Paper Title: Secondary School as a Model for the Dialogue between Science and Religion
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Abstract:
"Scientific research consists of seeing what everyone else has seen, but thinking what no one else has thought" - Albert Szent-Györgyi, Nobel Prize, 1937: Physiology and Medicine

Personal prepossession, or conviction, coming up – directly or indirectly – from previous experiences influence not only the things we accept as explanations for the operation of the world, but also actuates the way we explain or teach these things. Convictions determine the way we interpret our lives and acts or the problems of the world in the highest degree. Belief has a main role in recalling previous knowledge: it does not only determine what one evokes, but, more importantly, it also defines the way we call back our memories. This is in connection with the observation that in their pedagogical work teachers are influenced much more by the way they were taught than by what they learnt.

One of the most crucial situations in which belief plays an important role while communicating knowledge is teaching in secondary schools, since young adults are extremely sensitive to every fact and every kind of interpretation of the facts. In the Hungarian teaching system, high-school graduation is usually the last time students have to give account of more than some aspects of their studies, and this can also be the last point in their lives until when they are forced to think in terms of a unified world to some degree. However, in the last few years it seems that Hungarian protestant secondary schools have begun to struggle with living in and transmitting a somewhat unified world-view or at least the importance of the dialogue between science and religion.

However, the situation was not always this way. During the 20th century the famous "Fasori" lutheran school included legendary teachers like Sándor Mikola, László Rátz or Miklós Vermes, and legendary students, including several future Nobel laureates, such as Eugene P. Wigner, John C. Harsanyi or John von Neumann. Students graduated from this, and other Christian schools with a solid world-view in which belief and scientific knowledge, faith and scientific research could not only exist in a healthy consonance but also motivate each other. After a time of forced – and alleged – separation of belief and knowledge, nowadays it seems that in protestant secondary schools, and in the minds of many of their teachers', belief and knowledge are in contrast rather than in dialogue, and there are more than just historical reasons behind this phenomenon.

The aim of this paper is to find some reasons for the lack of the science and religion dialogue in the pedagogical programs of Hungarian secondary schools and in their teachers' approaches. This paper asks the question of the importance of dogmatic approach in teaching and talking about the dialogue between science and religion; and

also of the possible differences, other than historical, between our and the mentioned teachers' teaching systems, pedagogical programs or personal approaches.

Biography:
Eszter Kodácsy-Simon graduated from Eötvös Loránd University of Sciences in Budapest with an MSc in 2000 as a physics and mathematics teacher, where she wrote her thesis on teaching models in secondary schools in mathematics. This was followed by her MA in theology at the Evangelical-Lutheran Theological Seminary in Budapest in 2003, her thesis was written on William Ockham's system of concepts. She studied at Lutheran School of Theology in Chicago in 2000-2001 and at Helsinki University in 2004 fall semester. She taught mathematics and physics in Sylvester János Protestant High School, Budapest in 2001-2003. Now she is a PhD student at Evangelical-Lutheran Theological Seminary in Budapest. She is the coordinator and one of the founding members of Jesenius Center for Science and Religion, Budapest.

Paper Text:

"Scientific research consists of seeing what everyone else has seen, but thinking what no one else has thought" - Albert Szent-Györgyi

In Hungarian folk-tales the mother of the young lad makes some scones fried in ashes to his son before he leaves for a vague adventure. The young lad usually leaves for an unknown place, often does not know the exact goal of his adventure, and mostly he is sad to leave the warm and safe house of birth. The only thing he and his mother apprehend is that his real life starts now, and he has to leave his tiny village to start to live his own life which is full of miracles and – success.

At certain times we all experience getting some provisions for the journey. First, probably, when we start going to school, and our mother fills our lunch bag and gives a sendoff. On second occasion – and possibly the last time, but sure enough the most important time – when we leave the secondary school and start to build our own lives on our own. The education we got those years, the teachers' case of mind and the school's atmosphere that made an impression on us does and will always determine our approach and attitude to the great questions of our everyday lives. Eugene Paul Wigner[1] writes about his secondary school in his book about the structure of the nucleon as follows: "Much water has passed off the Danube since I had a swim in it. However time did not wash away my gratitude towards the place of my birth. I do not forget that it was my cradle, that it kept me alive for a long time, that I gained the basis of my knowledge. I rarely pass up an occasion like this to express my gratitude to my teachers and to the institution to which I can thank so much: to the Fasori Lutheran School. I will never forget my teachers… The poems also live in my heart briskly which I learnt in the Fasori Lutheran School and I can still discover much new feature and beauty in them."

Some Hungarian scientists are world-wide known people, and I am talking not exclusively about the Nobel prize winner natural scientists like Eugene Wigner, Albert von Szent-Györgyi Nagyrapolt[2], George de Hevesy[3], Georg von Békésy[4],

[1] Novel prize winner "for his contributions to the theory of the atomic nucleus and the elementary particles, particularly through the discovery and application of fundamental symmetry principles" 1963
[2] "for his discoveries in connection with the biological combustion processes, with special reference to vitamin C and the catalysis of fumaric acid" 1937
[3] "for his work on the use of isotopes as tracers in the study of chemical processes" 1943
[4] "for his discoveries of the physical mechanism of stimulation within the cochlea" 1961

Dennis Gábor[5], John C. Harsányi[6] or George A. Olah[7], but also others whose knowledge and achievements are acknowledged widely. There can be mentioned here Theodor von Kármán, Leo Szilárd, Edward Teller, John von Neumann, Theodor Herzl, Zoltán Bay, Kornél Lánczos, Viktor Szebehely and many others. Hungary is one of those countries that has produced the most Nobel laureates on natural sciences per capita. Some say that "Hungarians are predisposed towards logical thinking by the struggle to master their notoriously complex language." Others mention several different reasons for this phenomena, for example Georg von Békésy said: "In Hungary, life was different [than in Switzerland], and we all were involved in an ongoing struggle for almost everything which we wanted, although this struggle never caused anybody's perdition… People need such challenges, and these have existed throughout the history of Hungary."

Writing this paper would be a good chance to make compliments about Hungary and Hungarian talents, and I deeply admit the achievements of these scientists. However, this time I would like to point to another question: the role of the secondary school in the lives and in the professional carrier of the mentioned persons. How did the secondary school improve the interest and the enthusiasm in these people towards their field of inquiry? What kind of sendoff did the teachers give to their students through the years of their studies? Several of the mentioned, and many other famous scientists studied in Catholic or Protestant secondary schools, like Wigner, Neumann, Harsányi, Herzl, Szent-Györgyi, Oláh, Hevesy, Bay, Szebehely or Lánczos[8] – to mention only a few of them, but until the World War II it was compulsory to study "religious and moral philosophy" in every High-school in Hungary.[9] How could these persons and their teachers join the scientific and religious studies together? What kind of influence did one of these fields have on the other?

For me these questions arise also from a present problem in Protestant secondary schools, that polarizes the problem of secondary school education very well. Creationism in Hungary had never been a familiar religious stream until quite recently. During the last few years some Hungarian theologians and scientists started to emphasize the exclusive correctness – or at least the primacy – of the creation story instead of the scientific theories for the origin of the universe. Moreover, in 2004 some strongly creationist articles were published in the weekly journal of the Hungarian Lutheran Church. In those articles some pastors and theologians required that in secondary schools which belong to the church evolution-theory should not be taught, because it causes a "mental and psychical disruption" in the students' mind.[10]

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[5] "for his invention and development of the holographic method" 1971
[6] "for their pioneering analysis of equilibria in the theory of non-cooperative games" 1994
[7] "for his contribution to carbocation chemistry" 1994
[8] Wigner, Neumann, Herzl and Harsányi studied in Fasori Lutheran School, Szent-Györgyi studied in the Reformed secondary school in Budapest, Hevesy and Oláh studied in a secondary school of the Piarist Order, Bay studied in the Reformed Secondary School in Debrecen, Lánczos and Szebehely studied in the secondary school of the Cistercian Order.
[9] Religious education classes lasted about the same number of hours as mathematics classes.
[10] In 2003 believers in Krishna and Cristian creationists founded the "Intelligent Design Workgroup" and wrote a letter to the Minister of Education in Hungary in order to ask him to prescribe a standard of teaching an alternative "supreme, intelligent designer", and additional 230 subscribers have joined to this proclamation. A state official answered the letter, and essentially he handed over the decision to the competency of schools and biology teachers. After this several conferences and articles have been organized and written about the topic, and a debate started where people argued against creationism and others against standard scientific models. The number of the articles on this issue is increasing and people ask the question more and more of the role of education in this aspect.

It seems that in Hungary today there is a tendency to invigorate the extremes in these questions by trying to separate science and religion, and generating a sterile world-view where there are no connections and no dialogue between the different fields of life. However, in recent past it was a usual and normal approach in secondary schools to teach and study religion and science at the same time, it produced not only a healthy world-view but also a very rich and fruitful point of view. As Kornél Lánczos wrote in his biography "Our education in humanities opened up doors in many directions, through them we departed towards poetry, arts and physics." Or as Zoltán Bay said about his secondary school: "If I try to answer the question why I am grateful to my school in Debrecen, I will say briefly the following: because it covered the triple function of the human soul without which humans are not humans: the mind (knowledge), the love of beauty (arts) and the morals."

Importance of the dialogue between science and religion in teens

Psychological background

One of the most sensitive periods in human life is being a teenager, when one's personal system of values is built up. Education is important in these years because this is the time when someone's ability to tolerance, skills for a dialogue, or extensive knowledge can be supported and built. It is not always the professional knowledge that helps the students to improve, but the way of teaching, personal contacts, the discussions that give a sendoff to the students by which they can develop their personalities and later, their knowledge on the field of their special interest. Kornél Lánczos formulated the importance of this as it follows. "Our secondary school education was of a high standard. I am not thinking of what we learnt there, but of the attitude which developed in us lasting a whole life. It was a wonderful feeling when we were exposed to the impact of all the ideas that were created by the mankind. In the years of puberty this emotional approach made a deep impression on us."

Why is it important to emphasize education of teenagers? According to Georg von Békésy "there will be a contest among different countries in the future. The country which can manage the education of teens most smoothly and best will probably have an effect on the thinking and the economic scenario of great part of the world."

Several psychologists say that to a certain degree experiences gained through education can have a deeper impact on a person to the effect that one's belief is biased to an extreme or not. Education, and primer relationships – with teachers and others – have a greater influence on the attitude of the student than the innate characteristics such as being an emotional, intuitive, perceptive or thinker person – according to the grouping of Carl Gustav Jung. While the innate characteristics form the behaviour-motivation as instincts, the impressions given by education are connected to fears, and for this reason they prevail the behaviour-motivation much deeper than innate characteristics.

In the relationship between science and religion there are two extreme standpoints in the background of which lies the attitude of enthusiasm or compulsion. According to Erik Erikson, if the elemental trust towards the physical world could not evolve in childhood – because of too much stimulus or the lack of inducements – the child will have a schizoid habit. One will find the world around dangerous, threatening and strange, and his or her situation defenseless and unprotected.

Teenagers are especially endagered in this aspect, because in this age – irrespectively of the experiences gained in childhood – a kind of "pseudo-schizoid" stage can come off if they do not learn how to make a distinction between their inner and outer world, reality and fantasy, the person's own goals and the society's and the community's aims. In this "pseudo-schizoid" stage one will find very appealing the mystical, the secret, the esoteric world, and probably will completely refuse the real world and the scientific approach of this universe. But sure enough this person will not be the one to imagine a healthy consonance between different fields of life, or not even who can participate in a dialogue of them.

In adulthood this schizophrenic phenomena comes up as the decision between conjunctions *and* and *or* to connect the notions of *science* and *religion*. As Wesley J. Wildman writes in more positive terms: "The relationship between science and religion is fascinating partly because it compactly expresses a kind of schizophrenic anxiety within the contemporary West generally: *How can we think and act scientifically and theologically, critically and worshipfully, technologically and ethically at the same time?* This phenomenon has been noticed and discussed many times. I am not especially attached to the term 'schizophrenia' for describing it, but the analogy has some advantages. In clinical psychology, schizophrenia tends to mean dissociation from reality. In its popular sense, however, it suggests a split personality, in which the dissociation is internal rather than external – what psychologists might call multiple personality disorder. The two are not completely independent, since dissociation from reality is often the result of an attempt to avoid awareness of an internal tension or split, and vice versa."

To forerun this schizophrenic state, schools and teachers have an especially important role in the education of teenagers. In the same way as in the cases of the compulsive personalities. These persons try to follow a consequent and strict order in which even the smallest units are ruled very rigidly. This person is afraid of the unpredictable, uncertain, polyvalent phenomena. Psychology has proved that the more something is forbidden for the child or teenager the more the child will try to violate this prohibition. The price of this kind of unambiguous world and definite answers is the narrowing of the life and losing the multicoloured beauty of the world.

Avoiding both developing a pseudo-schizoid stage or firming compulsive personalities is neceassary not only to grasp the world in its versatility but is also important to the researcher's work. George Oláh said that "scientists as me … do research because there works in them the innate curiosity and that one which was infused in the school. They would like to find the unexpected. If they also experience that their work contributes to the advancement of human society, that is a pleasing addition." Education has to elaborate the need to curiosity in students, and has to provide a motivating background instead of a narrowing world-view.

Dogmatism

Those schools and those teachers that emphasize the dogmatism's approach nourish the schizophrenic attitude to life as well as the compulsive behaviour in the students. Dogmatism which means rigidity, one-sidedness and absolutism is not only unfruitful, but also can be very dangerous as it causes some kind of split in the person's mind. Contrary to creationism's stance, it is not the dialogue that splits a person, but the lack of the dialogue, the dogmatism's approach that can provoke mental or psychical cleavage.

Let me quote two of the mentioned scientists who emphasize that in their lives and professional carrier the lack of dogmatism was one very important component that helped to improve. "I have to tell some words on how much the school liberal was. Even on religious education classes it was allowed to have a debate with the teacher, and on other classes easy debates were going on. The teacher's authority required of students only not making malicious comments and not mocking, but otherwise teachers admitted without resentment if students were right. It was a Reformed school which taught and educated without the compulsion of dogmas" said Bay. Lánczos wrote that "we discussed our intellectual adventures in school debating circles. We wrote essays and gave lectures. Our minds had a feeling of the importance of these debates. We could stay away from dogmatic thinking, since we discussed with each other the different aspects of each topic. We attained the experience already in secondary schools that the same question can be approached from several directions."

Dogmatism in my understanding is not an approach for which dogmatic or theorem-based knowledge is not important. Dogmatism's approach is in opposition to what I would call as "conversation approach". This latter means for me that different disciplines, fields of studies are in conversation with each other.[11] It does not mean that theorems are not taught, on the contrary: different disciplines can enter into a conversation only if they all know their own bases and limits. To mention only few of the advantageous attributes of the conversation approach – and disabilities of the approach of dogmatism – as I see the former helps the teenagers

- to develop a trust in the world that surrounds them,
- to find the border between the inner and the outer world,
- not to narrow their epistemology only to one aspect,
- to give an extensive knowledge,
- to facilitate the skills to debate and dialogue,
- to come to self-supporting decisions and revision them,
- to build a healthy world-view in which natural sciences and religion, scientific knowledge and faith can exist together in their completeness,
- and so to keep away from being a schizophrenic or compulsive personality.

The schools of the mentioned scientists could put these aspects into practice and avoid dogmatism and other unfruitful approaches. George Oláh told about the importance of this all-round education: "To scientific career the most important are the good foundations, on which later the continuously collected knowledge can be built. I was grown up between the world wars. My school had a strict curriculum with high expectations which emphasized arts classes as well: studying Latin, German and French was compulsory. I was very interested in literature and history. I like reading even today which I think can be thanked for the extensive school education."

An analogy

There remains one question that arises from the search for the place of the mentioned: In our contemporary situation is it necessary to foster the dialogue of the different fields of the world and use the "conversation approach" in education, or is it only an

[11] Here this expression does not stand for the method of Socrates where the teacher and the student are in continuous conversation by which the student learns on his own. Though this is also a frutiful method, I use this expression for taking the different disciplines into dialogue.

optional addendum that helped some scientists in their lives and in their career? Is it a crucial question to teach and talk about the dialogue between science and religion or is it not so much essential?

Let me picture the situation of the teens in this question with an example from the history of science. If someone reads some of the writings of theologians and scientists from the Middle Ages and from the 20th century, then one can realize a very important difference. In the lives and in the professional career of the mediaeval (or earlier) scientists science and religion could exist together, rationality could help to develop – and sometimes even to prove – the truth of faith.

Scientific research of the world was possible because the world was created by the righteous and benignant God, and God's creation can be examined because everything is ordered in a good orderliness, according to God's will. Some of the earliest natural scientists were theologians, like Robert Grosseteste, Roger Bacon or William Ockham, for whom studying nature was the duty of the theologian. But even for scientists in the 16-17th centuries science and religion was in a good relationship, there was no contradiction between them for most of the scientists. As Johannes Kepler said: Studying astronomy is "reading the mind of God." Or as Nicolaus Copernicus wrote: "My goal is to find the truth in God's majestic creation." In Isaac Newton's words: "A heavenly Master governs all the world as Sovereign of the universe… no variety adhering to time and place could evolve, and all variety of created objects which represent order and life in the universe could happen only by the willful reasoning of its original Creator, Whom I call the Lord God." And Galileo Galilei said that "…the ways of nature help us not less than the words of Scripture to find God."

We know that crucial changes happened in between the 20th century and the time of Kepler, Newton and their contemporaries. We know that the results of the Enlightenment had an effect on every part of the world, and there was a scientific and technological revolution just as religious, cultural, social and political changes happened throughout the world. As Arthur Koestler formulated this: "since renaissance the 'ultimate reason' has been shifted from heaven to nucleus."

However – possibly to our greatest surprise – there are still scientists who find possible, moreover, essential to reconcile science and religion. Ernest Rutherford said that "those people that do not carry a scientific research out live in a misapprehension that the scientist has to be an atheist person because of his widespread knowledge; but on the contrary, our work brings us closer to God." According to Max Planck "for believers God is in the beginning, while for physicists God is at the end of every consideration." And to mention a sentence from William Herschel: "The more science is developed, the harder it is to reject the eternal existence of an omnipotent creator"

In spite of the revolutions and changes in science and religion, these two areas could find the way to the common questions, to the dialogue and even the integration of them in the lives of several scientists and theologians.

There happens something very similar in students' lives in secondary school. During those years students pass through several kinds of revolutions in their religious faith as well as in their rational thinking or in their emotions. They have to experience a kind of cultural and social changes in the classroom and in their communities, to live mental and spiritual revolutionary times. Moreover, we all have to live these times later on diverse occasions throughout our whole life.

Secondary schools cannot ignore these phenomena just as scientists do not ignore the times of technological revolution. The years of teens are very important and fruitful in

this aspect, because this is the time when teachers can free them from the disadvantages of dogmatism and can help to come to self-reliance in decision-making. In this aspect teachers can help the students to live in a healthy world-view and so to keep away from being a schizophrenic or compulsive personality who is stuck in dogmatism.

In this sense secondary schools have a role of "vaccination": they have to prepare their students to as many difficult situations and hard questions as it is possible. The school may not hide any approach but has to foster the examination of them, because this is the time when teenagers can try their wings with help. It is not only advantageous but is also necessary to talk about different approaches to the world. Otherwise, later it is very hard to convince those people educated in dogmatism of the importance of the dialogue between science and religion and other "disciplines". Thus the question whether it is necessary to foster the dialogue of different fields of the world or it is only an optional addendum depends on the attitude of the school: if the school wants to care about their students whole lives and not only teach them counting and reading and care about them for 4-6 years, then the answer is "necessary".

In this sense secondary school can play as a model for the dialogue between science and religion. It can be a model for students, because they will recall their memories and experiences from these years. The attitudes and approaches they see and learn these years will determine the way they will handle problems and questions.

In a different sense, secondary school can be – and hs to be – a model for the dialogue between science and religion. In Hungarian teaching system high-school graduation is usually the last time when students have to give account of more than some aspects of their studies, and this can also be the last point in their lives until they are forced to think in terms of a unified world to some degree. If a school teaches all the necessary subjects in a "conversation approach", then this school is a good example for the students and for anyone else in the sense of the dialogue of different disciplines.

Clever and wise

Moreover, the school *has to be* the model for the dialogue in one sense. It is so not because of "religious reasons" but because this is the last chance when students can learn how to be both wise and clever at the same time.

According to the concepts of László Végh, being clever and being wise are different attributes with different roles in one’s life. Being clever means being able to think in terms of cause and effect. This way of thinking is necessary for everyday problems that can be isolated from other parts of the world. This is a kind of short-term thinking in pursuance of effects.

Being wise means being able to analyse situations, understand complex systems with several different kinds of aspects, to collect one’s experiences and to construe a new phenomena through them. This kind of thinking needs the ability of creating, understanding and using models for knowing the world well. The wise person has to have an extensive knowledge, and the power of positive judgement.

In secondary schools teachers have to transmit problem-solving ability to being clever as well as the ability for being wise. Certain classes have the possibility to fulfill these

roles.[12] Mathematics can teach the logical way of thinking that is necessary to our living. Literature and reading can teach our mind for interpreting, comparing and connecting different phenomena. In physics classes one can learn how to make and use models and how to make a distinction bwtween important and unimportant things. Biology and geography can teach us systematic thinking. Religious education and moral philosophy studies can teach us for the evaluation of the former and to make connections between all the different aspects and areas.

Thus, secondary school has to be a model for the dialogue in this sense: the teachers have to teach teenagers for all these aspects. These years are almost the only ones when a person is open to learn the importance of these aspects, and these years are the time for this approach. Later, when one finds the field of interest and the area of his later professional career, the other aspects will be essential. Creativity does not exist without being clever, and analyzing work requires also being wise. And also for one's personal life it is essential to be clever and wise at the same time.

Fasori Lutheran School as an example for realization

Thinking about all the written observations, the question arises whether there is any school that brings all these into effect. How can a "faith-based" secondary school avoid dogmatism and absolutism? How can a school teach natural sciences and religion in their completeness and still, to create an atmosphere where all can participate in a dialogue? Is it possible for a school to transmit a healthy world-view in their students' lives?

Fortunately there are quite good initiations and practices in certain schools in Hungary as well as there are excellent teachers who try to realize all these aspects very consciously and ardently. All these are reassuring signs beside the creationists' initiatives, and hopefully more schools and teachers – do and will – belong to the former category than to the latter one.

However, I would like to instance one specific school as an example for the fruitful realization of the written above. There could be mentioned other schools in the past as well as in the present, but examining the life of the Fasori Lutheran School until World War II[13] can be a good example, because in this case we can also read and learn from the memories of scientists, theologians and scholars whose alma mater was this institution. This school can be an examplar through which we can search for useful hints, precedents and patterns for solving our present-day difficulties.

Certainly, one cannot talk about the characteristics of a school from 60-80 years back in the past without taking into account the historical, ideological, social, cultural, etc differences. However, I am sure that one can learn from the peculiarities of the school if tries to recognize the values and methods that are irrespective of time at least to a certain degree.

Reception and creativity

The conciliation in 1867 between the Hapsburg empire and Hungary was followed by a rapid economical and cultural development. In the background of the development

[12] According to a lecture presented by László Végh on the conference "Látlelet az ifjúságról", February 11-13, 2005, Budapest.
[13] The school was closed in 1952 for 38 years

there were such components as the motivating influence of the growing multiculturality, social and economical changes, the increase of the civil values, the emancipation of minority folks, the growing need for professionals in agriculture and technology, and also the advancement of the school-education. To the initiation of Loránd Eötvös the Hungarian system of education was renewed. The best of the pedagogical principles were combined with great teachers and foreign experiences of education.

Historical changes had an influence on the concepts of reception and creativity thus it can be worthwhile to think them over briefly. Creativity means usually the person's abilities that help the scientist to the success of a scientific research. Reception means the process of acquiring the former scientific results – it is study itself. In this sense, one can think about how creativity can be traced back to some kind of reception, and to what extent creativity depends on reception.

There are criteria about the creativity of a scientific result: it has to fulfill the requirement of originality, priority, – possibly – beauty, ingeniousity, resourcefulness, etc. In this sense there is not a notable difference between the creativity of a scientist and a creativity of a student who solves a problem first time in his life and only on his own. On the connection of creativity and reception in the case of the famous Hungarian scientists Gábor Palló writes the following: "To understand the success of the great Hungarian scientists the concept of reception has to be broadened. The Nobel prize in physics of Eugene Wigner is connected not with the activity of Loránd Eötvös in physics, and the Nobel prize in chemistry of George de Hevesy is built not on the knowledge of Than or Büdböck [Hungarian professors]. Their professional schools were situated outside of Hungary. Mihály Polányi became a physical chemist in Germany, Edward Teller studied quantum theory also there, John von Neumann studied the axiomatic examination of mathematics in Germany, and Albert von Szent-Györgyi studied modern biochemsitry in Cambridge. The Hungarian component of their success has to be searched outside of their professional career: in the education outside of school (for example schools competition), in the inspiration inside the family, in intellectual companies (for example Galilei circle), in literature (Ady, Madách), in politics, in the redeeming atmosphere, in the inclination to philosophy and in equals."

Palló unveils very essential attributes about the concept of reception in the case of Wigner, Neumann and others. However, there is one word I would like to argue with: education *outside* of school. There were examples as the Fasori Lutheran School that wanted and could provide all the necessary elements to such a rich background: there were organized competitions in the school, moreover, the teachers of this school made up and edited the excercises to these country-wide competitions. There were several scholarly societies and study circles in the school for physics, mathematics, other subjects and "interdisciplinary" topics – as we would name it today. Teachers of natural sciences did not teach only their subjects, but were sophisticated, and tried to hand on this approach. For example there was a physics teacher, Miklós Vermes who always introduced a piece of classical music in physics study circles, and students listened to that music while they tried to do the experiments.

And besides all these attributes, the school was Lutheran, the teachers were Christian persons. This was transmitted in several ways also: there were certain religious education classes, but besides that the attitude, the moral background, the world-view was Christian. In short: the school could teach for both being clever and being wise.

This versatility characterised the Fasori Lutheran School and their teachers. By this it could be an organic part of the cultural life in Budapest. On the next pages I try to

show briefly what characteristics of this school and its teachers could provide for creating the rich background that is necessary to the broader understanding of the definition of reception that helped the mentioned persons to elaborate their own way of thinking.

Locality and its consequences

From more than one thousand years ago the church raised Hungarian schools to a high level. The first Hungarian school – and Benedictine monastery – was established by Adalbert the Saint in 996 in Pannonhalma, in the north-western corner of Hungary. From this time on the Hungarian schools have developed almost without intermission. There were troubled times – even centuries – but the schools with their autonomy and the teachers always had an important role in preserving the culture and knowledge of the nation. Besides the Benedictines, the Roman Catholic School of the Piarist Order had several high-level secondary schools in the country. These schools – and later the Protestant ones – worked as the centers for the scientific life.

The Protestant churches got the permission for their first open worship in 1787, and they got entire autonomy and the right for establishing schools only in 1791. The local chorister started to collect and teach the children to the congregation on Deák square in Budapest in 1787. The congregation made a decision immediately in 1787 about the person of the chorister: the chorister had to be a person who has the knowledge to the educatetion of children. From the writings of the directors in 1806 and 1816 we know that the school enhanced the high professional level of the teachers and their moral and financial honor, and specially emphasized the education and "development of the students' heart and emotions" instead of conning. It has to be mentioned that the topical political, ideological and social situation of the curches influenced the curriculum of the schools already from the beginning, but especially on the turn of the 18th and 19th centuries. This influence could be motivating most of the times, or sometimes worked as a setback, but as a result, in the reception of natural sciences there appears a sociological factor which remains in Protestant secondary schools' education for every age.

The school developed and grew extremely fast: in 1822 another floor had to be built to the original building, and in 1864 a comletely new, three-floor building had to be added. Already in 1860 more than 200 students enrolled to the school. From 1900 to 1904 still another building was built to the school, but this time in another part of Budapest, in the place where latter famous scientists and Nobel laurate alumni studied. As John C. Harsányi writes about the situation of the school in the 1930's later in his autobiography: "The high school my parents chose for me was the Lutheran Gymnasium in Budapest, one of the best schools in Hungary, with such distinguished alumni as John von Neumann and Eugene Wigner. I was very happy in this school and received a superb education. In 1937, the year I graduated from it, I won the First Prize in Mathematics at the Hungary-wide annual competition for high school students." And as Eugene P. Wigner formulated: "The Fasori Lutheran School was perhaps the best secondary school in Hungary at that time, but probably one of the best schools in the world."

Why was the Fasori school so popular? Why could it develop so fast? How could it reach such a high professional level?

Besides the historical and social reasons some unique characteristics played a decisive role in establishing the content and attributes of the school and to develop to higher level all these skills of the institution.

First, the idea of the school emerged in a Lutheran congregation, and not only the idea, but more imporantly, the *demand was local*. The school was created by the local Lutheran congregation, according to the demands of the local Lutheran people. This institution was not strange or extraneous for the students and the teachers, it was not ordered by outside of the local community. The demands were real ones connected to the life of the people in that specific group, not generalities or ordinariness. Local demands played also an important role in that Hungarian Lutheran Church was always in minority.

Secondly, – and these characteristics are partly consequences of the first one – the education started *from the bases*, so the teachers had to lay down the foundations at every student. It applied to teaching professional knowledge or emotional and spiritual improvement as well as to developing the world-view or attitudes toward the great questions of the life. Knowledge and personal improvement came *naturally*, penetrated their lives without exterior pressure.

Thirdly, one of the invigorating sources of the school was the financial and mental support of the local community, the believers of the Lutheran congregation. This again means that the school was maintained only partly by the state, and mainly by the local community, so the responsibility, enthusiasm and consciousness was in the hand of the community. The most important in this aspect was not the support but the experience for the students that teachers, parents, members of the congregation and students *worked together* on the success of the education and the school. Good examples are for this characteristic the ways of collecting the equipments for the storerooms and the laboratories. Students collected on their own or created by their hands what they could do together with their teachers, while the members of the congregation and parents donated books, paintings or equipments to physics and biology classes, etc.

Fourthly, most of the teachers *participated in public life* actively. They gave presentations on several different topics, were members of different church-related or civil commities, sometimes even entered into political issues. For them it was usual that the same teacher gave a lecture on a professional question – on the area of natural sciences, mathematics, music or arts – and at another time on a religious topic. It is easy to understand this versatility, because scientific approach was part of their lives as well as religious belief.

Fifthly, an *organic development* went on in the school. The growth was organic *in the student's life*, because one could study in this atmosphere from the age of 7 to the age of 18, and this attitude was elemental part of his or her physical and mental surroundings. On the other side the development was organic *in the school's life*, because the teaching staff created a community which grew together with the school. New teachers could adapt themselves to the staff easily. The organic development is in contrast to the "conveyor belt-approach" that was far from the approach of Fasori school.

Sixthly, the school staff's ethical viewpoints were very similar. This moral community is something that sounds much more difficult or impossible – and somewhat idealistic – to achieve today. But it is not so. Because for these persons an ethical common ground did not mean a necessary accordance in every question, but much more a *skill and openness for the conversation and the debate*. They were not afraid of educating each other and of the debates on different questions in order to understand each other, and this resulted in a mental and spiritual vividity.

Seventhly, the most important component of the school was the professional and pedagogical skills of the teachers, the *personality of the teacher* and the *enthusiasm* and *conscientious* attitude of these people. As the school report wrote in 1922: "But after all the good teacher is the most important factor in the school. Good teacher = good school. This is the base equation of the school's formula. From this everything follows by mathematical accuracy." And as Ödön Hittrich, a director of the school emphasized: "The maintaner authority of our school always devotes great attention to choosing teachers, because they know well that the soul of the school are the teachers. The personality of the teacher has a deep impact on his students: the memory of a diligent, enthusiastic teacher is unforgettable for the students, because this teacher gives the real sendoff to his students."

Among the reasons for the high professional level were that most of the teachers studied abroad for some years, that they were interested in the latest news on their fields of inquiry, that they taught the students the hottest results of natural sciences, such as the theory of quantummechanics or the special theory of relativity. Teachers published several professional papers, and many of them were a member of the Hungarian Academy of Sciences. These teachers were not only interested in the current scientific issues, but also in the question how they can interpret these results to their teenager students. They wrote several excercise books on physics, biology etc. Since they were good in their fields of inquiry and also had a teacher's mind, they could interpret their knowledge in a deeply comprehensible way.

Wigner told in his speech on the Nobel-banquette: "What I wish to draw attention to is how much of our interest in science, and how much of our attitude toward science, we owe to our teachers. My own history begins in the high-school in Hungary where my mathematics teacher, Rátz, gave me books to read and evoked in me a sense for the beauty of his subject."

The most essential characteristics of the teachers was their personalities and their relations to their students. "Teachers and students are complementary roles to each other" said Georg von Békésy. It is written about Vilmos Tolnai, a linguist and literature-historian that "the great linguist and writer of the history of literature, the marvellously fresh teacher, who can charm his students' soul and take them to the clearer hight if the ideals. There could be quoted here several other sentences and anocdotes how teachers liked their students and the idea of education and pedagogy. One story exemplifies this attitude very well. László Rátz, a prominent mathematics teacher was elected to be the director of the school in 1909. One year later as the young John von Neumann had been enrolled to the school – where also his father had studied – Rátz quitted his position of the director and went back to teaching mathematics in full time, because he discovered the special talent of Neumann and kept it much more important not to leave this young boy's skills perish. As Wigner put it in one short sentence: "The good in the Fasori Lutheran School was that teachers were interested in teaching."

Theoretical disposition, practicality, affection for modern fields of interests, competitivity, versatility, problem-solving and philosophy, political commitment and activity – these are the attributes Gábor Palló finds as common intellectual characteristics of the famous Hungarian scientists. According to his explanation, the reason and motivation behind these characteristics are not some concrete phenomena, but a complete lifestyle. This style of life, this worldview, these attributes are the ones that the Fasori school could provide to their students.

Moreover, local demands, naturality, being able to work together, participating in several different aspects of life, organic development, skill and openness for the

conversation and the debate, the personality of the teacher and his or her enthusiasm and conscientious attitude – all these characteristics are important in educating mentally and spiritually healthy people, but also to our aspect: to the dialogue between science and religion. These characteristics are important to an humble approach of the world, to an aweful and honoring attitude towards the known and unknown parts of our universe and of ourselves, humans.

These were some of the main characteristics of the school and these were the attitudes that could be learnt there by many of the students. It appeared later in several forms on different fields of life where these students started to work. For example once Eugene Wigner said about physics and emotions, life and intellect that "There are phenomena which physics cannot describe. Such things are life, mind and consciousness. To be resigned to this is the same as if we would not take gravitation into consideration. But gravitation exists, and life exists. I am here, I feel joy and desire. It is said that the laws of physics are valid for humans, and emotions are uninteresting. I cannot accept this! I am convinced that consciousness can have the same influence on the events as gravitational force has. But then there exists something to which physics does not pay attention to, just as physics was not interested in nuclei a century ago."

This kind of approach would be required to many theologians and scientists today, and to reach this, first we should show and educate them on this attitude in schools.

Two exemplary teachers

Two prominent personalities, two excellent teachers mark the teaching of natural sciences in the first decades of the 20th century. Sándor Mikola, a teacher of physics and László Rátz, a teacher of mathematics were the persons who taught Wigner, Neumann, Harsányi and several other scientists. What did mark the pedagogy and personality of these teachers?

It is known that personal prepossession or conviction coming up – directly or indirectly – from previous experiences influence not only the things we accept as explanations for the operation of the world, but also actuates the way we explain or teach these things. Convictions determine the way we interpret our lives and acts or the problems of the world in the highest degree. Belief has a main role in recalling previous knowledge: it does not only determine what one evokes, but, more importantly, it also defines the way we call back our memories. This is in connection with the observation that in their pedagogical work teachers are influenced much more by the way they were taught than by what they learnt, by the person of the teacher than by the subject of the lessons.

Sándor Mikola

It is said in Hungary that the teachers of physics can trace back their "lineage" to Ányos Jedlik. It is so because most of the physics teachers learnt methodology of physics education and experiments from Miklós Vermes, a great physics teacher of the second half of the 20th century. Vermes started to teach beside and learnt from Sándor Mikola. Mikola writes with great awe at several places about his great master, Loránd Eötvös, and Eötvös learnt the secret of physics and physics education from

Jedlik. Eötvös told about his master in a speech in the Hungarian Academy of Sciences in 1897:

"Jedlik has finished his studies in a secondary school that was established by the Benedictines, he also taught theology by the rule of this Order and according the demands of the age, and besides theology he also studied some physics. He studied enough of theology to affirm himself in the dogmas, and enough of physics to awaken to the desire to more knowledge. However, this desire for knowledge did not launched him to the investigation of the ultimate reasons, but only to find satisfaction in the detailed knowledge of the phenomena of nature. His philosophy was very simple. God created this world with its rich diversity and marvellous order, and since this world is beautiful – and this beauty reveals in more fascinating pictures as we scrutinize it in its details – therefore human mind cannot have a major pleasure in this world than researching the details of the phenomena of nature. This was the amusement and this was the pleasure that physics gave him… Among us only his memory lives on, but not as the memory of an intellectual colossus that can be stared at only, but as the memory of a pioneering worker who can be followed… Thus if we want seriously Hungarian scientists' work to be considerable, let us follow the example of Jedlik…"

This wondering about the world, the beauty of the experiments, the humble desire for knowledge, the enthusiastic research of the scientist was the motivation of Jedlik and this approach was the "secret" that he passed on to the present day through Eötvös and Mikola. Jedlik was a good scientist, inventor, teacher and believer at the same time. And this was Eötvös and Mikola, too. Jedlik discovered the method of producing soda-water, invented the dynamo four years before Siemens, the electric motor first in the world in 1828 and many other machines. The only "problem" was that his creativity was isolated, and he could not make others acquainted with these products. Reception and creativity were separated in Jedlik's life. This was not the same with his followers, Eötvös and Mikola.

Mikola studied in the Lutheran school in Sopron, and taught in Fasori Lutheran School for 38 years. Besides that he was a famous scientist – he made research for example on electrets and their polarization in the 1910's– and he was a member of the Hungarian Academy of Sciences, but he was also an excellent teacher. He was the co-editor of the Hungarian Mathematical and Physical Journal for Secondary Schools for 9 years. He was the member of several committees on physics teaching, and was in the board of the physics competition for secondary schools.

The question arises about the connection between the belief of these teachers and their teaching. As Gábor Gyapay[14] formulated "the question whether their Lutheran belief determined their way of teaching in any sense would be hurtful for them. They were not Lutherans consciously, but they were Lutherans." This sentence can be the background of several consequences.

Mikola's greatest virtue of teaching was the intention to create precise concepts. According to his view the sciences are built on the abstract concepts, but they cannot be memorized, only the students can create these concepts themselves. He said that "…only those things can have a creative impact which happen to the person directly, which was experienced and lived by the person himself, so that the datas evolved by the exterior effects by the sense-organs will constitute the basis of the mental life." The students have to participate actively in this abstraction, and by this way they acquire such ethical virtues as care about the environment, initiative, love and appreciation of work, patience, self-discipline, steadiness and justice, moreover "the

[14] Dr Gábor Gyapay historian, the first director after restarting the school in 1989.

student’s relationship with the real elements and with the unchangable natural laws will keep one’s romanticism under control; the student’s usual connection with the teacher leading the demonstrations in physics will open one’s closed personality; and the joy over solving the difficult problems will increase the student’s self-confidence."

Mikola tried to emphasize his view by his teaching method which was teaching by experiments. He wanted to show that physics is not a separate corner of the world, but part of the universe and our life. We can get acquainted with natural laws, connections can be discovered, even by the students. And this applied not only to the mental sphere, but also to the physical and spiritual one. He committed himself to the collective education of body and soul. As a director he supported those school-endowments which awarded both physical and mental improvement. He was in love and conversant with nature as much as antique culture. His pedagogical views are deeply relevant today as well as 70 years before because they originated in the depth of humanity. This was the source also of his style of physics teaching, and this is the reason for his present-day success among teachers.

Perhaps this could be one of the motivations behind Wigner’s words when he referred to the global function of the nucleus: "I believe in that – by reducing the economical restrictions – the nucleus will have a role in the improvement of the international connections. The nucleus is not only the demonstration of the great international enterprise of humankind: of science, but it can also serve as a positive example for the successful active international cooperation. Cooperation on a definite purpose between people with diverse cultural background can create the feeling of a community and the respect of the other’s motivation and sensitivity. The world needs this today more than anything else."

László Rátz

The legendary teacher studied in the Lutheran school in Sopron and educated mathematics for 35 years in the Fasori Lutheran School. He was famous for his committed pedagogical work and compelling personality, for his vividity of education and certain knowledge. He could make worked every member of a class at the same time according to the students’ skills. He was able to talk down to his audience, be the class at any age and any interest. He strove for introducing and teaching mathematics not as an abstract subject but something that is strongly connected to practice and to life. For him mathematics was a way to come to know reality.

He was an editor of the Hungarian Mathematical and Physical Journal for Secondary Schools for more than 20 years. He edited and made up several mathematical problems for different competitions. He was a member of the reform committee of pedagogy in mathematics. Their idea was that teachers should develop the sense that mathematics is a cultural factor. "We want students finishing secondary schools to take academic mathematical knowledge to life… Students have to see how many ways mathematics is connected with practice in life, with sciences and with our world-view… Our conviction is that this kind of modification of teaching is required in order to understand modern culture in its basic characteristics." Mathematics and culture belong together, were connected in every age.

Another essential innovation of Rátz was the recognition of the importance and use of "function-like" thinking. He emphasized that students have to strive for the knowledge of reality by unveiling quantitative relations in the world. Connections, correspondences and relations – that are written by functions in the language of

mathematics – are substantial characters of the world, thus "from first-grade onwards the approach of the students and their function-like thinking has to be formed consciously."

Rátz was the first who fitted in the syllabus the concept and knowledge of functions organically. He wanted to develop this view in the students from the beginning. Moreover, he applied this view not only in mathematics but also to every aspect of life. He loved and held to "function-like" approach up to mysticism.

Students are still grateful to these prominent teachers, and this is marked by the fact that there is no street named after Wigner in Budapest but there is one named after Rátz on which there is a primary school, a secondary school, a college and a technical school. For secondary school students there is a competition in physics named after Mikola, and there is another in mathematics named after Rátz. In the Fasori Lutheran School there is a memorial tablet for both Mikola and Rátz, and there is a third one for the famous scientists.

Memories like these are important to everyone. We all need sendoffs to our lives, analogies and examples that can be followed. All these can help us to find our way of teaching and to elaborate our own world-view.

Without the claim to the completeness I tied to collect some of the components that can be useful to the dialogue between science and religion in secondary school education by the examples of some teachers and their later-scientist students. The importance of the teachers' attitude in their work in developing a healthy world-view and a healthy relationship between the different fields of interest cannot be emphasized enough. The education that the students get in their teens will determine their lives to a high degree. The sendoff they get from their school and teachers will be important for their career as well as for their personal life and for their belief.

It is the same important as the scone fried in ashes for the lad in the folk-tales. These scones are made of only few components, but these are essential for the child's life. And there are two more aspects in this food: first, they are made with solicitousness, with the love and care of the mother. Secondly, they are not for comsuming at home and in that certain moment but they are made for the way, for the way of life, for the whole life of the person.

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