How to relate regional history to general patterns of history? – The case of mathematics

Gert Schubring
Institut für Didaktik der Mathematik, Universität Bielefeld. Germany

Abstract

This study is concerned with how mathematics teaching became implemented in Westphalia between 1800 and 1840. Since Westphalia was one of the provinces of the German state of Prussia, this is evidently a particular regional history. By analyzing the concrete political, religious and cultural changes in this period, the case appears to be an indicator for the changes, which the educational systems in Europe underwent after the French Revolution. Taking into account the contextual systems contributes to unraveling the variety of patterns characterizing the history of mathematics education. The research is based on extensive investigations in archives of schools, municipalities, provincial governments and of the Prussian ministry of education.

Introduction

Over an extended period of time, I undertook a considerable amount of research about how mathematics teaching became implemented in Westphalia between 1800 and 1840. Actually, after 1815, Westphalia was one of the nine provinces of the Kingdom of Prussia, and Prussia itself was just one of then 39 states, which were considered to be German ones. The study of Westphalia seems therefore merely to constitute a regional case study; so how far can such a regional case bear any more general importance?

Generally speaking, one might rightly assume that what is going on at the general level, has to be reflected at the local and regional level, too. Consequently, in performing regional or local studies we need to be conscious of the developments at the general level, in order to be able to recognize reflections or specific realizations of such developments. On the other hand, developments at the local or regional level might constitute new patterns, which will eventually generalize to a more persistent feature. Thus, in general, there are interactions between the different levels and it is these interactions, which constitute the complexity of historical research. Admittedly, it is possible, too, that some local or regional developments remain definitely restricted to that region and express some entirely particular feature, which does not generalize to other regions. This occurs rarely, but also affords the particular attention of the researcher, to elaborate clearly that specificity. Even such isolated cases may obtain a certain importance.

Regarding overall developments in mathematics education in the period 1800 to 1840, some key moments immediately come into one’s mind: on the one hand, the French Revolution and, in its aftermath, the first establishment of a public education system and – at the same time – the introduction of mathematics as a major subject in the secondary schools. And, as regards mathematics, intimately linked to this profound restructuration, a dominance of the so-called analytic
method, of algebraization. On the other hand, there is an evident political and social dimension of these structural changes in many European countries: most countries became a part of the French, Napoleonic system, either as parts of the Empire itself, or as an allied or a satellite state. In varying degrees however, they shared the same social and educational policy during the Napoleonic period, but also the reactionary policy of restoration thereafter. Moreover, one might wonder how the traditional split between the catholic and the protestant education system and the consequent differences in their mathematical curricula might be affected by all these changes.

Given these general trends of history, what’s about Westphalia and its mathematics teaching in particular? Actually, before 1815, Westphalia had not existed as a political unit. By 1815, it was an artificial creation, and one issue of its creation was whether it would gain sufficient coherence and, in particular, a common educational structure for its new citizens. It was hence of a key importance whether the Gymnasien in this new province would be able to function according to a common structure and conception.

The outset

As a result of the Thirty-Years War, the political landscape in the region of Westphalia represented, as in other regions, a patchwork of numerous sovereign entities – principalities, dukedoms, counties, components of kingdoms, clerical states, independent towns, etc. Without counting even smaller entities, it consisted of 28 “states” within the realm of the Westphalian territory. Besides all its disparities, some structural features can be identified: as another major result of this same war, there was a certain form of religious tolerance – with the consequence of a peaceful coexistence of states with a catholic religion and others with a protestant one. And several greater states were “owners” of dependencies in Westphalia: on the one hand, the electorate of Cologne, a politically very important and influential clerical (and hence: catholic) state, governed also the dukedom Westfalen (capital Arnsberg) and the Vest Recklinghausen, the region around Recklinghausen. There were two other considerable clerical states, the archbishoprics of Paderborn and of Münster. On the other hand, Prussia – a protestant state originally located exclusively in the east of the German Empire, but expanding more and more – had established some footholds in the West, namely the principality of Minden-Ravensberg and the county Mark.

What was the situation of mathematics education in this region until 1789? Here, the religious split between the catholic and protestant faith was constitutive for the divergent educational systems, and mathematics was decisively affected by their differences. Since Luther’s Reformation, a system of secondary schools, Gelehrtenschulen or Gymnasien, had in particular expanded their preparation for studies at universities where their Philosophical faculties would at first deepen proedeutic knowledge, including mathematics, before students went on to professional studies. The focus of teaching at the secondary schools was on
classical languages. Mathematics was for a long time, despite Melanchthon’s more wide-ranging conception, restricted to reckoning and arithmetic in the lower grades. Only during the eighteenth century, did this become gradually supplemented by geometry teaching in the upper grades (see Schubring, 2002).

In the catholic territories, the education system was dominated by the Jesuits and by their Ratio Studiorum, which defined in a uniform manner the structure and the contents of teaching. The teaching of the former faculties of arts had been supplanted by the new colleges, which copied the model of Gymnasiens, but radicalized the monopoly of language teaching. Only in the last grade, the philosophical classes – extending, contrary to the preceding grades, over two, respectively three years – the teaching of philosophy had subdivisions, according to the Jesuit vision of Aristotle’s philosophy; in particular ethics and physics. And as a part of physics, a few months of mathematics teaching were prescribed, of a very elementary level, due to the missing earlier teaching.

While the expulsion (from 1759 on) and dissolution (in 1772/3) of the Jesuit order prompted the majority of catholic states to undertake educational reforms, without lasting effects, in general, due to the still unchanged feudal structures of society, there was one state, of medium size, which had already earlier initiated profound reforms independently of the overall anti-Jesuit policy, due to the Enlightenment. This was the clerical archbishopric Fürstbistum Münster where the enlightened governor Franz von Fürstenberg had effected structural and curricular reforms since 1763. Regarding the college/Gymnasium, he replaced the former monopolist curriculum by a multiple-subject one, introducing for the first time mathematics as one of the major teaching subjects, to be taught in each grade. Its rationale was the function ascribed to it to promote logical thinking, and not a utilitarian one. It was Fürstenberg himself who trained the first mathematics teacher to realize the new curriculum. This teacher, Caspar Zumkley, even became the director of the highly renowned Gymnasium in Münster. And, he turned out to be a prolific author of the mathematics textbooks for this new function. The new curriculum also became applied to the other secondary schools in the Fürstbistum and served as a model for the territories in Westphalia governed by Cologne, but the conditions were missing there to apply it entirely.

Chances for more general changes in the educational system were given by political events in the aftermath of the French Revolution: due to pressures by Napoleon, the formally still existing German Empire undertook a major reform in 1802/03. By the so-called Reichsdeputationshauptschluss, all clerical states were dissolved and their territories handed over to the greater secular states. This implied major changes on the landscape of Westphalia, evidently, since its majority had been occupied by clerical states. The greatest share was received by Prussia, who now not only succeeded in uniting its formerly separated components Mark and Minden-Ravensberg by acquiring Münster, but also gained Paderborn – thus integrating considerably extended catholic territories. While Prussia intended to reform the educational systems in the newly acquired regions in its enlightenment-
minded manner, it was not able to change much, since its catastrophic defeat in 1806 in its war against the French Empire made it lose all its territories in the West. Another winner was a state, not yet represented in this region: the county of Hessen-Darmstadt who expanded considerably to the North, incorporating the former Herzogtum Westfalen.

Political map of Westphalia in 1808 (based on Klueting 1998). The towns indicated by points are those with a later Prussian Gymnasium, the other names are capitals of the states

The French period

Napoleon used the Prussian defeat for a major territorial restructuring. He now created two satellite states in Germany: the Kingdom of Westphalia (capital: Kassel) and the Grand Duchy Berg (capital: Düsseldorf), both governed by his relatives. Hence, the region of Westphalia was divided among three powers: two direct satellite states of the Napoleonic Empire (Großherzogtum Berg and
Königreich Westphalen) and one genuine German state allied to France - now called Großherzogtum Hessen (see the map). Given the strong position of mathematics in the lycées established in France since 1803 (see Schubring, 1984), we should therefore expect an immediate and marked reinforcement of mathematics in secondary schooling. In 1810, Napoleon dared to occupy and annex some parts of the territories governed by his relatives, together with large parts of Northern Germany, directly to the French Empire, so that – for instance – the northern parts of Minden-Ravensberg and of Münster became French. Since a key characteristic of French educational policy in the Napoleonic period had been its strict uniformity for the entire country, and since satellite and allied states used to copy more or less the French structures, one should hence expect now a new status for mathematics teaching in Westphalia.

The surprising result of my research was, however, that this was not the case. The governments in Düsseldorf and in Kassel began only after several years to plan educational reforms, but they missed the necessary conceptions as well as energy to realize any essential changes. An explanation is, that these satellite states were victims of the financial burdens by which they had to contribute to finance Napoleon’s permanent wars, so that the governments could not spend on educational reforms. Even in the northern parts, which were French from 1810 on, projects for assimilating them to the common structures in the French departments did not become realized until 1813/14 when this entire system collapsed. The only state reorganizing somewhat the schools within its new territories was the originally German one: Hessen. During its government, mathematics teaching became in fact reinforced in Arnsberg, the only Gymnasium in that region.

We have to state here the revealing paradox that states, which were projected as model states of modern Napoleonic social and cultural structures for Germany as a whole, were not able to reform accordingly the educational system and in particular to promote mathematics teaching, one of the core components of the French original.¹

**Becoming a Prussian Province**

After the collapse of the Napoleonic system, an international congress of the allied powers, held in Vienna in 1815, decided about the new political landscape in Europe. In general, Napoleon’s allies were the losers and his enemies were the winners. Thus, Hessen lost its gains in Westphalia and was reduced to the former dukedom Hessen-Darmstadt. Prussia, on the other hand, was one of the global winners; and with regard to Westphalia, it now obtained all the Westphalian territories – much more than the status quo of 1803. By now, Prussia consisted of nine provinces and faced in particular the problem of establishing a common state

¹ In other respects, they succeeded, however, in implanting lasting social and political reforms, for instance by the introduction of the *Code Napoleon*, as the legal code.
for Protestants and Catholics, who used to live hitherto in more or less mono-
religious states with decidedly different cultural and social systems. This problem
was particularly acute in Westphalia, which united numerous formerly independent
states of either catholic or protestant character. After the first reorganizations by
the Prussian government, there were eleven Gymnasien, which survived or were
upgraded from a minor status: five were catholic ones and six were protestant
ones. The five were the Gymnasien in Arnsberg, Coesfeld, Münster, Paderborn, and
Recklinghausen and the six were those in Bielefeld, Dortmund, Hamm, Herford,
Minden, and Soest.

The constellation for the by now inevitable and urgent educational reforms in
Westphalia was rather unique. As is well known, as a consequence of its
catastrophic defeat in 1806, Prussia had thereafter undertaken a profound overhaul
of its entire political, social and educational structures – at first in the territories
that remained Prussian after Napoleon’s dictate of a peace treaty. Famous are the
decisive reductions of feudel structures, and the educational reforms, linked to
the name of Wilhelm von Humboldt who directed the key period of these reforms in
1809/10. The conceptually – and practically – most difficult issue of these reforms
was the dialectic between the centrality of government policy and the initiatives
and implementation at the basis. In fact, the key conception of all these reforms
was Selbстtätigkeit – one’s own activity: on the one hand, the reforms should not
just be decreed from above, they should be embraced and enacted by proper
initiatives and activities by the citizens themselves. On the other hand, there
should be a convergence between local and central intentions – actually, not at all
trivial to be achieved!

The reform conceptions as conceived of at the top for the educational system
as a whole and for mathematics in particular were in fact quite revolutionary.
Regarding the curriculum of the Gymnasien, it should realize the neo-humanist view
of Allgemeinbildung, of general education, i.e., to incite and develop all the
intellectual capacities – before training them for definite professions. Therefore,
three major teaching subject areas should constitute the core of instruction in each
grade: classical languages, history and geography, mathematics and the sciences. To
realize this, each Gymnasium should have at least two teachers for each of these
subjects: an Oberlehrer and an Unterlehrer – for the upper and for the lower grades.
Correspondingly, the Philosophical Faculties of the universities were restructured
to provide the scientific training of these teachers.

Regarding the curriculum, experts elaborated a comprehensive and coherent
program in 1810, operationalizing this concept of neohumanist Allgemeinbildung,
which was integrated as so-called Süvern-Lehrplan into the projected law for the
reformed school system. Johann Wilhelm Süvern was the responsible official in the
ministry for the projected law; the part for mathematics was elaborated by Johann
Georg Tralles (1763-1822), member of the Berlin Academy and first professor of
mathematics at the newly established Berlin University. The projected law was
never enacted, due to conservative resistance within the government. The part
about the Gymnasien became therefore communicated by the ministry to the regional authorities as a “guiding principle” in 1815 (Schubring, 1991, p. 45).

The program for mathematics was absolutely novel and ambitious: Planned for the six grades of the Gymnasium, covering nine years of secondary schooling and for six weekly hours in each grade, its rationale was an algebraic vision of mathematics. Sure, there was extended instruction in geometry, beginning with elementary constructions. It proceeded to angular functions and ended with analytical geometry in two and three dimensions and especially with conic sections. Geometry was complemented by an even more extended program in arithmetic and in algebra: the four basic operations were immediately followed by the reflection of the decimal system and the introduction of decimal fractions. This was followed by the generalization to non-decimal number systems. The programme continued with elements of algebra, theory of equations – from the first degree up to the fourth; binomial theorem, logarithms, combinatorial theory; and developed over the last four years the elements of the differential and integral calculus: elements of the theory of series, arithmetical series, the Taylor theorem and developments into series; eventually, probability and applied mathematics (ibid., p. 44).

**Beginning reforms in the Westphalian Gymnasia**

Compared with these ambitious curricula and with the endowments necessary for such well organized and well paid staffs of teachers, the state of the schools in Westphalia was, in general, terribly poor. It needed enormous investments for the governments to establish better and larger buildings, to increase salaries and create new positions for teachers and eventually, to achieve curricular reforms. With regard to mathematics, by 1815, only one protestant Gymnasium provided regular and extended mathematics teaching (Dortmund) and had a teacher for this instruction; for the catholic Gymnasia there were two (Münster, Paderborn).

To understand school policy in Prussia, it needs to be emphasized that there were three levels of administration and responsibility: the central one with the ministry of education (“Kultusministerium”) in Berlin, the provincial one with the Provinzialschulkollegium in the capital of each province and there as key acting person(s) one or two Provinzialshulrat (provincial school administrator), and the local one: on the one hand the directorship of the Gymnasium and on the other hand the municipality since a considerable part of the Gymnasia were not state-owned, but run by the municipality.

Right at the beginning of the concrete process of reforming the Westphalian Gymnasia, the 6 November 1817, the Berlin ministry communicated the Süvern-Plan to the regional authorities in Münster. The Süvern-Plan should serve as a guideline for establishing the new system of secondary education in the province of Westphalia (Schubring, 1991, p. 54 and p. 227).

In general, one can remark that there existed an overall consensus at all the levels of administration and policy – central, regional, and local – with regard to
the high rank of mathematics as one of the three major components of secondary schooling. The key prerequisite for implementing this decidedly novel role of mathematics was hence fulfilled. Nowhere in Westphalia within these first decades did a resistance show up against mathematics.

Since the regional level was the one, which had to mediate between initiatives and conceptions at the level of the ministry and possible resistance at the local level, it was quite decisive how the persons there would handle the matters of reforming and consolidating. From 1818 on, the ministry called persons from outside to act as Provinzialschulrat. The first one is well known as an educator: Friedrich Kohlrausch. It was his task to urge everywhere for increasing the budgets – the municipalities as well as the ministry – and to care for complete staffs of teachers, including the mathematics teachers.

It was he who had the idea to inaugurate a means, which should prove to constitute an excellent procedure for reducing the enormous heterogeneity among the Westphalian Gymnasia and achieving a common understanding and a more homogeneous functioning of these schools: the Direktoren-Konferenzen – the meetings of the directors of the Gymnasia. At these meetings, all issues of common interest for the schools were discussed and one tried, moderated by the Schulrat, to achieve a consensus. Particularly productive were the discussions about the teaching of the various subjects – this the more as there existed no common syllabus, due on the one hand to the missing general instruction and law and on the other hand to the conception of Selbsttätigkeit; thus, each Gymnasium defined its own syllabus; its control by the Provinzialstulkollegium was not too strict. The first such meeting took place in 1823 and became a regular meeting, to be held every two or three years. They proved to be such a productive means for the inner reform of schools that they were soon also copied by the other Prussian provinces.

In 1830, Kohlrausch, who had changed to the Kingdom of Hanover, was replaced by the protestant Christian Friedrich Wagner (1782-1863). Actually, Wagner was an extraordinary personality. He was not only an experienced mathematics teacher, he was also a first exponent of the neo-humanist program. Originating from West-Prussia, he had studied at Königsberg University and acted as a teacher at renowned schools. In 1810, he was the first to be examined according to the new neo-humanist regulations and it was Wilhelm von Humboldt himself who approved the result and his call to the position of Oberlehrer for mathematics in Gumbinnen in East-Prussia. In 1815, he published a paper on the classical issue of curvilinear angles. In 1816, Wagner changed to the position of Schulrat within the regional government of Gumbinnen (Schubring, 2009).

Since the financial basis of the Westphalian Gymnasia and their equipment with adequately paid teacher positions was decidedly improved by then, Wagner concentrated on inner reform. While Kohlrausch had restricted visitations of schools to the occasion of particular inaugurations, Wagner made visitations to a regular practice more or less each year. And his particular focus during his visitation of each Gymnasium was on the mathematics lessons and his talks with
the mathematics teachers. The advice for content and method of teaching he gave in these discussions and in his reports shows him as a moderately modern practitioner.

Remarkable is his focus on pedagogical methodology, on the application of modern developments in the wake of Pestalozzi; regarding contents, he was in favour of spherical trigonometry and conic sections – the two topics later on excluded by the ministry considered to be no more subjects of school mathematics -, but there were never signs that he accepted more algebraic or even analytic topics.

The two competing programs and the controversies in the Westphalian Gymnasia

What makes Westphalia to a particularly telling case for the process of implementation of the neo-humanist reforms was an unprecedented action prepared by Wagner in 1833. That same year, in the province of Saxony, an anti-mathematical movement had exploded for the first time. That province, established in 1815 by the incorporation of territories of the Kingdom of Saxony, an earlier ally of Napoleon, still knew strong defenders of the earlier exclusively classical curriculum of the royal Saxon elite schools. The 1833 meeting of the Saxon directors turned into a rebellion against the neo-humanist role of mathematics. The Saxon Provinzialschulrat, J. A. Matthias (1761-1837), himself a devoted mathematics teacher and author of influential textbooks, but somewhat impeded by his age, had problems to withstand this rebellion (Schubring, 2001).

Wagner had therefore the idea to consolidate the state of mathematics teaching already achieved in Westphalia by elaborating a common syllabus for the Gymnasia. This does not seem to be extraordinary; in fact, the point was another one: he asked two mathematics teachers whom he assumed to represent different visions of good mathematics instruction to elaborate each one a proper Lehrplan. Having received the two proposals, which were in fact quite antagonistic, Wagner submitted both texts to the staff of the eleven Gymnasia, asking for a common deliberation of the respective advantages and disadvantages. Historically, it is – to my knowledge – absolutely unique not only to have two competing programs but also to have them discussed in all schools concerned! And, even more unique, the discussion was not restricted to the mathematics teachers and/or the directors, but comprised, in general, the entire staff. All these discussions are well documented and extant, as well as the subsequent final discussions in the Direktoren-Versammlung of June 1834.

The actors of 1834

The two protagonists were Adolph Tellkampf (1798-1869) and Ludwig Erhard Suffrian (1805-1876); actually, both were protestant. Tellkampf, originating from Hanover, had begun a military career very early, during the anti-Napoleonic wars, but had then studied mathematics at one of the best universities, Göttingen, and achieved there not only the doctoral degree, but also the degree of Privatdozent so
that an academic career seemed to be open to him. Severe health problems forced
him, however, to resign and he was happy, after recovering, to obtain the position
of mathematics teacher at a Prussian Gymnasium, in Hamm in 1824. Before, he
had not been a productive mathematician, being a disciple of Bernhard Friedrich
Thibaut (1775-1832), a practitioner of rather traditional mathematics. Yet,
regarding school mathematics, Tellkampf favoured modern branches of
mathematics like descriptive geometry and analytic geometry. His textbook
_Vorschule der Mathematik_, published since 1829 in various editions, included the
concept of functions and analysis in the sense of the theory of series. Although not
adhering entirely to the program of the Süvern-Plan, he preferred its algebraic
vision. Not prepared for the teacher’s profession, Tellkampf became a successful
teacher. In 1835, Tellkampf returned to Hanover where he became the director of
a newly created realist secondary school and a major spokesman of German
mathematics teachers.

Suffrian represented the opposite pole. Born in Minden, he soon moved to the
Prussian province of Saxony. He ended secondary schooling in Halle and studied
mathematics and theology there. His favourite subject was astronomy, it was also
the subject of his doctoral dissertation. Being a teacher for mathematics and
natural sciences from 1825 on, still in the same province, he favoured elementary
synthetic geometry and especially mathematics with a flavour of classical antiquity.
In 1833, he changed from Saxony to Dortmund where the director was a
philologist ardently admiring that classical antiquity. Somewhat parallel to
Tellkampf, Suffrian became director of a realist school in Siegen, in 1836, and in
1848 director of the Gymnasium in Minden and, eventually, in 1850, successor of
Wagner in Münster.

And who were the other mathematics teachers, active in 1834? A
prosopographical analysis shows as a common characteristic that the great majority
were young, born between 1800 and 1806 and hence educated according to neo-
humanist principles. But otherwise one has to differentiate between catholic and
protestant teachers. All the catholic ones originated from Westphalia and returned
there after having studied. The two elders were clerics and had not studied at all or
had not studied mathematics. The younger ones had studied almost all in Bonn, at
the university created in 1818. And for them, a revealing contradiction became
characteristic: although this university represented, together with that in Berlin, the
new neo-humanist conception, the ministry had not been able to find for it a
modern mathematician and had called Wilhelm Adolph Diesterweg (1782-1835) as
professor of mathematics. Diesterweg, a former teacher, was not a productive
mathematician; he cultivated ancient Greek mathematics according to the
standards of classical philology, in particular reconstructing and editing
Apollonius’s work on conic sections.

The younger protestant teachers all came from outside Westphalia and had
studied at various Prussian universities so that they followed different visions of
school mathematics and were not as homogeneous as their catholic colleagues.
A prosopographical study of the directors shows similar patterns. All the catholic directors originated from Westphalia; the three elder ones were clerics – only one of them had studied at a university. The two younger ones had studied according to the neo-humanist visions and had an active own interest in the natural sciences. Among the protestant directors, only one had been educated in Westphalia. The two elders had studied encyclopaedically and were both active as mathematics teachers, too. The four younger ones were specialized in philology, but showed no hostility or indifference regarding mathematics.

The protestant regions in Westphalia had not cultivated enough mathematics in the pre-reform-period to already provide “home-grown” mathematics teachers. While only one teacher – Tellkampf – had studied mathematics sufficiently to follow its modern developments, the overwhelming majority is characterized by a rather traditional view of mathematics, by an attachment to elementary mathematics. This had the precious advantage however, to be well integrated into a common understanding and discourse with the colleagues of other disciplines in the staff of their Gymnasium.

The differences in the two syllabi

There were two key issues, which determined the emphasis of the two documents and of the ensuing debates: the Bildungswert – educational value – of mathematics instruction and the relation between arithmetic/algebra and geometry within school mathematics.

According to the classical educational discourse, the Bildungswert of a school discipline had to be legitimated and specified between two poles: the material and the formal one – i.e., a utilitarian function and its capacities to contribute to the formation of logical thinking.

Suffrian’s plan strictly separated an exclusively material value in the two lower grades – Sexta and Quinta -, focussing on practical abilities in reckoning, and formal value in the middle and upper grades. Opposing strictly geometry and arithmetic/algebra, he ascribed geometry the decisive educational importance. Mathematics teaching in the middle grades should begin with geometry, based on a modern adaptation of Euclid, and form the student “to a capable geometer in the manner of the Ancients”. All interference with arithmetic and the notion of number quantities should be postponed as long as possible and in any case take place only in the upper grades. There, he admitted the binomial theorem, logarithms, series and applications of algebra to geometry to be taught – and even to complete the hitherto exclusively synthetic geometry by “geometry according to the methodology of the moderns”, i.e. the use of analytic methods for conic sections. The neatest expression of Suffrian’s views should at the same time constitute the climax of mathematics instruction: in the upper grades, to read Euclid in the Greek original!

Tellkampf, on the other hand, differentiated between the Bildungswert of arithmetic and geometry, too, but not as extremely as Suffrian. For him, arithmetic constituted but seldom the source for immediate insight, whereas geometry
allowed intuitive access, since the object of consideration lies in the consciousness of the student. As an educational means, geometry outweighs arithmetic. In a certain sense, this claim of superiority for geometry remained restricted to educational rhetoric – the details of his syllabus show a well-balanced programme. The two lower grades were not as sharply separated from the following ones: instruction there should prepare the later “strictly scientific teaching” by understanding the basic concepts of arithmetic and by sensual intuition of spatial forms. Prime numbers and proportions were included here. Arithmetic and algebra constituted a considerable part of the “scientific” instruction in the middle and upper grades. In conformity with the Süvern-Plan, non-decimal number systems should be studied: to make the principles of the usual decimal system fully conscious. Topics here included the binomial theorem, the combinatorial theory, the elements of higher number theory and the solution of indeterminate equations. Contrary to his textbook, the notion of function should not be treated (except for the trigonometric functions – but within geometry); likewise, he criticized the introduction of the calculus as practiced by some mathematics teachers in other provinces: it should be taught at universities Regarding geometry, plane and spherical trigonometry were evident as well as conic sections, treated synthetically and analytically. New was his proposal to adapt Carnot’s géométrie de position.

Both plans, each one comprising in the original print twelve large pages in a small font, are – to my knowledge - the earliest detailed syllabi for mathematics instruction at secondary schools. Both consist of a general part with methodological reflections and recommendations and a special part with extensive presentation of the concepts to be taught in each case and indication how to link these concepts to have a linear, ascending sequence.

**The debates in the eleven Gymnasia**

The two controversial concepts instigated intense debates within the staffs of the eleven schools. The general focus was again on the Bildungswert and on the relation between arithmetic and geometry. Moreover, the mathematics teachers contributed extensively to the especially didactic issues of sequencing the various concepts and their suitability. None controversy or divergence about the place and legitimacy of mathematics instruction showed up, however; the general atmosphere was entirely non-controversial.

Suffrian’s radical separation of the instruction in the lower grades from the higher ones and its restriction to utilitarian practicing of the four operations was almost generally rejected. Also in these grades, instruction should have a “formal” component. And several schools - remarkably, largely catholic ones – also argued for teaching geometry in the lower grades.

Likewise, Suffrian’s radicalism in almost excluding arithmetic and algebra from being taught and reducing mathematics rather to geometry remained isolated. Teachers and directors argued for a more balanced relation between these two key branches. Likewise, the proposal to read Euclid in Greek was almost everywhere rejected – with but two exceptions: characteristically in schools, where there were
no ambitions to include advanced topics into the syllabus. The general consensus was to attribute the superior educational value to geometry – due to its alleged predominant function to exercise the mind and to form logical thinking.

Besides these general discussions, considerable extension was given to debates whether the sequencing of topics proposed by the two authors did meet the exigencies for learning as conceived of by the individual teacher and the specific situation at the respective school which continued to be highly differentiated. Actually, no two teachers agreed about these questions of teaching practice! One such issue, for instance, was: should plane trigonometry be taught before stereometry or after it and which of them in Sekunda or in Primä? An issue of common concern was, however, whether two topics could remain to be admitted within school mathematics: spherical trigonometry and conic sections. On the one hand, all teachers agreed that these topics, which were standard hitherto and which were esteemed as highly important, should be maintained; on the other hand, they were conscious that they did not appear in the list of topics for the final exam, the Abitur. Due to the missing general curriculum, these regulations for the Abitur of 1812 served, in a rather vaguely defined way, as a substitute. There was just one school where the teachers boldly demanded to extend instruction as far as the elements of the calculus: remarkably enough, it was the Münster Gymnasium, the school in Westphalia with the longest experience in a comprehensive mathematical curriculum.

*The meeting of the directors*

The meeting of the directors at the end of June 1834 had been well prepared by Wagner. Two of the directors had been charged as reporter and as co-reporter and had studied all the documents and reports from the schools. After their reports, there was an extended and careful discussion, which is also well documented, and this final discussion occurred in a sympathetic atmosphere, without any divergence about fundamental issues.

The discussion brought no new arguments, but confirmed the consensus which had emerged in the debates within the eleven Gymnasia: instruction in the lower grades should prepare for the later more scientific character of mathematics teaching. Geometry should predominate due to its formative character; its instruction should begin in Quarta, the first of the middle grades – one year earlier than arithmetic/algebra. All the details of the discussion about sequencing, methodology etc. were declared to be not capable of a decision from above – thanks to the neo-humanist principle of autonomy of the scientifically trained teacher, such decisions belonged to the realm of his autonomy.

There was one decision, however, which meant a disappointment for the mathematics teachers. Contrary to the opinion expressed almost unanimously, the directors judged spherical trigonometry and conic sections as being not legitimated by the regulations for the Abitur and voted therefore to admit to teach these topics only in the case of a particularly capable class. However, this restriction created no conflicts between directors and mathematics teachers, since a central decree by the
ministry of December 1834 formally excluded these two topics from school mathematics in Prussia (Schubring, 1991, p. 64).

**Aftermath and conclusions**

Westphalia proves to be the case of a successful implementation of mathematics as a new major teaching subject in the reformed Gymnasia. On the one hand, in this period, the neo-humanist conception of general education based on three pillars, one of them being mathematics, met a general consensus in society. On the other hand, its practice had been effectively prepared by the Fürstenberg reforms in the clerical state of Münster.

Contrary to the general thesis by Max Weber about the role of Protestantism, it was the catholic territories that ensured the successful implementation. In the protestant territories, the state of the Gymnasia before 1815 had been too poor to develop a solid basis. This confirms the importance of developments de “long durée” – of long-term.

The curricular development confirms this pattern of long-term-structures: the conception of the arithmetic/algebraic part of the teaching contents which persisted corresponds neatly to what is known since Newton as *Universal Arithmetica*.

Furthermore, one has to state that Prussia presented in the period after 1815 – a period, in Europe generally characterized by conservative restoration, by drawbacks, even by returns to almost Jesuit school structures – one of the rare states where the impetus of inner, social and cultural reforms was maintained. This peculiarity of Prussia has been called its policy of a revolution from above, which prepared Prussia’s later economic and political power.

One has to be aware that the exclusion of conic sections was the price to be paid for the non-conflict-laden integration of mathematics into the conception of general education and its realization in the structure of the Prussian Gymnasium, which prepared students for the universities. It was to a considerable degree due to the elementary, non-specialized character of the syllabus and its allusions to notions familiar to a classically minded and educated social elite that the consensus, which proved to be so operative in the case of Westphalia, had been able to emerge and to be maintained for a considerable period.

**References**


