Pacioli's lens: God, humanism, Euclid, and the rhetoric of double entry

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Pacioli’s lens: God, Humanism, Euclid, and the rhetoric of double entry¹

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ABSTRACT: This paper investigates why, in 1494, the Franciscan friar and teacher of mathematics, Luca Pacioli, published an instructional treatise describing the system of double entry bookkeeping. In doing so, it also explores the rhetoric and foundations of double entry through the lens of Pacioli’s treatise. Recent findings on Pacioli’s life and works, his writings, and the medieval accounting archives are combined to identify how he was inspired by his faith and his humanist beliefs to give all merchants access to the practical mathematics and the bookkeeping they required. The paper finds that Pacioli’s teaching method was inspired by Euclid, his Franciscan education, and his humanist beliefs; and that Pacioli reveals a simplicity in the then unrecognized axiomatic foundation of double entry that has been largely overlooked. The findings represent a paradigm shift in how we perceive Pacioli, his treatise, and double entry.

Keywords: Axiom, double entry bookkeeping, Euclid, humanism, Pacioli.

INTRODUCTION

Without the distinction between what is and what is not so, there can be no history (Hobsbawm 1998, ix).

Luca Pacioli, is revered as the ‘Father of Accounting’ because his instructional treatise (Thompson 1991, 588) on double entry bookkeeping, published in print in 1494, spurred the adoption of the method across Europe, standardized its use, and established the foundations of modern accounting (Cameran and Pettinicchio 2010, 91-2). Yet, paradoxically, the accounting literature is dismissive of Pacioli. Leading authorities have portrayed him as someone who lacked the experience to have written a treatise on double entry (Vianello 1896; Besta 1909); who combined material from two or more sources, that he may have prepared previously for other purposes, but failed to ensure they were in the same dialect or that they describe the same style of bookkeeping (Hernández-Esteve 1994a); and whose treatise was not fit for purpose (Yamey 1978, 2010). It seems that his efforts were unlikely to have resulted in anything very special, and that they did not. His treatise is seen as a curiosity with little intrinsic value and much of the scholarly enquiry about it has been focused elsewhere. Nor does the rest of the accounting literature on Pacioli suggest that we may have been too quick to judge either the man or his treatise.

However, recent evidence reveals that much of this literature blurs the distinction between fact and speculation thus, echoing Hobsbawm (1998), making it very difficult for accounting scholars to distinguish between ‘what is and what is not’. As a result, our historiography of Pacioli and many of the ‘answers’ we have at present concerning him and his treatise are, at best, questionable and, at worst, unfounded and misleading. Without clarity, consideration of his treatise lacks an understanding of the context and motivation for the manner in which it is presented. Arguably, this has obscured any insights it contains and may have led to its being misinterpreted and misunderstood.

Historical research should seek to provide us with a clear view of what occurred in the past and why; to identify the values of that time, contrast them with our values today and consider if there are lessons to be learned from the historical account. In this paper, we seek

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to fill these gaps in the literature by adopting Lee’s (2002, 124) recommendation of a biographical lens to provide insight, context, explanation, and understanding. In constructing this lens, we embrace the recent evidence on Pacioli along with critical reading of Pacioli’s published and unpublished works, and contemporary statements utilizing a wide array of material relating to him and to the Italy of his day, including sources previously overlooked. It is an approach “grounded firmly in the [historical] archive” (Carnegie 2014, 1242); and it is both critical of what others have written where the imagination has been used rather than the historical archive or the archive-based literature, and interpretive of the facts as presented in those sources. The clarity this process brings enables us to better understand his motivations and what influenced his writing. In turn, this enables an exploration of the rhetoric and fundamentals of double entry bookkeeping through Pacioli’s lens, to provide an understanding of this development of accounting practice and of why it is considered irreplaceable in the modern world.

The findings of this study represent a paradigm shift in how we view Pacioli, his treatise, and double entry. It sets aside the perception of Pacioli as a compiler and copyist lacking the necessary experience and expertise to write an instructional manual on double entry bookkeeping; a man whose sole contribution to accounting was that he printed a manuscript on the subject, but presented it in a way that made it unfit for purpose. In its place, Pacioli is revealed to have been a highly motivated individual qualified and ideally positioned to theorize the principles of double entry to a level that could be understood and applied by all. It presents the simplicity of double entry as viewed by Pacioli through his mathematical lens, a simplicity that can enhance the appreciation of accountants for the foundation of their discipline; and is of importance to those who teach accounting, because it serves as a reminder that accounting processes are based on a simple and inherent logic and offers an alternative principles-based approach by which the subject may be taught.

The next section sets the context of this study through an overview of the nature of business and its use of accounting in 15th century Italy. The literature on Pacioli is then addressed, identifying some of the major misconceptions that act as barriers to our understanding of the man and his motivation. This is followed by sections presenting what is known of Pacioli, his motivation, and his interpretation of double entry bookkeeping. His motivations and methods are then summarized and presented along with the conclusions to this study.

**BUSINESS AND ACCOUNTING IN 15TH CENTURY ITALY**

During the 15th century, commerce was highly dependent on credit. More than anything else, book transfers of debt\(^2\) between personal accounts were the tool that enabled the credit-based economy to operate efficiently (Sangster 2016; Goldthwaite 2009). For this reason, it was essential for a merchant to know what his obligations were and to whom; and this was the primary purpose of maintaining account books. This was the case even when double entry was used: periodic closing of the books was generally considered unnecessary; and closure of a ledger was principally done because it was full rather than to extract figures for profit or capital (Yamey 1949). Complete enterprise-wide systems of double entry bookkeeping were rare, particularly until the mid-15th century – the Catholic Church’s prohibition of usury meant that a cash account was seldom consistently maintained. As a

\(^{2}\) A book transfer of debt is a transfer of an amount from the account of a debtor to the account of a creditor, or from the account of a creditor to the account of someone else.
result, where double entry was used, these typically imperfect systems required manual adjustment, usually involving book transfers between capital (or an expense account) and cash when circumstances required it. Many examples of this practice can be seen in 15th century account books in the Florentine State Archive.

Of course, there were exceptions and bookkeeping practice varied with the region in which it was performed. In Venice, it was mainly undertaken for short-term ventures linked to voyages. In Florence, the emphasis was more on accounting for partnerships that typically lasted around three years. These conditions and their variations are described in the writings of archival historians, such as Lopez and Raymond (1955), Fernand Braudel (1982), Frederick C. Lane (1945, 1966, 1977), Fabio Besta (1909), Federigo Melis (1950), Tommaso Zerbi (1952), Raymond de Roover (1937, 1938, 1941, 1955, 1956, 1971), Alvaro Martinelli (1974), and Richard Goldthwaite (1995, 2009, 2015).

The Church formally relaxed its stance on usury in 1462 when it sponsored the opening of local pawn banks that charged interest on loans (Goldthwaite 2009, 411, 470). This allowed fully utilized cash accounts to be kept, so making double entry a closed system. This, in turn, created a level of connectivity between all the accounts that meant that all entries in the system could be validated to their contra entries; and statements could be prepared showing debts, income, and wealth without any (often unexplainable) adjustments for entries that would previously have been omitted from the cash account. These are essentially the benefits of double entry over single entry.

**Double entry versus single entry**

These benefits were first highlighted by Benedetto Cotrugli in 1458 in his manuscript book, *Libro de L Arte dela Mercatura* [The Art of Trade] (Sangster 2014). In his opinion, double entry bookkeeping was an essential tool of the merchant because it enabled him to:

… appropriately organize the accounting records… to ensure that [he is] able to remember everything that [he] does, namely to remember those who should have and those who should give, and the costs of goods and profits and losses, and any other matter that the merchant needs to know (1458, c.33r, translated by the author).5,6

Despite its benefits, double entry serves specific needs. When they are absent, other methods may suffice. Until the 19th century, use of double entry was the exception and single entry dominated practice (Yamey 1949, 105). It had many forms, including notations on

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3 “A a closed system is one in which all the functions are internalised in the system, and are not affected by outside factors. Double-entry bookkeeping has the characteristics of a closed system in that all transactions recorded take place within the accounts system… all flows resulting from transactions are depicted as having their origin in an account which is in the system, and they have their destination in another account in the system. It is impossible for a flow of money or of money value to go to an account outside the accounts system.” (Glaatier and Underdown (2001, 85).

4 Demski et al., (2006, 452) summarize the power this connectivity provides compared to single entry: “Every journal entry is potentially a source for finding a price or quantity we wish to know… taking all kinds of ratios, discovering many pieces of economic and market data. This cannot be said if bookkeeping were single-entry, without the redundancy which offers hidden data.”

5 A similar translation can be found in Lopez and Raymond (1955, 375) but it was based on the first printed edition of Cotrugli’s text (published in 1573), which has been criticized for its inaccuracy (Zanato 1993).

6 These are also the benefits of double entry over earlier methods of bookkeeping suggested by Yamey (1949, 105-6) and (1956, 7).
scrap of paper; stewardship-focused systems, such as charge and discharge; and agency or factor systems, such as Northern European Hanseatic accounting, a system designed for a different purpose that lacked much of the information needed to accurately calculate profit or loss or changes in overall net wealth – see, for example, Robertson and Funnell (2012). Another reason for perseverance with single entry was that double entry was perceived as being difficult to learn (Manzoni 1540).

The next three sub-sections describe how double entry was learned before Pacioli published his treatise and identify why Pacioli went against convention by embracing an alternative route to dissemination and learning of the skill: the medium of print.

**How double entry was learned in the 15th century**

In 15th century Venice, economically and socially structured for corporations, the only way to learn a trade or a commercial skill was to enter the workshop of a craftsman or a merchant, where accounting was one of the key skills learned (Ciocci 2009, 96-98). However, acquiring expertise in double entry bookkeeping was considered so difficult that a 5-year apprenticeship was required to become a bookkeeper in the complex environment of state government (Guerzoni 2008, 552). Even in Florence, where double entry had been in use at all levels of society for two centuries, anyone seeking to work as a bookkeeper could anticipate a 2-year apprenticeship to master the elements of the technique in a business context (Goldthwaite 2015, 622). But, apprenticeships that embraced instruction in double entry were the exception because, as mentioned above, most merchants did not use the method and so could not train an apprentice in its use.

An alternative and quicker route to proficiency in double entry lay away from the workplace: instruction from a bookkeeping tutor. But only one example of classroom instruction of double entry is known before the 16th century: an exemplar-based bookkeeping treatise dating from 1475 that simulated bookkeeping in a business (Sangster 2014, 2015). This single text compares with over 200 surviving instructional treatises dating from before 1500 on practical (abaco) mathematics (van Egmond 1981) – the principal subject in the commercial schools of future merchants, craftsmen, architects, engineers, and artists. It is clear from such a low ratio of surviving bookkeeping treatises compared to abaco treatises that there were very few tutors of bookkeeping; and there is no evidence that bookkeeping tutors and their students shared the secrets of the subject with others. For the tutor, this secrecy preserved a market for his services. For the bookkeeping student, it provided an edge over his contemporaries, an accelerated route to proficiency. On completing the course, he could immediately begin working as a bookkeeper for himself, or someone else, acquiring

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7 “The steward was charged with the sums for which he was responsible (opening balance, plus receipts), and discharged of his legitimate payments; the end balance showed what he must hand over to his lord or keep in his charge for the next period” (Baxter 1980, 69). Hoskin and Macve (1986, 122) discuss the benefits of double entry over charge and discharge.

8 “Hanseatic accounting... was limited to a record of debts and dues, and goods on hand that they were accountable for or that had been consigned to another party” (Funnell and Robertson 2011, 569). For a discussion of its weaknesses compared to double entry, see de Roover (1956, 165-170; 1971, 109-110).

9 Abaco mathematics is the primary focus of Pacioli’s Summa Arithmetica.

10 Commercial schools were one of the three main types of school at that time (Grendler 1989).

11 In keeping with secretive mentality of the medieval guilds (Eisenstein 1979), this was also the case with the abaco tutors. They only taught the rudiments of their subject in their schools and guarded the secrets of advanced algebra, teaching them only to their best apprentices (Heeffer 2011), the next generation of abaco teachers.
the rest of the necessary expertise ‘on the job’. However, as with anything in short supply, particularly something considered a trade secret, this tuition would have been expensive and available only to the wealthy (Sangster 2015).

Some overcame these difficulties by feigning their mastery of the technique and many of those working as bookkeepers did not know how to do double entry correctly (Casanova, 1558, carta B recto). Thus, not only were many merchants unable to teach double entry, so were many of their bookkeepers, but there was no realistic existing alternative for anyone wishing to learn the art. However, consideration of the way in which skill is acquired supports a solution, and one was found.

The acquisition of skill

Skill (or an art) can be broken down into two components: its maxims and practical knowledge (Polanyi 1958, 51-64; 1966, 4-7). The maxims are what can be taught. They serve as a guide to the skill when they are integrated into practical knowledge (formed by experience). At that point the learner acquires tacit knowledge that raises ability in the skill to a higher level. The apprentice becomes the master.

Bookkeeping apprenticeships should have provided both the maxims and the practical knowledge to all who sought them, but that system could not: Pacioli’s Introduction tells us that there were too few competent masters; and the virtual absence of extant bookkeeping manuals indicates that there were too few teachers of bookkeeping to provide the maxims of bookkeeping to those without a competent master from whom to learn. An alternative means of instruction was needed and it came in the form of the relatively new invention of the printed book.12

The first to attempt this was Pacioli; and he made it widely available by publishing 2,000 copies (Sangster 2007). However, he not only changed the medium, he changed the method to one with few examples – 25 journal entries compared with c.300 in de Rapheli’s much shorter treatise from 1475 (Sangster 2015). In his 27-page treatise, Pacioli set out a framework for independent learning of the subject – how to organize the books, make entries, and a syllabus. In the Introduction, he uses rhetoric13 to justify including it in his compendium of practical mathematics, Summa Arithmetica, while highlighting a need for instruction in double entry that could be solved through this medium.

Pacioli’s justification for publishing the treatise

Pacioli’s use of rhetoric has been highlighted by Aho (1985, 2005). He attributed Pacioli’s presentation style to his experience in the Confession, citing his use of the term, dipositione, as the title of the second part of the treatise in a similar sense to its use in that process. Without doubt, the Church, his faith, and his Franciscan education (which included training in the use of rhetoric) had a significant impact on how Pacioli developed and presented the material. There are many examples of rhetoric in the treatise and in the rest of Summa Arithmetica. For example, on the first page of the treatise he presents a persuasive argument justifying borrowing (and, by implication, lending), an important message to the mercantile audience for whom Summa Arithmetica was intended (Sangster, Stoner, and

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12 See also Geijsbeek (1914, 8-9).
13 According to Merriam-Webster (www.merriam-webster.com/dictionary/rhetoric), rhetoric is the art or skill of speaking or writing formally and effectively especially as a way to persuade or influence. Thompson (1991, 578) suggests that rhetoric employs three forms of argument: ethical appeals, emotional appeals, and rational appeals, all of which were employed by Pacioli.
McCarthy 2008, 2011), an audience brought up to believe that making money from debt was a major sin.

Another example of his use of rhetoric occurs when Pacioli justifies publishing the treatise, emphasizing its importance to his audience. He agreed with Cotrugli that double entry was one of three vital elements anyone needed to be a successful merchant. In particular, that it enabled a merchant to see, at a glance, the entries for each transaction, and thus gain peace of mind from knowing what his obligations were and who was in debt to him. However, unlike Cotrugli, who simply advised merchants to use the method, Pacioli set out to convince his audience that they should use the method and welcome delivery of instruction through this medium:

Since the revered subjects of… [the] Duke of Urbino have the need to understand commerce in all its aspects, I decided to compile… this further specific and much needed treatise. … so that the present book [Summa Arithmetica] may serve to satisfy any of their requirements concerning the keeping of accounts and records. (Pacioli 1494, c.198v, translated by von Gebsattel 1994, 41.)

In medieval society, by invoking the name of his patron, the Duke, Pacioli gave himself credibility as the author of the treatise and gave the treatise credibility as a worthy work (Parry 2002, 174). In addition, Pacioli’s persuasive rhetoric embraced reasons why this was an important tool that he was making available to those who needed it most, not just in his mind and, as discussed earlier, in Cotrugli’s but, also, in the eyes of the Duke (ibid.; Holzknecht 1923, 135).

Pacioli’s rhetoric tells his audience that they should use his treatise. But we need to look elsewhere to explain why Pacioli, a friar and teacher of mathematics, not bookkeeping, decided to include it in his compendium of mathematics; and did so in a counter-convention minimalist style that, as will be described later, his successors shunned. First, however, we need to address the misunderstandings and myths that make understanding Pacioli and identifying his motivation so difficult. While most have a minor impact, together they leave us with a confused and iconic image of Pacioli that has misled scholars and inhibited the development of our understanding. The next section begins by highlighting how our knowledge of Pacioli has been enriched over the recent past, enabling these misleading flaws in the literature to be identified and set aside.

PROBLEMS IN THE ACCOUNTING LITERATURE ON PACIOLI

It’s hard to believe that Pacioli knew all the famous people attributed to his circle, … since his life has been re-created from scanty references of that day, some historians like myself feel that some tales about his acquaintances are apocryphal. (Richard Vangermeersch, quoted by Berton 1993)

Contrary to this view, the vastly more extensive evidence accumulated in recent years tells us that Pacioli did know virtually everyone the literature claims, and many were not just famous, they were leaders in their field – architects, humanists, artists, theoretical mathematicians, abaco masters, heads of state, and Popes. However, sometimes what the earlier literature tells us about the timing and form of contact is misleadingly incorrect.

In part at least, this stems from a lack of awareness of the context of Pacioli’s time and place; and a failure to engage with newer sources.
The biographies

There are many biographies of Pacioli, mainly in disciplines other than accounting. However, they tend to limit their sources and their coverage to what is relevant to their own discipline. Most accounting scholars of Pacioli writing in English use well-known English language secondary sources from their own discipline, particularly Taylor’s biography (1942). They do so unaware of the rich mixture of activity and Pacioli’s commitment and motivation that is revealed elsewhere, mainly in Italian. As a result, assumptions are made and conclusions are drawn that lack sufficient or, at times, any supporting evidence. This creates the potential for myths (Previts 1974) that “can be damaging, promulgating falsehoods and inhibiting the development of [the] field” (McKercher and Prideaux 2014, 16). But, in other disciplines, not everyone has been misled.

Both S.A. Jayawardene (1998) and the Italian professor of the history of mathematics, Argante Ciocci (2009), have drawn attention to Taylor’s use of his imagination to fill in the gaps in what he knew of Pacioli’s life. For example:

[Taylor] certainly goes beyond the documentary evidence, imagining Pacioli as the favorite pupil of Piero in the field of mathematics, brought along by the painter to Urbino and the illuminated court of Federico da Montefeltro (Ciocci 2009, 97, translated by the author, emphasis added).

Neither of these two highlighted Pacioli ‘facts’ is supported by any evidence. Rather, they provide a believable explanation for Pacioli’s knowledge and expertise, and for his dedication in his *Summa Arithmetica* (1494) to Guidobaldo da Montefeltro, Duke of Urbino, and son of Federico. Pacioli never claims that he went with Piero to Urbino, and nor do any of his contemporaries. He met the Duke (Guidobaldo) in Rome in April 1489, five years before the publication of *Summa Arithmetica*. Pacioli (1494, Vol. 2, c.68v) tells us of this meeting, which is an interesting indictment in itself, for where should you start if you wish to describe someone’s life if it is not in what that person wrote about himself? Pacioli was motivated to make this dedication for other reasons: he was indebted to the Duke for two major acts – the loan of a copy of Euclid’s *Elements* in Greek that allowed him to check the Latin translations of this key source (ibid.) for his principal subject; and the assistance of his court mathematician, Paulo de Middelburg, in checking the mathematics in *Summa Arithmetica* (1494, Vol. 1, preliminaries, c.2r; Ciocci 2009, 52, 150).

Other Taylor myths include statements that Piero della Francesca brought Pacioli to the attention of Leon Battista Alberti (1404-1472), renowned architect, polymath, and humanist who found Pacioli a job in Venice in 1464 (1492, 43); and that Pacioli fled Milan in 1499 in the company of Leonardo da Vinci (ibid. 327). None of these ‘facts’ is supported by evidence and the last is known to be false (Ulivi 2009, 34, 45). Taylor has misled many scholars, including, for example, Fischer (2000, 300), on Pacioli’s education, his relationship with Piero, Urbino, and Alberti. These ‘conventionally accepted facts’ from Taylor (Macve 1996, 8) continue to have an ongoing and expanding impact on the public perception of Luca Pacioli. They form the basis for the biographical material in Brown and Johnston’s (1963) translation of Pacioli’s treatise, the main source for a video published 27 years later to commemorate Pacioli’s birth: *Luca Pacioli: Unsung Hero of the Renaissance* (Jackson,

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15 Piero della Francesca was one of the most respected artists of his day, and c.30 years older than his kinsman, Pacioli.
Tinius, and Weis 1990) and two accompanying articles by Weis and Tinius (1991a,b). The film is faithful to Taylor and it continues to spread Taylor’s ‘facts’, now to a much larger audience: it has been available on YouTube since March 2014, where it has been viewed over 49,000 times. This is the reality for the majority of those who have heard of Pacioli.

Two other scholars, in particular, undermine our assessment of the bookkeeping treatise. Firstly, Fabio Besta and his claim (1909, 364-8) that Pacioli could not have written his bookkeeping treatise because he was a friar not a bookkeeper. This ignores the fact, known to Besta, that Pacioli spent 6 years working for a merchant in Venice before he became a friar. Besta’s view has had a noticeable impact on the literature ever since. The second is more understandable because it requires knowledge of theory of pedagogy rather than history if it is to be avoided: the assertions by Basil Yamey (1978, 579-580) that it was “deficient as a source of instruction for a reader attempting to master the intricacies of double-entry bookkeeping” and (2010, 149) that no one could have learned bookkeeping from Pacioli’s treatise because it lacked sufficient examples to do so. Together, these statements by Besta and Yamey deflect us away from looking at Pacioli’s treatise for what it is. Instead we have spent over a century looking for his source because we want to know who wrote it and because it must have been ‘better’, firstly because Pacioli was not qualified to write it (Besta) and secondly because it is inadequate pedagogically (Yamey). Thus, in addition to the largely Taylor-inspired misdirections in the literature, Pacioli’s qualifications and ability are questioned, and the fitness for purpose of his treatise dismissed.

Another barrier to understanding Pacioli’s motivation and method is the perception that Summa Arithmetica is primarily an encyclopedia.

The nature of Pacioli’s Summa Arithmetica

The literature tell us that Summa Arithmetica is an ‘encyclopedia of mathematics’ (e.g. Masotti Biggiogero 1960, 7; Rose 1975, 143; Yamey 1994, 52; Chatfield and Vangemeersch 1996, viii). Not surprisingly, scholars focus primarily on the mathematical problems it contains. Few consider what the words are guiding the reader to do, or how. The bookkeeping treatise is seen as a puzzling ‘extra’ included on a whim to satisfy a request from someone to whom Pacioli could not say ‘no’, the Duke of Urbino. However, as will be shown later, although it represents less than 5 percent of Summa Arithmetica, when clarity is obtained and his motivations and methods are revealed in the context of his time and place, the treatise can be seen to be an integral part of Pacioli’s purpose, arguably no less important to that goal than the abaco mathematics that precedes it.

In the next section, a brief overview is presented of what is known about Pacioli. This is followed by a discussion of how his beliefs, education, and experience motivated him to write and publish a treatise on double entry bookkeeping, include it in a compendium of mathematics, and do so in the style he adopted.

PACIOLI’S MOTIVATION

We know a great deal more about Pacioli than is evident in what has been written in the English language. We know where he was born; who brought him up; where he spent his life; what he did during his life, and when; what he looked like; when he died; and, from his own hand, we know who he knew, what he believed, and what he valued. In 2009, the Italian archival historian of mathematics, Elisabetta Ulivi, revealed that Pacioli put his responsibility

16 (July 2, 2017) Available at https://www.youtube.com/watch?v=OoTc3wLTqkk
to his convent in his hometown of Sansepolcro above all other duties, spending days travelling back and forth to the town while teaching elsewhere. That he did not just know Leonardo da Vinci, he used Leonardo’s father in his professional role as a notary; and that, in May 1493, he withdrew the large sum of 550 lire (c. 90 ducats) he had on deposit in Sansepolcro (2009, 33) just before travelling north to Assisi, Urbino, Venice, where he had a book to publish, and to Padova (Ricci 1940, 13). Even after paying his debts, he was left with over 400 lire sufficient, if he wished, to have paid the wages of those involved in the printing of *Summa Arithmetica*.

Through her archival studies, Ulivi has shed light on the teaching of *abaco* in the 14th and 15th centuries, and on Pacioli’s life; and Ciocchi (2009, 103-106) has reconstructed the process that transformed Pacioli from a practical mathematician in the 1470s into a theoretical mathematician by the 1490s. Yet more insights have been presented by other historians of mathematics, such as Fenny Smith (2008) (or Rankin 1992) and Albrecht Heeffer (2010, 2012), for whom Pacioli’s capacity to explain, to offer original solutions, and to organize his teaching in a manner that emphasized learning from single generalizable examples rather than repetitive rote, set him aside from his peers. Through their efforts, we now have a far clearer contextualization of the nature of Pacioli’s writings and, thereby, his teaching.

As to his motivation, the dedicatory letters to the book and in the first chapter of the bookkeeping treatise tell us that it was written to bring mathematics to everyone/to provide merchants with all they needed. But, those statements tell us what he hoped to achieve, they do not tell us why he did it in the style he chose. The rest of this section of the paper discusses what motivated Pacioli.

**Pacioli and humanism**

After a humanist grammar school education and training in *abaco* mathematics, Pacioli left his hometown of Sansepolcro in 1464 and travelled to Venice. There he studied theoretical mathematics while working as assistant to a merchant and tutor of *abaco* to the merchant’s three sons, to whom he dedicated his first book on *abaco* mathematics in 1470 (Pacioli, 1494, f. 67v). That year, he travelled to Rome and spent many months in the home of Leon Battista Alberti (Pacioli 1509, c. 29v), one of the leaders of the humanist education movement. Humanists combined classical learning from ancient Greece and Rome, including Aristotle, Cicero, and Livy, with expression in the spoken language of the day; and they embraced rhetoric to communicate and printing to disseminate to a wide audience (Crudin 2015; Grafton 2002). The humanist ethos sought to enfranchise the masses through widely disseminated education. In the words of Alberti:

> The best works are those that benefit many people. Those are most virtuous, perhaps, that cannot be pursued without strength and nobility. We must give ourselves to manly effort, then, and follow the noblest pursuits. (Alberti 1433-1440, 141, translation by Crudin 2015)

Alberti influenced Pacioli’s awareness of humanist ideals from his schooling into a belief that he embraced to the full, not just in an appreciation of the value of original texts from the scholars of Greek and Roman antiquity but, also, in a desire to bring knowledge to those who needed it, by whatever means (see, for example, Mancini 1882, footnote 1, 146). This is evidenced in Pacioli’s publishing of a book on practical mathematics containing a treatise on bookkeeping *in the spoken language* and *in print* – both vehicles of dissemination.

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17 This was the only school in Sansepolcro (Banker 2003).
that had been championed by Alberti (Grafton 2002, 170, 331-2).

When he left Alberti, Pacioli returned to Sansepolcro to train as a novitiate in the Franciscan convent.

**Pacioli the friar**

Pacioli began his training no later than February 26, 1471 (Ulivi 2009, 30\(^{18}\)). As a novice, Pacioli would have been:

expected to learn the Divine Office and the breviary prayers... [It was] an overall program of personal transformation,... gearing the novices towards poverty, humility, obedience, self-negation, and the love of God. ...[It involved] various forms of communal religious instruction, manual labour, and exercises in singing, private reading, prayer, and meditation. (Roest 2000, 244.)

By the time he left Sansepolcro in 1475, Pacioli had been ordained as a friar and had received an education to prepare him for further study.

**Pacioli’s university studies**

In 1475, Pacioli embarked on a series of activities that had one dominant theme: education. First, he studied for a degree in theology in Perugia, the nearest university town to Sansepolcro. Doing so was not only the next step for Franciscan friars with exceptional talent (Roest 2000, 250), it was necessary if he were to be allowed to teach in universities (Verger 1992). He studied mathematics and philosophy (Boncompagni 1879, 382).

The goals of this Franciscan education were laid down by Guibert de Tournai in *Erudimentum Doctrinæ* (c. 1261).\(^{19}\) This laid out a four-part blueprint on learning. The first part established the centrality of God to the pursuit of wisdom and the primacy of theology over all other sciences; the second part dealt with the qualities of a teacher; the third explained how teaching and learning should take place; and the fourth comprised of an extended course in the Arts, including grammar, poetics, dialect, and rhetoric; arithmetic, music, geometry, and astronomy; physics, ethics, magic, and mechanics. This program of learning had been modified by Pacioli’s time with the inclusion of more refined and more rigorous forms of speculative theological analysis, but the underlying principles continued to exert a strong influence on what was taught and what was learned. (Roest 2000, 250-271)

To support his studies, Pacioli taught *abaco*, at first privately, and then employed by the city council. In 1476, he started writing his second book, a 396-folio (i.e. 792-page) *abaco* treatise (Pacioli 1494, c. 67v) that he dedicated to the youth of Perugia: *Tractatus mathematicus ad discipulos perusinos* (Pacioli 1480).

**Pacioli, mathematics and God**

The combination of his religious faith and mathematics was compelling to Pacioli and a perfect match with his humanist ideals. To Pacioli, mathematics was the most fundamental science, and divine. He believed it revealed the secrets of the universe and his humanist beliefs told him that everyone would benefit by being given the opportunity to learn and understand mathematics so that they too could have access to these secrets and improve their standing in the eyes of God:

For Luca Pacioli, mathematics was a true philosophy, the foundation and guarantee of the certainty of all knowledge. In the Introduction to *Summa Arithmetica*... Pacioli

\(^{18}\) To eliminate confusion with the variable dates of the year-end at that time, Ulivi uses modern dating with the year ending on December 31. That convention is also adopted in this paper.

\(^{19}\) No complete copy of this work has survived.
defines a cultural project for the mathematization of knowledge... At the core of this program is the universality of mathematics as the primary, most certain science on which are based all the arts and sciences invented by man... [but] there is a more fundamental motivation that Pacioli places at the base of his project: the idea that the world was created by God by means of numbers, geometric shapes and proportions. [To Pacioli,] mathematics was not simply the mother of science and art, it was the language in which God created the world. (Ciocci 2009, 205-6, 213-4; translated by the author.)

His training as a Franciscan and, in particular, his Franciscan university education taught him how to teach, how to use rhetoric and logic to convince his audience, but not how best to teach his subject, which he was teaching in the abaco tradition. This pedagogy involved setting countless problems to be solved that might eventually result in students grasping how to solve other similar cases. Over the course of the next few years, inspired by his faith, Euclid, and his humanist inspired goal to enfranchise through education, he developed a new approach to the teaching of algebra. It advanced the way in which it was taught in Europe and, in conjunction with his next book, De Divina Proportione (1498; 1509), changed the manner in which all European mathematics was taught (Ciocci 2011) – without doubt, Pacioli’s “influence as a mathematician on succeeding generations was considerable” (Macve 1996, 16).

**Pacioli, Euclid, algebra, and double entry**

In much of Summa Arithmetica, Pacioli presents his compilation of material from a range of sources with very little to distinguish it and very little originality. This was not the case with his treatment of algebra. It was original and unique (Ciocci 2015; Heeffer 2013) and owed a considerable debt to the way in which Euclid interpreted geometry in his Elements. Euclid had gathered, compiled, organized, and reworked the mathematical concepts of his predecessors (Klarreich and Moncrief 2002). While doing so, he identified the axiomatic\(^{20}\) nature of geometry and presented the subject in an axiomatic model proving 465 theorems from 5 axioms and 5 postulates\(^{21}\) through a process of deduction\(^{22}\) (Vialar 2015, 149). Pacioli learned of this after being introduced to Euclid’s Elements by Piero della Francesca; and he spent at least 15 years studying both Latin translations and the copy in its original Greek acquired for him by the Duke of Urbino in 1489.

After being awarded his degree in the early 1480s, Pacioli emulated Euclid’s gathering of source material, spending over a decade seeking out abaco problems and solutions in the manuscripts of his predecessors, scouring libraries\(^{23}\) for sources and ideas, particularly in Florence (Ciocci 2009; Heeffer 2012). In this, as he acknowledges in Summa Arithmetica, Pacioli was indebted to the works of Leonardo Pisano (Fibonacci) (c. 1170-c. 1240), widely recognized as the inspiration for abaco mathematics. At the same time, Pacioli perfected his knowledge by teaching and exchanging problems and their solutions with practical mathematicians, including the very best, the Florentine Giovanni del Sodo (Ulivi 2015); and also many of those who used mathematics in their work, including the artists Botticelli and Pollaiolo (Ciocci 2009). He then rewrote the algebra in his Perugian abaco text from 1480,

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\(^{20}\) Axioms are “prerequisites that are neither provable nor in need of proof” (Höffe 2003, 53).

\(^{21}\) A postulate is “a thing suggested or assumed as true as the basis for reasoning, discussion, or belief” (en.oxforddictionaries.com).

\(^{22}\) A deduction is “a systematic method of deriving conclusions that cannot be false when the premises [i.e. axioms] are true” (Collins English Dictionary 2014).

\(^{23}\) Many of these libraries would have been private collections of merchants (Heeffer 2017).
and material from other sources, using a rhetorical style of didactic writing typical of the ancient texts of Greece and Rome, of Aristotle (Höffe 2003, 79), Cicero (Toohey 2013, 146), and Euclid (Murdoch 2012, 480). What facilitated this transformation and why Euclid’s presentation of geometry influenced him so much was that algebra, like geometry, is axiomatic: “a few simple algebraic equations offer themselves naturally as axioms, and from them all other facts may be proved [by deduction]” (Pinter 2010, 14).

The approach of the abaco masters to teaching algebra did not acknowledge the power of the solutions they developed. They did not present them as theorems. They simply presented a problem, worked through it, solved it, and found the answer; then moved to another problem. When they presented a problem and solved it in the same way as another, there was rarely any mention of the other problem. Students had to work out for themselves the generalizability of solutions. Pacioli set this approach aside, transforming problem-based solutions into algebraic theory. He presented the solutions before the problems. Each solution was presented as a generalizable theorem, which Pacioli called a ‘chiave’ (‘key’). He did not say how it was derived. Instead, he demonstrated its validity with a problem, justifying the answer as an application and, therefore, proof of that solution. (Heeffer 2010, 13; 2012, 38-9; 2013)²⁵

Figure 1 presents an example of Pacioli’s approach:

**FIGURE 1: Pacioli’s 14th key.**

On three quantities in continuous proportion, multiply each with the sum of the other two and add these products together. Then divide this by double the sum of these three quantities and this always gives the second quantity. (Pacioli 1494, f. 89v, translation based on Heeffer 2012, 39.)

To demonstrate the validity of this theorem, Pacioli then presents a problem and its solution (the answer to the problem is 3 and the other two numbers in the sequence are 1 and 9):

Find 3 numbers in continuous proportion that sum to 13 which, when you multiply each number by the sum of the other two and add the answers together, gives you 78. … You solve this with the 14th key. That says that if you divide the sum of this multiplication, i.e. 78, by twice 13 you will find the second amount. (Pacioli 1494, f. 91r, translated by the author)

In this transformation of the teaching of algebra, Pacioli was being consistent with his humanist ideals, seeking improved ways of disseminating knowledge that could make it more accessible. Alberti had sown the seeds, but it was Pacioli’s Franciscan education, his experience as a teacher, plus his reading of Euclid’s *Elements* and the insights that gave him in how to teach algebra, and in how to do so in writing, that transformed him as a teacher. There was no mystery in determining what was important in Pacioli’s text: by demonstrating where a particular technique might be applied, he told his audience the circumstances under which it should be used.

Euclid’s approach also informed how Pacioli taught double entry, a subject he would

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²⁴ Didactic writing “refers to texts that are intended... to teach, preach, or advise” (Grammar.about.com 2016).

“Much of the most ancient surviving literature is didactic, containing genealogies, proverbial wisdom, and religious instruction. Most European literary works of the Middle Ages have a strong didactic element, usually expounding doctrines of the Church.” (Oxford.reference.com 2016)

²⁵ In contrast to the abaco masters, in his best known work, *Liber abaci* (1202, 1228), Fibonacci presents theory before showing problems that illustrate application of that theory. But, while his chapter on algebra in that book follows Euclid, the proofs presented by Fibonacci were not Euclidean and not axiomatic (Heeffer 2017). However, Pacioli’s placing of his algebraic key before the example that he uses to prove the validity of the key may have been inspired by Fibonacci’s placement of his theory before an example that illustrates its application.
have learned during his six years as a merchant’s apprentice in Venice in the 1460s. Realizing that double entry was an application of algebra, he set aside the exemplar-based instruction of the bookkeeping tutors (Sangster 2015) and taught double entry from a foundation of axioms.

**PACIOLI’S ANALYSIS AND PEDAGOGY OF DOUBLE ENTRY BOOKKEEPING**

Because double entry is an axiomatic system26 (Demski, FitzGerald, Y. Ijiri, Y. Ijiri, and Lin 2006, 452),27 it has a rhetorical power: logically, you cannot deny the validity of information obtained from an axiomatic system if you accept the axioms on which that information depends. That is, the axioms that direct what is recorded in double entry confirm the truth of the information derived from the system. Thus, “[double entry] may be made to prove anything” (Cayley 1894, 19), such as the balance on an account, the profit or loss of individual items of merchandise, and the overall profit or loss of the business. This was an important benefit of using double entry, one that resulted in a medieval double entry ledger being accepted as judicial evidence in a dispute – see, for example, Pacioli (1494, f. 201v); Goldthwaite (2016); Sangster (2016). Ryabova (2016) describes how, in 15th century Venice, the journal and other documents were used by the Court to reconstruct the ledger of the Soranzo Fraterna. In doing so, it was demonstrated that the ledger maintained by the business was incomplete. The court accepted that the reconstructed double entry ledger was evidential of the truth. Recognition of double entry in this way was founded on the demonstrative logic28 of an axiomatic system; and, at that time, demonstrative logic was the sole procedure used for demonstrating scientific certitude (Klarreich and Moncrief 2002).

Pacioli’s treatise demonstrates the axiomatic nature of double entry. He adopts a categorical approach using categorical terms,29 such as ‘debit’ and ‘credit’ and categorical propositions30 (i.e. theorems), such as ‘all expenses are debited’. Initially, he presents five axioms that show how double entry works, plus three postulates that indicate how to use the system. He then extends his coverage, illustrating how double entry applies to specific situations and identifying theorems, the proof of which can be deduced from his axioms.

In the next sub-section, Pacioli’s axioms and postulates are indicated with ‘{A}’ and ‘<P>’ respectively. To illustrate how they define the process of double entry as an axiomatic system, these are then presented in Figure 2, together with the theorems they demonstrate.

**Pacioli’s approach**

Pacioli begins by describing the books used and establishing a specific business scenario – the opening of the account books for a new business. In Chapter 9, he describes how {A1} every transaction involves two things, hereafter ‘elements’: either a purchase or a sale of something (that can be expressed as a categorical term: ‘the item exchanged’) for one

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26 An axiomatic system is “is any set of axioms from which some or all axioms can be used in conjunction to logically derive theorems.” (https://en.wikipedia.org/wiki/Axiomatic_system)

27 For an overview of attempts to define double entry and accounting as axiomatic systems, see Rambaud et al. (2010, 4-8).

28 Demonstrative logic is, “a process of reasoning from accepted premises to conclusions” (Seubert 1986, 1).

29 A categorical term is “a word or phrase that designates a class. Each categorical term divides the world into two parts: the original class and its complement” (Kemerling 2011).

30 A categorical proposition is “a statement of the relationship between two classes, each of which is designated by a categorical term” (Kemerling 2011).
of nine or more things (cash, IOU, barter, bank draft, or a mixture of these). In doing so, he creates a second categorical term that he labels, “the nine ways in which it is common for merchants to buy... [and sell]”, hereafter the ‘form of settlement’. In this way, he declares that {A2} all ‘forms of settlement’ can substitute for each other.

In Chapter 11, he presents the categorical terms, ‘debit’ (debitore) and ‘credit’ (creditore) and states {A3} that of the two elements in a transaction, one (i.e. ‘the item exchanged’ or ‘the form of settlement’) is a debit and the other is a credit. In Chapter 12, he implicitly links them together in the relationship {A4} ‘debit=credit’ because the layout of his example journal entries forces them to be equal. In Chapter 14, he makes the axiom explicit by declaring the relationship – “never shall an entry be made in credit [for which] the same amount is not entered in debit” (von Gebsattel 1994, 56). Also in Chapter 12, he states {A5} that entries in the money column are to be in one currency only.

In Chapter 12, he also introduces capital and cash, two more categorical terms, which he defines and then presents in two postulates: <P1> “cash [received] must always be a [debit]” and <P2> “capital [given (by the business)] must always be entered as a [credit]” (ibid., 53). Because ‘cash’ has been defined as a ‘form of settlement’ and Axiom 2 tells us that they are interchangeable in any transaction, all ‘forms of settlement’ received are therefore entered as debits.

Finally, because one of the two elements that must be recorded for each transaction is the ‘form of settlement’ and we know how it should be classified (as debit or credit), we know that the classification (as debit or credit) for the other element, ‘the item exchanged’, is the opposite.

By the end of Chapter 12, the only item needed to ensure double entry would be correctly recorded for all transactions was an indication of what to do if a form of settlement was given, not received. Commonsense tells us that the entries would be reversed. This is made explicit in Chapter 18, in an example of a journal entry for a purchase of sugar for cash that shows that giving cash in settlement of a transaction is recorded as a credit. This can be presented as a third postulate: <P3> ‘cash given is recorded as a credit’ and distributed: ‘all forms of settlement given are recorded as a credit’.

All that is needed to learn or use double entry correctly to enter all transactions are Pacioli’s five axioms and his first and third postulates. Together, these reveal the inherent simplicity of double entry and can be used to deduce the correct entries for any transaction. This is illustrated in Figure 2, with the axioms, postulates, and theorems indicated.

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31 Pacioli uses the word, ‘termine’ (time). This is not equivalent to the modern term ‘credit’, which is much broader in meaning. ‘Termine’ refers to a specific arrangement of credit, a promissory note or an IOU, a written acknowledgement that the amount is due.

32 Some accounting terminology at that time was ambiguous. These two terms were also used for ‘debtor’ and ‘creditor’. The context of their use indicated their meaning.

33 The other postulate, ‘capital given (by the business) must always be entered as a credit’ is redundant and only used to simplify recording the entries for a new business. Capital is given to the owner in exchange for items received from the owner. Capital is, therefore, a form of settlement. Pacioli does not mention this, preferring to recognize the treatment of capital as a postulate.
The first axiom is commonsense to anyone who knows how trade is conducted. The second, third, and fourth define how double entry works. The fifth is essential for it to work. The first and third postulates complement each other. Together, they can be compared to the ‘seed’ in a random number generator: they make the system work, determining what is debited and what is credited for any transaction.

In its simplicity, Pacioli’s axiomatic approach is far less complex than the learning device of his successors: rules, all of which can be derived from this set of 5 axioms and 2 postulates.

Pacioli’s axioms versus the rules of double entry

There are two groups of frequently used rules of double entry, the accounting equation rules, which can be summarized as: ‘debit increases in assets and expenses, credit increases in liabilities and revenues and capital’, and the three ‘golden rules’.

1. **Real account** (i.e. assets, liabilities, and capital): Debit what comes in and credit what goes out.
2. **Personal account** (i.e. debtors and creditors): Debit the receiver and credit the giver.
3. **Nominal account** (revenue, expenses, gains, losses): Debit all expenses & losses and credit all incomes & gains.

These two sets of rules describe how to do double entry, **not** how it works. Pacioli’s axiomatic system describes how to do double entry **and** how double entry works. It provides understanding of double entry. With rules-based instruction, it is the student who needs to find the understanding. Just as the approach of the *abaco* masters of algebra left the student to identify the generalizable solutions.

Euclid’s 465 geometric theorems are valid because they were derived and can be proved from his five axioms and five postulates (Pinter 2010, 11-12). The rules of double entry

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entry are valid because they are derived from Pacioli’s five axioms and two postulates. The
axioms and postulates apply to all entries for transactions without any need to distinguish
between either the location of the elements of the transaction within the accounting equation
or the type of account (required for the three ‘golden rules’).

It should be emphasized that Pacioli taught the fundamentals of double entry – how to
record transactions. This did not include making entries for adjustments. At that time, when
calculation of profit and wealth were the exception, this was sufficient for most, if not all of
his intended audience (see, for example, Chatfield 1996).

An axiomatic approach has another advantage over rules because rules place far greater
reliance on prior knowledge and understanding of categorical terms.

**Rules and categorical terms**

If students rely on rules, theory of pedagogy (Gagné 1967; Gagné and Briggs 1974)
tells us that categorical terms, such as ‘real account’, ‘personal account’, and ‘nominal
Pacioli’s axioms do not have that problem. They do not include any of these eight categorical
terms, and the ones they do refer to, such as ‘cash’ and ‘capital’, must also be addressed if
rules are used. Axioms are a simpler route to understanding, but it is an approach that has
remained virtually unused since Pacioli published his treatise.

**Why rules, not Pacioli’s axioms, are used in teaching double entry**

The bookkeeping tutors had no motivation to change. Their small numbers and a
resultant lack of competition among them was in sharp contrast to the situation faced by the
highly competitive (Radford 2003) abaco teachers who needed to impress their employers if
they were to have any students. In addition, it was recognized that merchants who had studied
abaco were not very good at that subject – it is one of the reasons why Pacioli wrote *Summa
Arithmetica*. Thus, despite its simplicity, in contrast to how the abaco masters embraced his
approach to the teaching of algebra, Pacioli’s axiomatic approach was not adopted by the
bookkeeping tutors and so did not progress into the instructional bookkeeping texts of the
16th century.

Over the next 150 years, the pre-Pacioli exemplar-based approach continued to
dominate. The principles of Pacioli’s pedagogy, with its axioms, minimalist use of examples
and no exemplar account books was too big a step from the style of the bookkeeping tutors
for them to follow suit. However, starting with Manzoni (1540), who added rules while
acknowledging that students struggled to learn double entry using exemplars, a stream of
European texts were printed, most of which adopted Pacioli’s framework (Geijsbeek 1914, 9,
29, 31; Macve 1996, 18-19). This standardized the method of double entry, but Pacioli’s
axiomatic approach was consistently ignored.

Over time, Pacioli’s text disappeared from the public conscience and only resurfaced in
the mid-19th century, as a curiosity, an emblem of accounting’s past, and not as the unique
axiomatic instructional bookkeeping text that it is.

35 "In order to understand the process properly we will... [show] how [the merchant] should proceed orderly to
keep his accounts and entries so that everything may be readily found in its place" (Pacioli 1494, Chapter 2,

36 Gagné calls these, ‘defined concepts’.
CONCLUSION

In adopting a biographical lens, this paper has demonstrated that there is a time and a place for biographical research when it can contribute, not just “to our understanding of the role of the individual in accounting’s past” (Carnegie and Napier 1996, 21) but, also to provide “insight, context, and explanation for broader historical issues... [so that we can] explain and understand accounting practices, developments, failures and successes” (Lee 2002, 124). This biographical lens revealed a different Pacioli, set firmly in the context of the society and culture of his time and place. By setting aside some of the myths in the literature, it established a firmer foundation, providing “validated premises rather than contrived ones” (Previts 1974, 8) on which to base the rest of this study.

Pacioli was part of a 200-year Franciscan tradition of theologian-mathematicians:

who had a strong interest in ethics, economic exchange, in some theory of money,
and who often worked as radical thinkers on the margins of, or strongly opposed to, mainstream theology and the Roman Catholic Church (Derks 2008, 205).

But, Pacioli did it differently. Neither strongly opposed to mainstream theology nor to the Church, his religious background, education in the Franciscan tradition, and faith is evident throughout his treatise. It is replete with religious, moral, and ethical advice about what a merchant needed to do to be successful, for himself and in the eyes of God. He was devoutly religious, and he was a humanist. He sought to emancipate and educate his audience, the merchant class, providing them with the tools they needed – mathematics and double entry bookkeeping – and, in turn, bring them closer to God. It was this combination of his faith and his commitment to the ideals of the humanist education movement that motivated him to publish *Summa Arithmetica* in print, in the spoken language of the day, and include in it a treatise on double entry bookkeeping.

Pacioli’s expertise lay in education theory and practice, supported by his knowledge and experience of rhetoric, didactic writing, and Euclidian geometry; and in other theoretical and practical mathematics, principally algebra. Recognizing that double entry is an application of that subject, he applied his skill in mathematics to reduce it to its key components and then used them as the basis for the instruction. Pacioli’s axiomatic approach reveals the rhetoric of double entry and explains why a properly maintained double entry ledger would have been considered a vehicle of evidential truth in medieval Italy; and why double entry is considered irreplaceable today.

The insights he offered to the teaching, learning and understanding of double entry by adopting this approach is, as yet, unfulfilled. None have recognized the simplicity of double entry that is revealed when its axiomatic principles are presented in this way – a simplicity Pacioli identified through his mathematical lens.

Pacioli’s bookkeeping treatise influenced generations of textbook writers, so perpetuating the instructional framework he devised and standardizing the manner in which entries were made by bookkeepers across Northern Europe. Until now, that has been the extent of Pacioli’s recognized contribution to accounting, but we were looking at it from the wrong perspective. We not only failed to identify his axiomatic approach, we did not notice that he only taught double entry for transactions, plus opening and closing the ledger. Recording double entries for adjustments was beyond his scope because it was beyond the common practice of those for whom he wrote. It was a treatise written for its time and context but it has only ever been evaluated in the context of the modern world, with its demand for adjusting entries, something for which the treatise was not devised.
Taken overall, these findings represent a paradigm shift in how we perceive Pacioli, in how we perceive his treatise, and in how we perceive double entry bookkeeping and how it can be taught. No longer will Pacioli be viewed simply as the first man to print a manual on double entry bookkeeping that standardized the manner in which entries were made. He understood double entry and he presented it in a way that anyone could adopt to ensure entries of transactions were always correct. Rather than being embarrassed that a lowly friar, who many believe had no practical accounting experience, could have written this bookkeeping treatise, this study shows that we can be satisfied that the right person wrote the treatise for the right reasons; that he knew what he was doing and, in the process, developed a sound, straightforward, and reliable principles-based method of instruction in double entry – surely a much more fitting epitaph than is accorded by his current status as “the key promoter of accounting” (Chatfield and Vangermeersch 1996, viii). Are these revelations not what historical research should seek to do, to provide us with a clear view of what occurred in the past and why, to identify the values of that time, contrast them with our values today and consider if there are lessons to be learned from the historical account?

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