prove his research interest directed mainly to salt-related research, but also to its practical industrial use. Pál Sárvári (1765–1846),[26] a student and successor of his work, broadened the scope of the topics of his lectures (to sulphates, phosphates, nitrates, various compounds, elements of materials, evaporation, etc.), while new discoveries in that area were numerically increasing very quickly. In 1815, the establishment of the separate Department of Chemistry, Mineralogy, Botany, and Technology was the breakthrough – the subjects were taught in Hungarian. From the curriculum created in 1837, it is clear that the number of chemistry courses was 60 per year. A great promoter of experimental chemistry, Imre Nagy Csécsi (1804–1847) supported the idea of increasing this number. Even in his last will, he left a certain amount of money for the school so that a new chemistry laboratory could be established.[27]

The development of zoology and botany was similar to that of chemistry. They became independent from other school subjects in the 19th century; till then, those subjects were part of philosophy lectures and later physics in the Reformed College, as well. From the 16th to the 18th century, no significant works were published in the Reformed College in the field of science. In other words, there were no scholars who would support scientific research. A change occurred in the early 19th century when, thanks to Ferenc Kerekes, the Botanic Garden was established in 1841. In its inventory, there were 253 exotic plants, 390 medicinal plants, and 720 agricultural plants, in addition to which 150 trees and bushes were planted in the garden. In the field of zoology, János Kovács (1816–1906) expanded a collection of plant specimens to 1,654 animal specimens.[28]

[26] SZINNYEI 1908, 248–249.
[27] Gaál 1988, 592–626.
[28] Uo.

The Evangelical College in Prešov

The Prešov Evangelical College was found in Košice in 1665 by the act of the Upper Hungarian evangelical authorities and free royal towns. Thanks to a large number of donors, the sufficient amount of financial resources was collected, so it was possible to start constructing the school building, which was put into use only in 1667. Besides the main objective, which were the education and training of evangelical young people, there were made great efforts to turn the school institution into a counterbalance to the Catholic university in Trnava to become a stronghold against the increasingly stronger anti-Reformation movement.[29]

During the centuries of the school's existence, several important scholars and personalities of the social and cultural life worked in it. The evangelical college was constituted as a ten-class grammar school, where in lower classes students obtained fundamental knowledge in reading, grammar, rhetoric, poetic, classical languages, and in higher classes students were trained in the study of logic, metaphysics, and the highest level presented obtaining knowledge in theology. The ninth class was the class of physics and metaphysics (*Classis Physicorum et Metaphysicorum*). It is clearly evident from the school agenda in 1667 that physics was lectured by the important scholar of the period, the supporter of Renaissance atomism, Izák Cabán, and the textbook was titled *Physics by Sperling*.[30]

As a result of the unfavourable political situation, the Evangelical College underwent a complicated development in the next decades, its activity being violently disconnected for several times, for some time functioning merely as an elementary school. In the school agenda of 1707, there are some records about training in "classical, humanities subjects", physics having been missing from the previous periods. The school agenda in 1742 included geography in the second year. The training in mathematics, physics, and geography was integrated into the agenda of 1758 in the higher years.[31]

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[29] KÓNYA, Peter (2013): Eperjes mint a felső-magyarországi evangélikus művelődés központja [Presov as the Centre of Evangelical Education in Upper Hungary during the 16th-17th Centuries]. In: *Sárospataki Füzetek* [Sárospataki Notes]. XVII, 3. 79–91.

[30] HÖRK, József (1896): *Az Eperjesi Ev. Ker. Kollegium Története* [The History of Evangelical A. C. College in Prešov]. Kassa, Bernovics Gusztáv kő- és könyvnyomdája. 16–23.

[31] I. m. 393–401.

After 1805, the reorganization of study took place, and it resulted in the expansion of the natural science subjects taught, where the fundamentals of natural history were added up. Education in mathematics and physics lay within the philosophy professors' authority, whose work was exactly determined in the agenda, whereby the individual subjects were to be lectured. The professor of rhetoric lectured, among other things, geography and natural sciences in coincidence with specified literature. The content of the natural science subjects is known from the agenda dated as late as the second half of the 19th century. Geography was taught from the first year; in the third year, mathematics and geometry were added, and in the fourth year mineralogy, chemistry being taught as part of it; later, botany and zoology were added, and physics was taught in the last years within natural history. From the point of view of the contents, the subjects provided fundamental knowledge from the branches of individual natural sciences.[32]

The Evangelical College owned various collections, especially of botany, zoology, and mineralogy, and they were accumulated by the school starting from the first half of the 19th century. Fridrich Hazslinszký (1818–1896), the well-known natural scientist, first of all mycologist, and the author of many scientific papers in the field of botany, had the greatest interest in the expansion of the school.[33] Besides him, Professor Otto Ludmann[34] was also interested in natural sciences, especially geography.

The previous outline of natural sciences at the mentioned Protestant schools shows that there were considerable differences in teaching natural science subjects between the Calvinist and the Evangelical education system. Almost none of the agendas of the Reformed schools from the period of the 16th–18th centuries – which could provide us a better overview of the number of natural science subjects and their more exact determination – survived; however, there are some resources (textbooks, collections, teaching aids) clearly pointing to the fact that they played a rather important

[32] I. m. 393–401.

[33] REPČÁK, Miroslav – VOZÁROVÁ, Marta (1996): *Život a dielo Fridricha Hazslinského (1818–1896). Zborník referátov* [Life and Work of Friedrich Hazslinsky (1818–1896). Collection of Essays]. Prešov, Spoločnosť slovenských mykológov.

[34] SZINNYEI, József (1902): *Magyar írók élete és munkái VIII.* [Life and Works of Hungarian Writers VIII]. Budapest, Hornyaszky Viktor könyvnyomdája. 38.

role in the teaching process. In spite of the fact that natural science subjects made the smaller part of the total number of subjects taught in Calvinist schools up to 19th century, they were able to reach a very high (even European) level.

The situation in the evangelical school was different: the natural science subjects were included in the curriculum, the studied literature is known, but no prominent professor personalities developing any natural science branch are known (only from the 19th century onwards). Unlike in the Reformed colleges, there was no similar research and discovery work among the teachers at the Lutheran colleges in the 17th–18th centuries; this also applies to the use of innovative teaching methods and teaching aids. On the contrary, the activity of the professors in the Reformed colleges in Sárospatak and Debrecen shows that these schools were open to new scientific impulses in the field of natural sciences. They maintained not only intensive relations with the European scientific environment but also incorporated new inventions and theories in their lectures. Besides the innovations regarding the individual natural science subjects, teachers showed interest in new ways of teaching based on demonstration, experiment, and use of "modern teaching aids as early as the 17th century.

There are several reasons of the stronger position of natural sciences in Calvinist schools. One of the factors is the character of Calvinist theology itself and the ideas – mentioned in the introductory section – of its founder, John Calvin, regarding the relationship of religion and science (natural sciences). Since its beginning, Calvinism created a "freer" intellectual environment that was open to a more positive attitude towards new discoveries and scientific theories. Professors at Calvinist schools had a more autonomous position within the process of teaching, and therefore they could determine the contents of their lectures more independently. An important factor could be that, especially during the 17th century, the important scientific and pedagogical personalities worked in both schools. Their activity generated followers who continued with development of natural sciences.

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