Research workshop
Teaching mathematics in the early modern world

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All Souls College, Oxford

ABSTRACTS

Maria Avxentevskaya

The Mathematical Pygmalion: Teaching Mathematics as a Liberal Art

In 1648, John Wilkins's *Mathematicall Magick* quoted Peter Ramus as saying that Germany is eminent for inventions in 'mixed mathematics' thanks to public lectures in the vernacular. Ramus as a reformer of mathematical education and Wilkins as a popularizer of mathematical learning shared views on how to teach mathematical arts. Wilkins's scientific narratives, primarily *Mathematical Magick* and *Vindiciae Academiarum* (1654) co-authored with Seth Ward, elaborated on rhetorical techniques of transmitting the performative knowing-how of mathematical operations. Wilkins combined historical accounts of the wondrous power of mathematical knowledge with visualizations of geometrical proofs, crafting a storyline that established a realm of articulated mathematical experience. Summarizing the scattered understandings of 'mixed mathematics,' he introduced a legitimate account of a noble mathematical art in the vernacular. *Mathematicall Magick*, as well as similar efforts by John Pell and John Wallis, brought the "fair lady" of mixed mathematics into the genteel milieu of educated communication, by improving her tone, verbal language, and socializing skills. The positioning of 'mixed mathematics' among the liberal arts also promoted application of the methods of other liberal arts in mathematics, such as combinatorics, modelling, visualizations of operations, and suggestions for new mathematical signs. The elevated social standing of mathematical knowledge supported the values of ingenuousness and ingenuity in learning and practicing mathematics. My paper will trace the early modern tendency for liberalizing mathematical arts, from Ramist influences to implementations in the Royal Society's agenda, considering how the increased social visibility of mathematics may have contributed to its remarkable progress.

Angela Axworthy

Oronce Fine's project for the revival of mathematics in sixteenth-century Paris

This paper will offer a synthetic outline of the conceptions on mathematics and of the mathematical teaching of Oronce Fine (1494–1555), first Royal Lecturer in mathematics. Its general aim is to display the epistemological discourse and the pedagogical project that underlay the institutional transition from the mathematical curriculum of the Parisian Faculty of the Arts to the constitution of a mathematical teaching independent of the University, in the framework of the institution of the Royal Lecturers, founded by François I^{er} in 1530.

As first Royal Lecturer in mathematics, Fine's primary role was to offer a teaching of mathematics proper to set forth the unity, autonomy and importance of mathematics and to change the rather negative image attributed to these disciplines in the framework of the university in view of the abstract nature of arithmetic and geometry and of their apparent lack of connection with more valued domains of knowledge, such as natural philosophy and theology. In order to reawaken the interest of French humanists and students, Fine worked to develop a mathematical program that would openly reveal the practical, as well as speculative orientations of mathematics. He also repeatedly argued, in the prefaces of his numerous treatises, in favour of the importance of developing the teaching of mathematics.

After presenting the significance of Fine's contribution to the revival of mathematics in sixteenth-century France, we will give here a brief summary of his conception of mathematics and of his teaching program, such as represented by the Protomathesis (1532).

Stefano Gulizia

A 1509 List of Euclid Aficionados: Antiquarianism and Early Science in Sixteenth-Century Venice

This paper examines one aspect of information management—the chapter use of specialized list and diagrams—in early sixteenth-century Venice, at the time when the Republic is launching a great hydraulic project of farmland reclamation. The mathematicians and engineers associated with this program become increasingly aware of their technical know-how vis-à-vis the humanistic culture of their patrician employers; in a way, mathematical life emerges here as an intellectual gear system, or as part of an organic 'territorial machine' of reconnaissance and defence. My point of departure is a 1509 printed edition of Euclid, edited by Luca Pacioli, which contains an extraordinary and virtually unstudied document: the text of Pacioli's own public lecture on mathematics that breaks off the treatise and offers a list of various personalities in attendance (30^{r}–31^{v}). As I propose, this list is a window into the intellectual friction provoked by the Venetian plans of urban renovation, while, in its alphabetical unfolding, it also serves as a paratextual aid, similar to Gessner's edition of the Historia Animalium.

The first part of my paper looks at the 1509 list as a problem of information overload, while a second section explores at greater length some of the characteristics associated with the Venetian personalities present at the Euclid lecture. In particular, I expand the role of a) Vettor Fausto, a naval architect who translated Aristotle's Mechanics, b) Fra Giocondo, another architect identified as "antiquarian," and c) Cristoforo Sabbadino, whose sophisticated scientific expertise bridges humanism and agricultural reclamation.

Mordechai Feingold

Teaching and learning mathematics in the early modern English universities

In theory, mathematics was an integral part of the Oxford and Cambridge curriculum during the early modern period. But whether the generality of students and tutors actually adhered to such a requirement remains to be determined. My paper will attempt to offer a fresh look at the place of mathematics within the distinctly humanistic character of the course of study, and reflect on what was taught, to whom, and how.

Boris Jardine

The Life Mathematick: John Speidell, his son Euclid, and the Teaching of Practical Geometry, 1605–1702

In this paper I examine what it meant to be a 'mathematical practitioner' in the seventeenth century, and the role that instruments played in that practice. John Speidell (1577–1649) was one of the pre-eminent teachers of mathematics in London in the first half of the seventeenth century, and was author of an important early work on logarithms, as well as various elementary mathematical works. His son Euclid was also a mathematical practitioner, though of a rather less studious sort and, perhaps because of this, now a somewhat obscure figure. A newly discovered manuscript at the Lincolnshire Archives sheds light on both father and son. Its title is 'The Life of John Speidell late London Professor of the Mathematics and of his Son Euclid to his Age of 58', and the contents reveal the difficulties of living by mathematics in a tumultuous century. In addition to presenting the manuscript and putting flesh on the bones of Speidell Senior and Speidell Junior, in this paper I argue that instruments were not just an adjunct of mathematical teaching but were central to its development in the seventeenth century.

Matthew Landrus
Teaching practical men geometry and mathematics around 1500

Although there was an increasing number of books around 1500 that indirectly or directly assessed geometry and arithmetic, the means by which these disciplines were useful in the visual arts and engineering is difficult to prove. Written lessons of systematic sciences would not contribute in obvious ways to the systematic uses of those lessons for projects in the visual or mechanical arts. For example, evidence of the use of Euclidian geometry in machine design at this time is not well documented, though there is an example of this in Leonardo da Vinci's 'Giant Crossbow' project. Evidence of musical proportions in his 'Last Supper' is generally agreed upon today, though proof of this is complicated. Leonardo's teachers for both projects were, respectively, Fazio Cardano and Franchino Gaffurio. Nonetheless, the use of Pythagorean theories in the visual arts at this time cannot be proven. There was however an increase in the ways in which 'mechanical artificers' – as Egnazio Danti would call them in the late sixteenth century – used mathematical and proportion theories for visual and mechanical projects. Moreover, these 'practical men' were influenced by trends in humanistic discourses that valued engagements between moral philosophy and the practical arts. My discussion will address methods of studying and teaching mathematics around 1500, focusing on artist/engineers and the court of Ludovico Sforza.

Snezana Lawrence
London Drawing Schools in the Long Eighteenth Century

This talk will examine the practice of establishing geometry and drawing schools in London throughout the eighteenth and the beginning of the nineteenth century. They were eventually succeeded by Mechanics' Institutes and the new universities (ones in London founded in the 1820s), but in the eighteenth century these places were organised often by single teachers, who often published works for their students. This practice, and their mathematics, mostly geometry manuals, will be the main focus of this talk. These schools taught basic mathematics, especially geometry, to working men, artisans, and aspiring architectural draftsmen, and offered a curriculum which often included allusions to the origins and a version of history of geometry. I will in particular look at the work of Batty Langley (1696–1751) and his publications on mathematical topics that he believed would be useful for his students.

Yelda Nasifoglu
Cultivating the 'mathematique braine' at the English Catholic College in Rome

Will Poole
Foundation and growth of the Savilian Library from Henry Savile to John Wallis

This paper will survey the development of the Savilian Library, one of the earliest academic libraries devoted to mathematical and astronomical books and manuscripts. The Savilian collection was augmented by several early professors, notably Christopher Wren and John Wallis, and also acted as a repository for unpublished works and important annotated copies of printed books. I shall detail the surviving records of its development over, roughly, its first century.

Philip Sanders

Johannes Scheubel (1494–1570) and the teaching of the regular polyhedra at the University of Tübingen

In 1533, the Greek *editio princeps* of Proclus's *Commentary on the first book of Euclid's Elements* was published by Simon Grynaeus. Proclus stated here that Euclid "thought the goal of the *Elements* as a whole to be the construction of the so-called Platonic figures"; indeed, the thirteenth, and final book of the (genuine) *Elements* concludes with their construction.

During 1534 and 1535, Grynaeus spent some months at the University of Tübingen, and perhaps enthused Johannes Scheubel to study Proclus's text – Scheubel was then a mature student at Tübingen, becoming a professor of mathematics there in 1543. Scheubel seems to have been the first to specifically cite Proclus's statement, quoting from Grynaeus's volume in his own edition of the first six books of the *Elements* (1550).

Proclus's statement was widely accepted as valid, by Scheubel and his contemporaries (though not by Ramus). It gave Scheubel good reason to promote the study of the polyhedra – outside the lecture room if not inside (where the formal study of the *Elements* did not extend to the final books). In this paper I discuss Scheubel's gift of a set of wooden polyhedra to the University of Tübingen, and argue that he encouraged his students to study them – including David Chytraeus (1530–1600), later a prominent teacher, historian and theologian; and Stephan Neudörffer, portrayed studying a dodecahedron with his mathematician father, Johann Neudörffer, in a twin portrait by Nicolaus Neufchatel, of 1561.

Ivan Tafteberg Jakobsen

Mathematics Education in the Danish eighteenth-century Navy

Theory of navigation was a high-tech subject in the eighteenth century, and mathematics played an important role.

The Danish Navy had a formal education of cadets from the beginning of the century. It is possible to get some insight into this education by consulting textbooks, the cadets' handwritten books and personal letters, memoirs and diaries. This has been done in the past, most recently by Jakob Seerup (the National Museum of Denmark). Based on the published results of this research I intend to present some aspects of the mathematical part of the education.

The mathematical education contains elements of basic arithmetic and geometry as presented in a contemporary textbook for schools, and it contains the requisites needed for the mastering of celestial navigation, but not necessarily with proofs of the theorems. The books that the cadets wrote in their own hand while being students at the Soekadetakademi (the Royal Navy School) give insight into this. Furthermore Jakob Seerup has transcribed and published at the web a lifelong diary of one of the officers (Peter Schioenning, 1732–1813), from where unique information about the teaching and the order of the subjects can be gleaned, and this will be presented together with some examples from the textbooks.

Interesting aspects are the drilling of skills in solving problems by copying other students' solutions, the use of "technical" aids like the Gunter-scale, and the very thorough oral examinations.

Benjamin Wardhaugh

Defacing Euclid: studying and annotating geometry in Britain, c. 1650–1750

This paper will examine the evidence provided by the printed geometry books that survive from early modern Britain, including editions Euclid's *Elements of Geometry* and other popular texts. It will consider what we can learn from provenance information, readers' annotations, and other marks about how these books were used.

Large numbers of geometry books survive from early modern Britain, and a high proportion of them bear readers' marks including ownership inscriptions, corrections of errors, and detailed responses intended to re-structure or re-interpret the printed text. Many also bear marks made unintentionally, providing further evidence about the environments in which they were used and the types of engagement they received from readers. In many cases we also have information about the identities of individual or institutional owners of the books. Together this enables us to build up a rich picture of the trajectories of individual books and the diverse ways in which certain texts and certain types of writing were engaged with.

I will suggest that mathematical and geometrical 'reading' was a distinctive practice, done with pen in hand and involving a characteristically aggressive attitude towards textual correctness and coherence. Studying and learning geometry involved elements of private rehearsal and semi-public performance, and the margins of printed texts were employed in distinctive ways to facilitate these practices. I will conclude with some reflections on how these observations can be related to the longer-term history of British mathematics.