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The Jesuit *Ratio Studiorum*, Christopher Clavius, and the Study of Mathematical Sciences in Universities

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Argument

In this paper, I examine the treatment of mathematics in the definitive 1599 *Ratio Studiorum* of the Jesuit Order and in the preliminary drafts of the *Ratio* that were done in 1586 and 1591. Drawing on some additional writings of the Jesuit mathematician Christopher Clavius and his view of the importance of mathematics in a university curriculum, I suggest that the inclusion of mathematics as a standard part of the curriculum in Jesuit schools at the beginning of the "scientific revolution" was of significant importance in a climate that often demeaned the work of mathematicians. Jesuit schools were being founded around the time of Galileo and other key figures who influenced the scientific revolution. The introduction of mathematical sciences into universities and the textbooks of Clavius laid the groundwork for generations of students to become better acquainted with mathematics and the sciences that were being developed during that period of history.

Historical Overview

The Society of Jesus, commonly called the Jesuits, was founded by Ignatius of Loyola (1491–1556) and approved by Pope Paul III in 1540 as a religious order within the Catholic Church. During its 460-year history the Society has been noted especially for its educational institutions. The historical documents that follow are related to the role of mathematics in these institutions and this introduction provides the context to help the reader understand and evaluate them.

Ignatius of Loyola left the Society of Jesus two foundational documents: the *Spiritual Exercises* and the *Constitutions of the Society of Jesus*.[1]

After Ignatius' death in 1556, it was felt that these foundational documents needed commentaries to provide additional guidance. In fact, Part IV of the *Constitutions*

[1] Both documents express the saint's thoughts about human beings and their relationship to God and to other people, but each in a distinctively different way. The *Spiritual Exercises* focuses on an *individual* and his or her personal relationship with God and others and offers guidelines for individuals desiring to spend a prolonged period in prayer. In contrast, the *Constitutions* focuses on a *group* – the Society of Jesus – and its members, but also includes thoughts on the key Jesuit work: education, normally a *group* experience (cf. Schineller 1999).

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does refer to a more detailed "separate treatise" that would be written regarding schools (Part IV, Chapter 13, [455]).[2] This "separate treatise" eventually became the definitive *Ratio Studiorum* ("Plan of Studies") that was approved on January 8, 1599, 59 years after the papal approbation of the Society of Jesus and 43 years after Ignatius' death.[3] The 1599 *Ratio* had a tremendous impact on Jesuit efforts in education until the order was temporarily suppressed at the end of the eighteenth century.

In actuality, three different versions of a *Ratio Studiorum* were publicly issued by the Jesuit Curia: two preliminary drafts in 1586 and 1591, and the definitive version of 1599. There also exists a slightly revised version of the 1586 text that was never published.[4] The documentation that follows includes translations of the sections of all four drafts of the *Ratio* related to mathematics. Also included are translations of two key documents authored by Father Christopher Clavius, a Jesuit mathematician. This introduction attempts to address the influence of Clavius and to put all these documents into proper context.

It should also be noted that the 1599 *Ratio* appeared at a crucial time in the growth of Jesuit schools. In 1556, at the death of Ignatius, Jesuit schools numbered about 35. Forty years later, in 1596, they numbered around 245. Nineteen years later, in 1615, three years after the death of Clavius and 16 years after the promulgation of the *Ratio*, they numbered around 372 (cf. Harney 1941, 201).

Context of the *Ratio*

To appreciate fully the impact of the 1599 *Ratio* on the study of mathematics in universities, it is important to situate this document among the significant events in the history of science. About 55 years *before* the 1599 *Ratio* appeared, in 1543, Nicholas Copernicus published *De revolutionibus orbium coelestium* (On the Revolutions of the Heavenly Spheres); about 17 years *before* the *Ratio*, in 1582, Pope Gregory XIII ordered the shift to the Gregorian calendar based on the astronomical and mathematical work done by Clavius; about 35 years *after* the *Ratio*, in 1633, Galileo was condemned; and about 90 years *after*, in 1687, Sir Isaac Newton published his *Philosophiæ Naturalis Principia Mathematica* (Mathematical Principles of Natural Philosophy). Thus the definitive *Ratio* appeared about the same time as the *beginnings*

[2] The *Constitutions of the Society of Jesus* is published in several editions and in various languages. References are commonly made to the whole paragraph number indicated in square brackets rather than to specific pages in any particular edition.

[3] Later in 1599, on October 1, the definitive version of the *Directory* was also approved, a collection of directions that expanded on the guidelines found in the *Spiritual Exercises* to assist Jesuits in giving retreats. The *Ratio* may also be seen as a type of "directory" expanding on the relatively brief notes in the *Constitutions* about subjects to be taught and the pedagogical methods to be used in Jesuit universities.

[4] The second 1586 version was recently found in the Jesuit archives, cf. Homann 1999, 34. Neither of the 1586 documents were first drafts; both had had several predecessors, the best known of which was the *Ratio* of Francis Borgia, S. J., compiled between 1565 and 1572.

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of the scientific revolution, and so it is not surprising that the references to science that it contains may seem sparse to contemporary eyes.

Another major factor to consider is the lack of prestige given in the sixteenth century to mathematics and to scientific disciplines. At that time, a number of Italian philosophers, including some Jesuits, denied to pure mathematics the status of *scientia*, true scientific knowledge in Aristotle's sense, because it did not demonstrate its conclusions through causes and it dealt with abstractions in the intellect, rather than real objects (Dear 1995, 36–37; Homann 1999, 5; Lattis 1994, 33; Wallace 1984, 136). Thus, many did not consider mathematics to be worthy of study in a university. Mathematics was presented via the subjects of the *quadrivium*, namely arithmetic, geometry, music (taught as applied arithmetic), and astronomy (taught as applied geometry), and also, in some degree, via logic (one subject of the *trivium*). But, at that time, the *trivium* and *quadrivium* were considered preparatory arts learned before one studied philosophy and then pursued the higher disciplines of theology, medicine, or law, which were usually the only accepted professional disciplines for university study, particularly in Italy (Homann 1999, 81; cf. Dear 1995, 35). The arts and humanities were only beginning to make their way into the universities, to be followed by the sciences as we think of them today. We should also note that the "mathematical sciences" in the sixteenth century included applied topics now considered separately as part of astronomy, physics, and engineering.[5]

Evidence of the hostility toward mathematics in that era is provided in the 1591 draft of the *Ratio*, which includes a curious admonition, probably inspired by Clavius, directed toward university administrators to make sure that philosophy teachers do not disparage the dignity of mathematics. This rule concludes with the astute observation, "for it often happens, that the less one knows about such things, the more he disparages them."[6]

The Vision of Christopher Clavius, S. J. and his Impact on the *Ratio*

Christopher Clavius, S. J. was professor of mathematics at the Jesuit-run Roman College (now known as the Gregorian University) for about 45 years, from 1565 until his death in 1612. Born in Bamberg in Germany in 1538, Clavius joined the

[5] See the introduction by Edward C. Phillips, S. J. to the translations of Documents 34 and 35 (of Clavius): "For a better understanding of some portions of these documents, it should be remembered that at that period 'Mathematics' was a term including astronomy and much of what would now be taught in physics." Also, cf. Homann 1999, 81: ". . . mathematics courses comprised not only arithmetic, geometry, and algebra, but also diverse use of mensuration and calculus in astronomy and astrology, computation of time (calendar and sundial), surveying, theory of music, optics (perspective), and mechanics."

[6] "*fit enim sæpe, ut qui minus ista novit, his magis detrahat.*" *Ratio Studiorum*, 1591, *Regulæ Præpositi Provincialis: de mathematicis*, n. 44; cf. Homann 1999, 79, n. 69.

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Jesuits in 1555 in Rome. Nine years later, in 1564, he was ordained a priest while studying theology at the Roman College. Except for two years in 1596 and 1597 when he was in Naples and Spain, after his ordination Clavius spent his life teaching in Rome. Clavius appreciated the value of mathematics and did not feel himself bound by the Aristotelian categories that gave it a relatively low place in the hierarchy of academic disciplines. On the contrary, Clavius wrote: "Since . . . the mathematical disciplines in fact require, delight in, and honor truth . . . there can be no doubt that they must be conceded the first place among all the other sciences."[7] This predates the famous statement of Carl Friedrich Gauss (1777–1855) that "mathematics is the queen of the sciences" by about two centuries!

Although not officially a member of any commission involved with the *Ratio*,[8] Clavius' influence on the *Ratio*'s sections on mathematics cannot be denied. During the 1580s, Clavius authored two documents (whose translations follow), at least the first of which was probably read by the commission charged with composing the first, 1586 *Ratio* (Homann 1999, 61, 64). Similarities between the sentiments expressed in these documents and in the 1586 and 1591 draft *Rationes* along with the inclusion of Clavius by name in these drafts attest to their influence.

The first document, *Modus quo disciplinæ mathematicæ in scholis Societatis possint promoveri* (A Method of Promoting the Mathematical Disciplines in the Schools of the Society),[9] blamed philosophy instructors, in part, for the low opinion of mathematics held by many, since some "teach that mathematical sciences are not sciences."[10] Clavius bemoaned the poverty of mathematical interest and instruction, and argued that the lack of well-trained mathematics teachers and the absence of Jesuits studying mathematics harmed the Society (cf. Homann 1999, 61–64). The document also notes that without mathematics one cannot understand most physical phenomena, including astronomy, tides, comets, and rainbows.[11] Clavius' other brief note, *De re mathematica instructio* (On Teaching Mathematics),[12] dealt with problems concerning the faculty and the need to have well-trained, mature instructors (cf. Homann 1999, 63). Its sentiments are reflected in the 1586 *Ratio*, which prescribes at least two

[7] Dear 1995, 38, *In disciplinas mathematicas prolegomena*, in *Opera mathematica*, Vol 1, 5. "*Cum . . . disciplinæ Mathematicæ veritatem adeo expetant, adament, excolantque, . . . , quin eis primus locus inter alias scientias omnes sit concedendus*."

[8] In an article by Gabriel Codina, S. J., Clavius' name does not appear among the members of any commission charged with writing or revising various drafts of the *Ratio*. Cf. Codina 1999, 8–9.

[9] This is Document 34 in the 1901 *Monumenta Pædagogica S.I.* A translation is included in the documentation.

[10] Homann 1999, 61–62; Dear 1995, 35; Clavius, "A Method . . . ," (Doc. 34), Latin text, 473: "*præceptores philosophiæ . . . in quibus docent scientias mathematicas non esse scientias*."

[11] Homann 1999, 62; Clavius, "A Method . . . ," (Doc. 34), Latin text, 472: "*cum tamen apud peritos constet physicam sine illis recte percipi non posse, . . .*." Some of the thrust of this *apologia* for mathematics seems to have influenced the content of the 1586 *Ratio* if not the exact wording as well.

[12] This is Document 35 in the 1901 *Monumenta Pædagogica S.I.* A translation is included in the documentation.

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mathematics instructors at the Roman College, naming Clavius as a possibility for one of these positions.

The impact Clavius had on the 1586 *Ratio* cannot be overestimated. He was someone who had done significant scientific and mathematical work, his work in revising the Julian calendar being only one example. The details of the calendar computations are found in his treatise, *Novi calendarii Romani apologia* (A Defense of the New Roman Calendar), which appeared around 1590 and was more than 800 pages long. And he proclaimed the importance of mathematics in the face of an academic culture in Italy and professorial colleagues at the Roman College who apparently demeaned mathematics whenever possible. Clavius saw new uses for mathematics in ways that were only beginning to be discovered in the last decades of the sixteenth century. His daring proposals are now viewed as revolutionary. Clavius did not want partial remedies but a complete and complex strategy to effect a radical change in attitude and structures (Homann 1999, 64; Feldhay 1995, 221). He wanted to make sure that Jesuit schools, then beginning to be founded in various parts of Europe, would place proper emphasis on mathematics, by recruiting and training qualified instructors of mathematics as well as by requiring that mathematics be studied by all. The emphasis on mathematics came at a crucial time in Jesuit history because of the rapid growth in the number of Jesuit schools, as noted above.

Due to Clavius' prestige and influence, the 1586 *Ratio* included a lengthy *apologia* about mathematics and its connection to various disciplines and professions, including poetry, history, politics, metaphysics, theology, law, farming, and medicine. This draft of the *Ratio* required teachers of mathematics in *gymnasia* and two professors of mathematics at the Roman College. All students were required to study mathematics for at least a year and a half and an academy of eight to ten Jesuit students would be established to study specialized mathematics. The text also stated that the second professor, "who could only be Father Clavius" (1586 *Ratio*, On Mathematics, par. 3), would teach students in the special academy. After their studies, these young Jesuits would be able to travel to various countries and use their mathematical knowledge wherever they went (cf. Feldhay 1995, 221–22). Although this last comment may seem odd, we should note that the Jesuit mathematician Matteo Ricci had studied under Clavius in Rome about ten years earlier[13] and in 1586 was actually using his mathematical acumen to gain credibility in China, initially by translating two of Clavius' mathematical books into Chinese, thereby giving the Orient its first opportunity to enjoy Euclid. Thus, at the same time mathematics was demeaned by philosophers in Italy, mathematics and astronomical technology became the doorway by which Ricci was able to gain entry into the culture of China. Because of his scientific knowledge, greatly due to Clavius, Ricci ("Li Ma Tou" in Chinese) is one of the few Westerners regularly honored in China and his grave near Beijing is still a place of pilgrimage.

[13] Ricci studied at the Roman College from about 1572 until 1577.

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Some modern scholars view the 1586 *Ratio* as a radical document for raising mathematics to a level on a par with other university-level disciplines and for giving it a prominence unheard of in Italian universities (Feldhay 1995, 221–22; Dear 1995, 35). Unfortunately, the culture and the times of the sixteenth century were not appropriately receptive to this insight.

Changes between the 1586 *Ratio* and the 1599 *Ratio*

The advice contained in the 1586 first draft of the *Ratio* regarding both mathematics and other disciplines seemed too radical for some people. This draft was submitted by a Spanish Jesuit, Father Enrique Enriquez, to the Spanish Inquisition. His contention was that the *Ratio* was at variance with the teachings of Thomas Aquinas, much of whose outlook was Aristotelian (Farrell 1938, 231; Feldhay 1995, 222). Changes were introduced into the *Ratio*, and some of the differences between the 1586 draft and the definitive 1599 *Ratio* are noteworthy in light of what scholars have recently written about these changes (cf. Feldhay 1995, 223ff).

One striking difference pertains to the amount of text devoted to mathematics. In the 1599 *Ratio*, the references to mathematics are only about a *quarter* of the length of what is found in the first 1586 draft.[14]

The never published 1586 second draft kept the *apologia* for mathematics found in the first draft, but revised the practical advice. This new draft added the suggestion of a public presentation of mathematical problems before an assembly of students once or twice a month, and monthly repetitions of the principal topics in an interactive format. In contrast, the number of students mentioned for special tutoring is reduced from eight or ten to only four or five. Perhaps those who revised the *Ratio* felt that Clavius was too optimistic in gauging the number of young Jesuits competent for studying advanced mathematics.

The 1591 draft did not include any rationale as to why various disciplines were to be taught, so the general *apologia* for mathematics disappeared. In addition, the study of mathematics by all is reduced to one year. A second year is only *recommended* for students of metaphysics, and the special academy is reduced from three years to six months.[15]

The definitive 1599 *Ratio* makes no direct mention of how long students should study mathematics, but only says that mathematics should be taught to the students of physics and those in the second year of philosophy. It also reduces the public

[14] In the first 1586 version, the section dealing with mathematics runs to about 54 lines in a recent edition of the Latin text. In the 1599 version, the section dealing with mathematics is only 10 lines in the same edition, with four additional lines about studying mathematics in a different section.

[15] The philosophy curriculum at the Roman College in the late sixteenth century consisted of a three-year cycle, with logic taught the first year, natural philosophy and mathematics the second, and metaphysics the third (cf. Wallace 1984, 6–8, 59–61).

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presentations of mathematical problems from once or twice a month to once a month or once every two months.

Role of Mathematics in Jesuit Education

When the Jesuit *Constitutions* lists the subjects taught in universities, it says, "Logic, physics, metaphysics, and moral philosophy will be treated, and also mathematical topics, in so far as they are in accord with the end proposed to us" (Part IV, Chapter 12, [451]). The Latin reads "*et etiam mathematicæ*." The presence of the *etiam* seems to give an added emphasis, as if one would not normally expect mathematics to be taught at a university.

The general norm found in the *Constitutions* about what should be taught in universities is this:

> Since the end of the learning which is acquired in this Society is with God's favor to help the souls of its own members and those of their neighbors, it is by this norm that the decision will be made, . . . as to what subjects [Jesuits] ought to learn. (Part IV, Chapter 5, [351])

Elsewhere, we find this advice:

> Since the arts or natural sciences . . . are useful for the perfect understanding and use of [theology], and also by their own nature help toward the same ends, they should be treated with fitting diligence. (Part IV, Chapter 12, [450])

The thrust of Ignatius of Loyola's thought seems obvious: Any discipline, including scientific disciplines, which "help[s] souls" and "by their own nature help toward the . . . ends" envisioned in the *Constitutions*, is worthy of study in a Jesuit university (Smolarski 1999, 109–10).

Early Jesuit education was innovative in introducing into universities the study of mathematics alongside philosophy and physics (Dear 1995, 35). Especially in the first 1586 *Ratio*, mathematics was presented as a key to understanding physical reality as well as the model of correct rational procedure (Feldhay 1995, 222). Thus mathematics serves the understanding of the physical world as well as of ultimate, i.e., metaphysical reality. But, as already noted, merely prescribing that mathematics be taught in a Jesuit university did not eliminate all the anti-mathematical prejudices of scholars from other disciplines.[16]

[16] Cf. 1591 *Ratio*, rule 44 concerning mathematics of the Rules for Provincials, cited earlier.

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Since mathematics is abstract, it does not directly solve societal or spiritual problems, which are so often the focus of religious organizations. But, mathematics trains the mind to think in disciplined, structured ways, offers insights into the diversity of creation, and provides the language for the world of science. Following Galileo, one can even consider that the "book" that is the universe "is written in the language of mathematics."[17]

The Legacies of Clavius and the *Ratio*

In one of Clavius' two major documents, he proposed establishing an "academy" for more advanced study in mathematics. Such a specialized academy was explicitly mentioned in the first two draft versions of the *Ratio*, but the topic was reduced to a reference to "private lessons" for those more inclined toward mathematics in the definitive 1599 version of the *Ratio*. The final version of the *Ratio* did, however, prescribe the study of Euclid in Jesuit schools and ordered a monthly presentation by some student of "some famous mathematical problem" and a defense of his solution.

Although a special, advanced mathematics curriculum was not mentioned in the definitive *Ratio* for all schools, nevertheless, Clavius' vision of a special school to train Jesuit mathematicians was actualized in Antwerp near the end of Clavius' life. Jesuit Father François d'Aguilon in 1611 founded a school for mathematics (MacDonnell 1989, A1) and was joined around 1616 by Jesuit Father Gregory St. Vincent who had studied under Clavius in Rome. During his life, St. Vincent researched mathematical concepts we would now see as precursors to analytic geometry and the infinitesimal calculus (MacDonnell 1989, A13).

In a sense, Clavius created little new mathematics. But the time was not ripe, since before one can develop mathematics, there needs to be a climate that can nurture that development. The greatest legacy of Clavius was his influence in getting the editors of the definitive version of the *Ratio Studiorum* to include mathematics as a standard subject to be taught in Jesuit schools. This is most significant, particularly in view of the low opinion commonly found in Italian academic circles about mathematics, as mentioned above, and was particularly crucial because the founding of Jesuit schools essentially coincided with the beginnings of the scientific revolution.

This is not to say that Clavius did nothing that was of importance to future mathematicians. Clavius wrote a text containing Euclid's works as well as comments on it and his own evaluation of Euclid's axioms. This and other geometrical texts led to Clavius being called the "Euclid of his time" (Sarton 1957, 261). The well-written and model texts of Clavius were reprinted and used in Jesuit schools for decades and

[17] Galileo, *The Assayer* (1623) (cf. Drake 1957, 237–38). The pervasive nature of mathematics was emphasized in the 1586 *Ratio* influenced by Clavius whom Galileo knew (cf. Wallace 1984, 91, 269).

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by people such as Leibniz and Descartes (MacDonnell 1989, 7, 48).[18] There is evidence that one of Clavius' theorems regarding a regular polygon with an odd number of sides (which he proved geometrically) was proven again by Gauss (this time algebraically) and used by him to construct a 17-sided polygon by rule and compass (MacDonnell 1989, 25). Clavius' vision also influenced Jesuits after him to become involved in science at the dawn of the scientific age. Influenced by this vision and guided by the *Ratio* during their studies, many Jesuits became pioneers in scientific fields – so many that thirty-five craters on the moon are named after Jesuit mathematicians, astronomers, and scientists (MacDonnell 1989, 74a–74b).

Clavius realized the importance of mathematics and of solid scientific work in an age that was demeaning of both. Although it seems that he could not bear to let go of the Ptolemaic system, he did confirm Galileo's observations of Saturn and Jupiter, and in 1611 wrote in his *Sphæra* that "since things are thus, astronomers ought to consider how the celestial orbs may be arranged in order to save these phenomena" (Lattis 1994, 198, 261), thereby opening the path to a mathematical reconsideration of planetary motion.

The historian of science George Sarton calls Clavius "the most influential teacher of the Renaissance" (Sarton 1957, 70) and notes that Pope Sixtus V said: "Had the Jesuit Order produced nothing more than this Clavius, on this account alone the Order should be praised" (Sarton 1957, 261).

Conclusion

The Jesuit educational system had its roots in the *Ratio Studiorum* written more than 400 years ago. The *Ratio* provided an academic system that was rigorous and, to a great extent, daring in its inclusion of mathematics and science, thanks to the vision and influence of Clavius. This academic system provided students with the intellectual tools necessary to become leaders in a world that was rapidly changing.

Ignatius of Loyola realized the benefits of education by his studies at the University of Paris (1528–35). It was there that Ignatius befriended fellow students who would later constitute the initial members of a new religious order, the Society of Jesus, and his continued respect for education is reflected in the *Constitutions*. Ignatius and the early Jesuits who followed in his footsteps saw education as a way to transform society, and the *Ratio* provided structures to provide an excellent education. Including mathematics in the *Ratio* forced Jesuits and their students to become familiar with this

[18] We should also note some of Clavius' other contributions to mathematics, such as the use of x as an indeterminate unknown quantity (Cajori 1928, § 161, 154; MacDonnell 1989, 29); the decimal point (Cajori 1928, § 280, 322; MacDonnell 1989, 18); parentheses in algebraic expressions (Cajori 1928, § 161, 151, § 351, 392; MacDonnell 1989, A5). He seems to be one of the first in Italy to make use of the square root sign (Cajori 1928, § 327, 369). In some cases, Clavius did not invent a new notation but chose one of several different notations that were in use in the sixteenth century. But the widespread use in Jesuit schools of books by Clavius helped his notation to become the *de facto* standard.

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foundational language used by intellectuals in a world on the brink of what we now call "the scientific revolution." Through mathematics, Jesuits and their students became engaged, perhaps unknowingly and unwillingly, with a culture that was only beginning to make its influence felt, the culture of Galileo and Newton, among others.

Near the end of the Jesuit *Constitutions*, Ignatius speaks about various means to glorify God and to preserve the Jesuit Order. While speaking about such religious topics, Ignatius noted that "the human means ought to be sought with diligence, especially well-grounded and solid learning" (Part X, [814]). The *Ratio Studiorum* provided a plan to obtain "well-grounded and solid learning," and the influence of Clavius enabled students in Jesuit schools to be "well-grounded" in the newly developing mathematical sciences.

DOCUMENTS AND TRANSLATIONS

Documents of Clavius:

Latin: *Monumenta Paedagogica Societatis Jesu Quae Primam Rationem Studiorum Anno 1586 Editam Praecessere*, edited by C. Gomez-Rodeles et al. Matriti: Typis Augustini Avrial, 1901. Doc. 34, *Modus quo disciplinae mathematicae in scholis Societatis possent promoueri*, pp. 471–74. Doc. 35, *De re mathematica instructio*, pp. 474–476. Also found in *Monumenta Paedagogica Societatis Iesu, Vol. VII: Collectanea de Ratione Studiorum Societatis Iesu*, edited by Ladislaus Lukács, S. J. Rome: Institutum Historicum Societatis Iesu, 1992, pp. 109–22.

English: *Bulletin of the American Association of Jesuit Scientists* (Eastern Section), v. 18, n. 4 (May 1941), Doc. 34. "A Method of Promoting Mathematical Studies in the Schools of the Society," pp. [203]-[206]. Doc. 35, "On Teaching Mathematics," pp. [206]-[208]. (Translation presented by Edward C. Phillips, S. J. and made by Edwin Cuffe, S. J. with the advice of Edward H. Nash, S. J.)

Another translation of the first two-thirds of Doc. 34 is found in A. C. Crombie, "Mathematics and Platonism in the Sixteenth-Century Italian Universities and in Jesuit Educational Policy." ΠΡΙΣΜΑΤΑ (Prismata): Naturwissenschaftsgeschichtliche Studien (Festschrift für Willy Hartner), pp. 65–66.

Ratio Studiorum:

Latin: *Ratio atque Institutio Studiorum Societatis Iesu (1586, 1586B, 1591, 1599)* in *Monumenta Pædagogica Societatis Iesu, Vol. V* edited by Ladislaus Lukács, S. J. Rome: Institutum Historicum Societatis Iesu, 1986.

English: Edward A. Fitzpatrick, ed., *St. Ignatius and the Ratio Studiorum* New York: McGraw-Hill, 1933. This includes the translation of the 1599 *Ratio* by A. R. Ball.

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