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POSITION OF NATURAL SCIENCES IN THE EDUCATION OF REFORMED HIGHER SCHOOLS IN THE HUNGARIAN KINGDOM IN EARLY MODERN AGE (ON EXAMPLE OF REFORMED COLLEGIUM IN SAROSPATAK)

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, also in the education. Transformation of schools to Protestant ones 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 show an important attribute of Reformed education, which started in 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 Reformed schools and their status amongst other courses. In addition, I pay attention to the research of the teaching method that was used 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 other partial issues related to this.

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

1. Introduction

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. With the exception of many changes that occurred in religious and spiritual life of the society, the far-reaching effect of the Reformation spread to education, its curriculum and, overall, with respect to the question of knowledge in society. Protestant reformers realized that schools and their educational function were essential in enhancing a more thorough understanding of faith with a view to upholding a deeper anchorage of faith in religious people. The changes that occurred in education at the time were reflected at two levels.

Firstly, Protestantism viewed the role of schools and the relationship between education and society differently from then on. A 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 schools and learnedness both had in the strengthening and deepening of faith. In protestant theory and practice of education, schools were turning to be perceived as “imaginary gates or church halls” the

primary role of which was education of not only the good but also the religious who were educated.

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 going over the boundaries of medieval theology and its interpretation of universe was understood to be 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 significance on the change of perception of natural sciences and their status in educational system.

Calvinism under the influence of its founder John Calvin brought new perspectives on natural sciences to Protestantism.

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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 Elister 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 from this is the second fundamental statement, i.e. there is not and should not be any barriers that would set out the possibilities 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"* [1, p. 271]

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 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 the life of Jesus Christ, it is the work about him and for this reason, it gives answers to questions about faith and religion, and not answers to questions about internal behaviour and laws of the world [1]. According to Calvin, God became man in all respects 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 that man is capable to understand 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 predominantly in the western countries influenced the development of thought in the 17th century. The significance of Calvinism or Calvin himself on its later development overestimate, however, it is important to admit that his ideas were one out of many other stimuli for a more dynamic development of natural sciences.

The Hungarian Kingdom belonged to the countries, which were dramatically affected by the reformation process with all its consequences. A wide acceptance of the Reformation ideas caused that a majority of people (90%) in the country had turned Protestant (Lutheran or Calvinist) by the end of the 16th century. The new confessional situation in the country required changes in many areas of life, among others also 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 education of wide masses of people, in fact, a more important role of predominantly higher schools was the education of ensuing generations of learned young priests or intelligentsia that served as a firm support to the Protestant churches that were formed at the time. The Protestant schools were established either by transformation of Catholic schools or by secular patrons (town magistrates or secular landowners) who were founding and maintaining them brand new. In the majority of church congregations, be it in villages or towns, little towns according to a dominating Protestant faith (Lutheran or Calvin), elementary schools were founded with a view to provide an adoption of elementary skills, i.e. reading, writing, counting and catechism. In more prominent towns, either larger landowning towns or free royal towns, schools of higher importance were established (grammar schools) [2] that were providing higher education that served as a preparation for university studies abroad [3].

Transformation of schools to Protestant ones 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 show an important attribute of Protestant education, which started in 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 Reformed schools and their status amongst other courses. In addition, I pay attention to the research of the teaching method that was used 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 other partial issues related to this.

The topic has already been tackled by an older Hungarian historiography, however it stayed outside of focus of Slovakian researchers, be it historians, teachers or church historians. The backdrop for this study draws on research articles written by researchers from home and abroad, this is completed by new archive materials such as school regulations, register of collections of school artifacts, natural science textbooks etc. As there was an extensive network of higher Protestant schools with a rich history and a large amount of materials in the Hungarian Kingdom, I primarily zone in on the Reformed Collegium in Sarospatak (HU).

2. Reformed Collegium in Sarospatak

According to tradition, the Protestant school in Sarospatak was founded in 1531 and continued the work that a previous parish school had begun [4]. The establishment of the school in the first period of its existence was under the Perényi dynasty. After the

dynasty's rule ended, the school was under the patronage of the Rákóczi dynasty. Owing primarily to their support, the school gained importance and became the bulwark of Protestantism, more precisely, Calvinist church on the territory of the Upper Hungarian Kingdom. During its existence, many distinguished reformers, scholars of the times worked at the school, and owing to their activities, the school quickly transformed itself to a higher education institution in which, except for seven free arts, theology was taught in higher grades. Many of the students who graduated from the school went on to pursue university studies abroad and upon their return, they continued to work for the school as teachers. Owing to such peregrination, new thought-provoking ideas came to Sarospatak, along with the latest knowledge and discoveries in various sciences [5, p. 75-79].

The Reformed school in Sarospatak was at its peak in the first half of the 17th century when Jan Amos Komensky, a distinguished education theory scholar, worked and implemented his educational theory [6, p. 151]. It is from this period, viz. from 1621, that the first well-preserved school regulations document comes from. It stipulates the duties of the individual school officials, it specifies the entire teaching process, and it covers all areas of student life, it sets out punishments and penalties. The Article 11 mentions that the taught courses were theology, philosophy, Latin language, Greek language, useful Latin features, poetics, rhetoric and logic [7, p. 25], however, natural sciences were not mentioned. It is understood that in accordance with the custom of that period it is permissible to assume that the basics of natural sciences were taught as well, however they were part of philosophy courses. An important quality of Protestant schools was autonomy in school administration as well as in the teaching process that included teaching methods and curricula. Schools or individual teachers, hence, decided what to study, how to study. Such academic freedom enabled a quicker implementation of new knowledge, particularly in natural sciences, to the teaching process in Protestant schools.

With regard to curriculum, the Reformed Collegium in Sarospatak, as well as all other types of such schools, 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, despite this, physics was notable for the most innovations in the teaching process. During the entire 17th century, the Collegium in Sarospatak hosted professors who significantly contributed to the separation of physics and helped it become a teaching course of its own. The first important step to achieve this was taken when a first textbook about natural sciences that was published at home (*Philosophiae Naturalis. Sive Introductio in theatrum naturae, 1667*) by Janos Posahazi [8]. During his abroad trips to England, Germany, he learned about new scientific theories that he spread on when he returned 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, Newton). They were also the proponents of the teaching method that was based on experience and examples rather than on philosophical and theoretical approach.

The most important breakthrough in teaching physics not only in Sarospatak but generally in the entire Kingdom of Hungary was the teaching tenure of professor István Simándi. When he returned from his studies abroad in 1707, he accepted the position of professor at Sarospatak where he persuaded the principal of the school about a need to innovate teaching physics by using demonstration, making observations and experiments. He was the first professor to start teaching experimental physics (*Physica experimentalis*) using physical aids, and making various experiments. Unfortunately, the exact content of the course, or what was taught in experimental physics, remains unknown due to insufficient number of preserved artefacts. The School Council was open minded with regard to Simándi's idea, and approved the financial aid of 800 Rhenish gold coins to purchase teaching aids for a course in physics from abroad. Upon his return in 1708 Simándi brought 57 aids (items) to help him teach physics, which became the basis for a physical collection, and which is nowadays part of the school's museum in Sarospatak. The most precious and most interesting items of the Simándi Collection, among others, is a vacuum cleaner manufactured in Leyden, with the help of which it was possible to make various experiments that required a vacuum; or an optical device *laterna magica*; or a machine that was able to set exact time *Horodictum meridionale* [9, p. 274-277]. It is interesting to note that Simándi's activities, besides being welcome by one group of people, they were viewed negatively by others to the extent he was accused of carrying out black magic due to the physical experiments he was conducting with his machines. His prolific work in physics was discontinued due to his death from plague in 1710 [8].

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 on teaching natural sciences. Professor Marton Szilagyi made in 1774 a list of all aids and items that were used in the course of teaching physics to students at that time, also it shows information lesson plans and topics presented to students. During the past seventy years, the collection has been amassed by other 132 items, which were divided in the list according to branches of physics into machines: *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 based on newest 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 following category of items *Instrumenta Subtilium Effluviurum* because physics at the time recognized magnetic and electric phenomena to be immaterial liquids dissolved in matter [10, p. 456-468].

The 18th century also saw an important progress in other natural sciences, especially in chemistry. This had an impact on the Reformed Collegium in Sarospatak in the sense that the school included thirty chemicals and chemical machines in the collection. The items related to natural sciences in the school were growing. The school acquired telescopes, microscopes, geographical globes, which served as proof that the school did not want to lag behind with respect to astronomy, biology, and geography, and that, in fact, the school wanted to stay on par with the progress that European and world science had been experiencing at the time. Professor Mozes Kezy (1781-1831), who since 1813 had been professor of mathematics and physics, further completed the collection. During the years that he spent in the school, he enriched the collection by his own constructions of many machines, e.g. electric machine or he had local tradesmen who would manufacture items for him [10, p. 456-468].

Textbooks and academic articles written by professors who were teaching natural sciences document the high quality of natural science items, except the items used in teaching. A majority of articles were written in Latin but research articles and textbooks written in Hungarian were becoming more frequent since the end of 18th century. The first natural science textbook was written by Janos Posahazi *Natural Philosophy (Philosophia Naturalis, 1667)*. In the following centuries, the number of natural science works was increasing, e.g. professor Istvan Emody's textbook (1770-1823) *Natural history I. (Termeszeti historia I.)* written in 1809 (2nd edition in 1818), in which he outlined animals, classification of animals, and includes at the end of the textbook their Latin, Hungarian and German forms. The continuation of his work was the textbook written by Jozsef Vadnay *The Natural History II. Plants (Termeszeti Historia. A plantak orszaga)* published in 1811 and the textbook written by József Gelei *The Natural History III. Minerals (Termaszeti historia III. Az asvanyok orszaga)* published in Sarospatak in 1818, too. The abovementioned Mozes Kezy wrote in 1818 *The Basics of Physics (Elementa physicae. In usum praelectionum suarum)* for the purpose of teaching physics, and he later published the work *Short Outline of Physics* in Hungarian (1830), *Basic Algebra (Elementa algebrae)* in 1830 and *Basics of Pure Geometry (Elementa geometriae purea)* in 1831.

Mathematics was significantly developing the Reformed Collegium as well, although it cannot be considered as a natural science to full extent, rather it is "the language of natural sciences", in the period that is under scrutiny in this article, it belonged to the group of the so-called real courses. Mathematics was the first to start making an effort to be independent from natural philosophy within the terms of a teaching context and it was

becoming a separate course. Mathematics was from the beginning of 19th century studied in each year and was completed with algebra, space geometry. The largest credit on the development of mathematics at the Reformed Collegium in Sarospatak is attributed in fact to the first professor of mathematics Pal Sipos (1759-1816) [8]. As recognition of his scholarly work, as well as for his discovery of the so-called isometric curve in geometry, he was recognized abroad, and the Royal Scientific Academy in Berlin awarded him a gold medal in 1795 [11].

Geography took a similar path in terms of its development. It had been lectured since 17th century, however, it began to exist as a separate course in 1786 when it started to be taught from first to seventh grade and since 1804 to the ninth grade [12, p. 103-104].

3. Conclusion

The previous outline of natural sciences at the mentioned Reformed school shows the important positions of natural sciences in the education. Nearly no school agendas of reformed schools from the period of 16th- 18th centuries, which could give the better quantity overview of the number of natural science subjects and their more exact determination, were remained, however, on the other hand, there are some resources (textbooks, collections, teaching aids) that clearly show the fact that they played rather important 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 very high (also European) level. The activity of professors in the Reformed Collegiums in Sarospatak shows that these schools were opened for new scientific impulses in the field of natural sciences. They kept not only intensive contacts with European scientific environment but also implemented new inventions and theories in their lectures very soon. Besides the innovation of individual natural science subjects' contents, teachers showed the 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 in the preface mentioned ideas of its founder John Calvin on the relationship of religion and science (natural sciences). Since its beginning, Calvinism created "freer" intellectual environment which was friendly to more positive relationship to new discoveries and scientific theories. Professors at Calvinist schools had more autonomous position within the process of teaching, and therefore they could set the contents of their lectures more independently. The important factor could be the fact, that especially during the 17th century the important scientific and pedagogical personalities acted in both schools. Thanks to their activity, they generated their followers who continued with the development of natural sciences.

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