IN DEFENSE OF PACIOLI

Abstract: This paper responds to Basil Yamey's paper in the December 2010 issue of this journal. In that paper, Professor Yamey contradicts some of the points made in our 2008 paper; also in this journal, in which we conclude that Pacioli's *Summa de Arithmetica, Geometria, Proportioni et Proportionalita* (1494) was written primarily for merchants and their sons. He does so by attempting to explain why Pacioli's exposition of double-entry bookkeeping, *De Computis et Scripturis*, was neither an effective reference text for merchants nor a satisfactory school text for their sons. We are unconvinced by Professor Yamey's argument and counter it in this paper by demonstrating that, if anything, Pacioli's bookkeeping treatise was even more fit-for-purpose than we previously indicated.

INTRODUCTION

We welcome the commentary by Professor Basil Yamey [2010] on our paper [Sangster et al., 2008], in which we concluded that the *Summa de Arithmetica, Geometria, Proportioni et Proportionalita* (*Summa*) of Luca Pacioli [1494] was written primarily for merchants and their sons. We are grateful for this opportunity to revisit our work with a new purpose, adding evidence to our previous arguments and, not least, to correct at least one error in our paper that has troubled us since it appeared in print.

Some of Professor Yamey's comments focus on our paper and some on *De Comptuis et Scripturis* (*De Scripturis*), Pacioli's treatise on double-entry bookkeeping (DEB). We shall endeavor to address both sets of comments. First, however, we must consider Yamey's overall conclusion and the method by which he attempts to justify reaching it.

Yamey states that he is not persuaded by our conclusion that *Summa* was written for merchants and their sons. To support this position, he focuses solely upon consideration of *De Scripturis* [Yamey, 2010, p. 146, footnote 1] to demonstrate that *De*
Scripturis was "seriously inadequate and defective" (pp. 145-146).

We do not accept that Yamey succeeds in demonstrating the inadequacy of De Scripturis and, consequently, we do not believe that he is correct in questioning the validity of our conclusion concerning the intended market for Summa. We also do not believe that focusing solely upon De Scripturis rather than on Summa in its entirety is appropriate, particularly in this case as our paper considered the market for the entire book, not solely De Scripturis. Nor do we believe it is possible to reach such a conclusion while ignoring relevant characteristics of the time and place in which it was printed. We first revisit the main theme of our 2008 paper:

THE MERCHANT MARKET

At the beginning of his commentary, Yamey [2010, p. 145] reiterates what he said in his article on De Computis in 2004: "... it is unlikely that merchants, even Italian merchants, were major purchasers of the Summa." In this earlier article, Yamey [2004, p. 144] concluded that, "The fact that so many copies have survived to the present day is best explained in terms of purchases by mathematicians and other learned individuals rather than by merchants." We addressed these issues in our 2008 paper and concluded that a print run of 1,000 or more copies\(^1\) made it inconceivable that purchases of Summa were mainly by mathematicians and other learned individuals. Along with a number of other factors, this left the merchant class as the likely purchasers of Summa, a market that is consistent with the number of extant copies of the book.

Yamey appears to have overlooked the fact that our conclusion (that the motivation for the publication of Summa was to provide an instructional and reference text for merchants and their sons) was based upon the content of Summa as a whole. His commentary appears to imply that he believes that we identified that market on the assumption that Summa would have sold into it because 27 of its 615 pages (4% of the book) consisted of a treatise on DEB that was "fit-for-purpose," and that he believes that merchants would not have bought Summa if the treatise were not "fit-for-purpose." If so, he is incorrect on both

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\(^1\)Any such statement ought to be based upon a comparison of the number of copies printed with the number that have survived. When Yamey wrote his 2004 paper, it was believed that only 300 copies of Summa had been printed [Antinori, 1980]. Antonori revised this estimate to 1,200 in 1994 (in conversation with Hernández-Esteve, 2009), but never said so in print. Sangster [2007] estimated that 1,000 to 2,000 copies may have been printed.
counts.

**SUMMA AS A WHOLE**

The need to consider *Summa* as a whole when analyzing the market for the book is supported by the mathematician Smith [2008, p. 143; see also Rankin, 1992], whose Ph.D. in 1992 was on Pacioli and his mathematics: "[Summa] was [written] with the aim of completeness: to furnish the merchant, and anyone interested in mathematics generally, with the tools necessary for the efficient running of a commercial business." We made a similar point in our paper [Sangster et al., 2008, p. 130]:

The bookkeeping treatise was not only intended to be read and used by merchants and their sons, it was designed specifically for them. Further analysis of the content and sequencing of *Summa* indicates that the entire book was written primarily as a reference text for merchants and as a school text for their sons.

While some merchants may, as Yamey [2010, p. 146] suggests, have purchased *Summa* "primarily for its pages on bookkeeping and accounts," anyone reading even the first two pages of Smith's [2008] article would appreciate that the relevance of the rest of *Summa* to any merchant makes that extremely unlikely.

Pacioli clearly saw *De Scripturis* as an integral part of *Summa*. As Pacioli [Geijsbeek (trans.), 1914, p. 33] writes in his introduction to the treatise:

> The second thing necessary in business is to be a good bookkeeper and ready mathematician. To become such we have given above [in the foregoing sections of the book] the rules and canons necessary to each transaction, so that any diligent reader can understand it all by himself. If one has not understood this first part well, it will be useless for him to read the following.

The undeniable and important link between bookkeeping and mathematics is also found in the comments of the mathematical historian Heeffer [2009, pp. 2, 13] on the development of both subjects in the 14th and 15th centuries:

> These two developments of the fourteenth and fifteenth century were both instrumental in the objectivation of value and they supported the reciprocal relations of exchange on which mercantilism depended... [Pacioli's] *Summa* literally brings together all important aspects of knowledge in such a mercantile society, including algebra and double-entry bookkeeping.
This link between bookkeeping and mathematics is long-standing and is not confined to the 14th and 15th centuries. The bookkeeping treatise by John Mellis [1588] is followed by a treatise on arithmetic which includes a chapter on barter calculations and a chapter on calculating currency exchange. It is also evident in Edwards' [2009] discussion of the way that DEB was taught as applied algebra in late 18th and early 19th century England, and by the frequent inclusion of bookkeeping in U.K. school mathematics texts, such as Hutton's text from 1802. Even today, many U.K. universities require accounting students to obtain passes in high-school mathematics examinations as a prerequisite for admission to study accounting.

We are perplexed that Yamey appears so unwilling to accept our conclusion concerning the market for Summa. However, as he chooses to focus on De Scripturis in his commentary, we shall endeavor to demonstrate that he is incorrect in dismissing its relevance and usefulness to merchants and their sons, particularly in Venice where the book was printed. In order to do so, we must place some of the issues raised by Yamey in context, in particular printing and education.

PACIOLI'S SUMMA IN PLACE AND TIME

Printing: Summa was published only 40 years after the first book was printed in Mainz on the newly invented Gutenberg press. In those early years of printing, typesetting was crude and inconsistent, and proofreading was prone to inaccuracy, if it took place at all [Sangster, 2007, p. 134]. Developments in printing in the Renaissance occurred over a lengthy period. For example, the Venetian-based printer Erhard Ratdolt was the first to discover how to print graphics in the margins of pages and then used the technique (which was crucial in the printing of Summa) in his printing of Euclid's Elementa Geometriae in 1482 [Baldasso, 2010, p. 91], the book Pacioli is using in his famous portrait currently in Naples [Mackinnon, 1993].

De Scripturis suffers in places from poor typesetting. Yet, if a student of bookkeeping in 2010, using Geijbeek's [1914] similarly presented translation of De Scripturis, feels that De Scripturis merits being described as “amazing” and another states, “I feel that the double entry process is very easy when using this book as it makes clear sense” [Sangster et al., 2010], what would the students or merchants of the late 15th century for whom it was written have thought about it? We do not know, but we can surmise which generation of students would be more likely to relate to the content and style of the text, and it is not those
studying the subject in 2010.

In terms of representing bookkeeping in print, compared with Pacioli’s *De Scripturis* of 1494, we see improvements in Tagliente’s two somewhat unsophisticated texts on double entry in the journal (for gentlemen and merchants) [1525a] and single entry in a ledger (for merchants and artisans) [1525b], and many more in Manzoni’s [1540] textbook, *Quaderno doppio...*, published some 40 years after *Summa*. Yamey elects to compare the 1540 edition of Manzoni’s book to *De Scripturis*, but he makes no allowance for the increased sophistication of printing or professionalism of printers and typesetters that appear to have occurred during the 46 years that passed between their publications. He also fails to take into account that readers of printed textbooks in 1494 were not accustomed to the virtually perfect typesetting of the 21st century. As was previously mentioned, typesetting was erratic; and it was no less prone to error than text in scribal manuscripts. A present-day reader would possibly find some of the typesetting in *De Scripturis* confusing and irritating, but would a merchant have done so in 1494 and would it have left him “perplexed,” as Yamey [2010, p. 146] suggests? Surely, not to the same extent as it might today and not to the extent that anyone reading the actual text would be confused for long [Sangster, 2010].

*Education:* Leonardo Pisano’s [1202] *Liber Abaci*, a manuscript book of applied mathematics, was the first of its type. It spawned not only many abridged versions, but a completely new branch of education: the abbaco schools of Northern Italy, schools for sons of merchants and other craftsmen [Grendler, 1989]. *Summa* was a school textbook. Yamey [2010, p. 150] cites Raymond de Roover [1944] to that effect and, as we explained [Sangster et al., 2008, pp. 124, 128], the schools for which it was prepared were the abbaco schools. Ulivi [2002, p. 11] offers an alternative view, suggesting that texts such as *Summa* were principally intended as *aide memoires* for those who had already studied in an abbaco school, if anything, reinforcing what we wrote concerning the market for the book. As the book was printed in Venice, it would have been sold mainly in that region, an assumption we implicitly made in our consideration of the market and in our discussion of teachers and students in the abbaco school system.

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2 See Gordon [1914, pp. 156-157].

3 The abbaco school system operated in the north of the country in cities like Florence, Lucca, Parma, Perugia, Pisa, Siena, and Venice.
De Roover [1944, p. 398] discusses the omission of topics from *De Scripturis* but accepts that this is justified. Yamey [2010, pp. 145-146] is of a different opinion and uses the absence of some topics from *De Scripturis* as partial justification for stating that *De Scripturis* was deficient and not fit-for-purpose, either for merchants or, disagreeing with de Roover, for their sons. How can anyone possibly know if this was the case? We contend that there is good reason to believe that *De Scripturis* actually covers all the basic principles of DEB clearly enough to be used by merchants and used effectively in a classroom, even 500 years ago. We also believe that Yamey is wrong in how he interprets the relevance of the content and presentation of material in *De Scripturis*.

**A 15th CENTURY LENS**

*Summa* and *De Scripturis* must be judged through a 15th century lens, not a modern one, and judged as a whole. We believe that in limiting his assessment of our conclusion concerning the market for *Summa* to a critique of *De Scripturis*, Professor Yamey has used a lens that is neither of that period nor modern, and is overwhelmingly myopic. In many places, he also takes no or insufficient note of the importance of analyzing and/or critiquing the contents of *De Scripturis* from a perspective that is sympathetic to the technological, cultural, educational, and mercantile context of the time and place of *Summa*’s genesis. We also believe that he is too willing to dismiss opinion which challenges the views he holds.

To illustrate this last point, Lane [1945, p. 44] compared research conducted by de Roover [1941] on the ledger accounts of Florentine cloth manufacturers with his own on the ledger accounts of Venetian merchants in the 15th and 16th centuries. He found that the accounts maintained, the timing and frequency of account closure, the accounting techniques applied, and the key focus of accounting activity were not the same. Bookkeeping in the 15th century was performed according to the needs of the enterprise and to meet the decision-making needs of the managers, and these were clearly different in these two centers of business activity.

Yamey [2010, p. 151] asserts that the differences between the practice of bookkeeping and accounting in various parts of Italy were not significant, a reasonable statement if we are considering solely the *principles* of DEB. However, it seems that Yamey (p. 158) has the wider discipline of accounting in mind for he completely ignores the significantly different accounting
priorities and techniques in use in Florence compared to Venice and uses the word "Italy" when he should have used "Florence." The substitution is misleading, to say the least, and it results in his continuing a line of argument that we believe to be fundamentally flawed. This argument, as we discuss later in this paper, goes to the core of his view that *De Scripturis* was not fit-for-purpose.

**DE SCRIPTURIS**

Yamey raises a number of issues criticizing *De Scripturis*, including its lack of appropriate example entries and the omission of crucially important bookkeeping and accounting techniques that were in use at that time. Before addressing the issues he raises in more detail, we shall first briefly clarify the criticism he makes concerning example entries and then offer some initial background concerning the omission of topics in the context of the time when *Summa* was published. We will return to both these topics later.

*Examples: De Scripturis* does not include a surfeit of examples of bookkeeping entries, but it does have more than many realize. It contains 25 examples of journal entries, not just the seven in Chapter 12, virtually one per page of text. Similarly, the text contains several examples of ledger entries, sufficient for Yamey [2010, p. 153] to state that there was no need for more. What Yamey (p. 147) is concerned about is the lack of a model set of entries in account books (i.e., journal and ledger), such as that contained in Manzoni's textbook of 1540, not worked examples such as would typically appear in a modern textbook. In this case, as we shall explain later, we believe he is focusing on the wrong learning resource and overestimating the instructional benefits of examples without detailed explanations.

*Important Omissions:* Whatever the merits of Yamey's (p. 150) position concerning topics not covered in *De Scripturis*, incomplete coverage was typical of such books at that time. As Graf- ton [2008, p. 29] observes:

> Again and again, publisher, authors and readers of textbooks in technical fields noted, often with rancor, that the textbook [of the 15th and 16th centuries] could not provide all of the information or instruct in all of the techniques that one needed to practice in a given field....In general, textbooks [of that period] on technical subjects were always liable to be incomplete.
Even if Professor Yamey were correct, does being guilty of the same "crime" as all these other textbooks render De Scripturis (and consequently, in Yamey's eyes, Summa) unfit as an instructional manual or reference text for merchants and their sons and, in particular, merchants of Venice?

A MISCELLANY OF ARGUMENT: CLAIMS AND RESPONSES

1. Yamey [2010, p. 144] contends that our statement that the "bookkeeping treatise would have been invaluable to many merchants in various ways" [Sangster et al., 2008, pp. 128-129] rests on the assumption by us that De Scripturis was an effective exposition of the double-entry method and guide to its practice in Venice.

It is inaccurate of Yamey to imply that we made such an assumption. Indeed, we acknowledged (p. 113) deficiencies in the treatise, deficiencies that are the basis of many of the points he raises, adding that, "Anyone using the bookkeeping treatise to learn how to do bookkeeping would need to have either been in business himself or, as suggested by Yamey [1978, p. 580], to have known someone he could ask for help in following it." However, our position has changed since 2008. While we still subscribe to the view that such access or help would have been useful, we are no longer so convinced that it would have been necessary, as we explain in the following sections.

2. Yamey [2010, p. 150] is doubtful that "an exposition directed at experienced merchants would also serve as an introductory basic text for inexperienced young beginners."

This statement ignores the emphasis upon merchants, not their sons, in Pacioli's statement in the Introduction to De Scripturis [Geijsbeek, 1914, p. 33], that he has prepared his treatise: "In order that [merchants]...may have all the rules that a good merchant needs, I decided to compile... a special treatise which is much needed... to enable them to keep all their accounts and books in an orderly way." Pacioli clearly believed that sufficient merchants in late-15th century Venice were not experienced in the use of DEB, and thus justified including the treatise in Summa. Has Yamey any reason for implying that Venetian merchants generally did have this experience, or that they were more experienced in the use of DEB than their sons? He gives none, and Pacioli ought to have had an informed view on that, having worked for a Venetian merchant for six years 30 years
earlier [Taylor, 1942].

3. **The treatise is not sufficiently detailed to have been of practical use to merchants.**

As alluded to previously, Yamey [2010, p. 150] lists a number of facets and techniques of 15th century accounting practice omitted by Pacioli, including compound journal entries, closing and reversed opening balance accounts, doubtful debts, balancing of merchandise accounts, *nosto* and *vosto* accounts, and fixed-asset accounts. He suggests that the items he lists would have been welcomed, even by “experienced merchants” (presumably “experienced” in DEB) using his treatise to guide them. We accept that the items listed by Yamey were used in practice at that time, but “in Florence” not, as stated by Yamey, “in Italy,” and not typically “in Venice.”

For example, not only was the concept of periodic closing of the ledger as practiced in Florence only infrequently observed by Venetian merchants (so making the inclusion of illustrations of balance accounts in *De Scripturis* much less important than in Florence), venture accounting, as Lane [1945, p. 164] notes, rather than manufacturing accounting, was of primary importance in Venice. “The Venetians, being mainly exporters and importers, were concerned chiefly with keeping track of wares shipped, wares received, and amounts owed by or to agents.” It is, therefore, unsurprising that Lane [1945, p. 173] ascribed the popularity of the “Venetian method” to the quality of Venetian accounting tutors, the printed textbook, and to the fact that, “The venture system of accounting used at Venice was the most practical form for merchants much of whose wealth was coming and going on the seas.” *De Scripturis* deals with how to record such transactions and is clearly focused upon meeting the needs of merchants of Venice, not those in Florence, or elsewhere.

In addition, merchants had access to transactions, and they already knew how to maintain single entry, mainly cash records. Pacioli gave them the tools to convert to a three-book, double-entry system – *memoriale*, *giornale*, and *quaderno* – that was simple and straightforward to apply and that also gave them a means of systematically managing records of their ventures, their debtors, and their creditors. These were surely useful benefits for merchants adopting his Venetian method.

As for the “omitted items,” once the underlying principles of the method are known and understood, any of these could be added if the merchant wished. All he had to do was ask someone to demonstrate how to do so or employ a bookkeeper
who already knew. How long, for example, would it take such a merchant to learn how to prepare a compound journal entry, the first item in Yamey's list, but not something Tagliente [1525a, b] or Manzoni [1540] included in the examples in their Venetian textbooks? It seems strange that Yamey saw the absence of any such entries in De Scripturis as being something that would have frustrated a Venetian merchant.

Among topics not mentioned by Yamey, two surely ought to have been part of any treatise on DEB and accounting at that time – multiple currencies and barter. Pacioli deals appropriately with the former in De Scripturis but, for barter, he chooses to split his coverage, placing most of it in a separate part of Summa (the 15-page Distinctio 9, Tractatus 4 [Pacioli, 1494, ff. 161r-168r]), with some other examples elsewhere [Smith, 2008]. How to record such transactions is covered in Chapter 20 of De Scripturis, along with a reference back to the earlier tractatus [Pacioli, 1494, f. 204v]. Merchants would surely have been delighted to see the extent of Pacioli's coverage of this topic.

Any assessment of the fitness for purpose of De Scripturis ought to include mention of the coverage of these two extremely important topics for 15th century merchants. Pacioli's coverage of barter also demonstrates the questionability of Yamey's decision not to take the rest of Summa into account when considering subject coverage and relevance to merchants, a strange decision given that the subheading he used for this section of his Commentary is, "Important Omissions From The Summa." If we are going to criticize something, we ought to also give credit where credit is due, otherwise our critique risks being overly selective and biased.

4. Yamey [2010, pp. 151-152] questions our suggestion that De Scripturis could have standardized the practice of DEB because the typesetting of the example journal entries in Chapter 12 would have caused too much confusion.

Sangster et al. [2008, p. 129] were referring to standardization within a single merchant's business: "The merchant could also use the bookkeeping treatise as a guide to ensure that his bookkeeper was actually recording inventory and transactions in the appropriate manner...[Summa] effectively gave merchants the capability to audit their bookkeepers through standardizing the DEB method in use." Yamey's conclusion is excessively negative when read in that context, but it is also excessively negative if his interpretation of our wording (as if we referred to
widespread standardization) is used. Any reader of *De Scripturis* can see that the example journal entries in that chapter are incorrectly presented and deduce how they ought to appear from Pacioli's description of the layout to adopt.⁴

5. **The treatise is not sufficiently clear to have been of practical use to merchants.**

Yamey suggests that Manzoni's book of 1540 demonstrates how this topic could have been presented in a manner that is clearer than Pacioli's, principally because it contains 300 example entries into model account books compared with the much smaller number of examples that appear in the text of *De Scripturis* rather than in model account books.

We believe that Pacioli's treatise is considerably clearer than Manzoni's for anyone who wished to learn and understand the method and then to apply what they had learned in their own businesses because he explains the principles of the method better. Manzoni's narrative text is less detailed than Pacioli's and contains many fewer examples within the dialogue. Those that are included are merged into the text with no attempt made to show how they should be entered in the account books. This is perhaps why readers of Manzoni needed the presentation of example entries in the form of a complete journal and ledger while, as we suggest, readers of *De Scripturis* did not.

6. **Yamey [2010, p. 152] disagrees with our view that it would have been too costly and complex to include a set of model account books in *De Scripturis*.**

In this case, Yamey has misunderstood us. Sangster et al. [2008, p. 114, emphasis added] were not referring to adding a set of model account books, but to adding some worked examples:

Including *worked examples* would have significantly increased the length of the bookkeeping treatise, perhaps by as much as 30% if modern texts are a guide. It would also have considerably increased the complexity, and therefore the cost, of the typesetting and required many costly wood blocks to be carved or metal plates to be cast. *It is unlikely to have been an accident that the journal entries shown on the last page appear after all the text.*

In the final sentence, we were suggesting that those extra entries may have appeared on the final page because it was easier to

⁴See, Sangster [2010] for a detailed discussion of this issue.
print them without any surrounding text. What we had in mind was not a set of model account books but, in keeping with Pacioli's pedagogy, worked examples of each of the main types of entries placed in the text, as they would be in a modern text, or presented in the margin, as was done extensively in Volume 2 of Summa.

However, is it realistic to think that Pacioli's typesetter would have been capable of doing so with or without the use of wooden or metal blocks? Ability of the typesetter aside, the cost of adding this level of complexity may have been prohibitive in the context of this book, irrespective of whether or not Pacioli truly did not perceive a need to add any more to the treatise. Perhaps Yamey is correct that the examples we had in mind would not require very complex typesetting, but looking at Manzoni's journal entries and comparing them with Pacioli's in Chapter 12 suggests to us that even that level of complexity was beyond the ability of Pacioli's typesetter (who could not even manage to include '/' in the text [Yamey, 2010, p. 151]), and it is that level of complexity that we had in mind.

7. Yamey [2010, p. 149] states that we misinterpret the passage in De Scripturis in which Pacioli wrote: "For if we wanted to give you an example of all the ways in which merchants do business...this would make our treatise very long...," and that we use it erroneously as an explanation for why Pacioli did not include a set of examples in the manner of Manzoni.

Yamey correctly identified what Pacioli was referring to calculating amounts to be entered in the journal. However, he has misunderstood both what we had in mind (worked examples not model account books) and our reason for using this quotation, which was simply evidence that supported our contention [Sangster et al., 2008, p. 114] that, "For pragmatic economic reasons, if material was not considered essential in a printed book in the late 15th century, it was omitted."

8. Yamey [2010, p. 149] believes that the lack of a model set of account books, combined with the seriously confusing and internally inconsistent Chapter 34, rendered De Scripturis unfit for the purposes we claimed for it.

Yamey made this statement after describing Manzoni's inclusion of a model journal and ledger containing entries for 300 transactions, which Yamey [2010, p. 147] believes is the best
element of Manzoni's textbook from which to learn this subject: "We can be sure that merchants, bookkeepers and schoolboys were much better served by the model set of account books included as an integrated part of Manzoni's treatise than by Manzoni's rule and, indeed, by much of his written text."

As Yamey mentions, Manzoni was not the only person to include an exemplar of this type. Neither, in fact, was he the first. Tagliente's two brief texts [1525a, b] are virtually devoid of textual discussion of principles. In the first, he starts with a brief statement that each entry in the journal is posted to the ledger, once to the debit side of an account and once to the credit side. He then relies almost exclusively upon teaching from example entries in a journal. He does the same in the second book, which shows how to record each of a series of entries in a book for debtors and creditors maintained under single entry. In contrast, Pietra's [1586] textbook is replete with discursive text and also includes over 800 examples in a model set of books covering an entire year. Yamey mentions Ympyn [1543a, b, 1547] and North [1714] as two others whose textbooks contain both text and a set of model account books. Presumably, it was expected that learners seeking confirmation that they have learned everything correctly would look no further than the model set of books.

This is not the same as learning leading to understanding. It is, however, the equivalent of having a deaf and mute tutor at your side as you set about making entries in your account books. Yamey is certainly correct in asserting that including a model set of account books, such as those in Manzoni's text, would have improved Pacioli's treatise. But was the inclusion of such an exemplar a necessary addition if De Scripturis was to have been fit-for-purpose?

Pacioli was intent upon merchants learning, understanding, and then applying the principles of DEB from a few simple generalizable statements and examples rather than initially learning and then testing learning using a set of model entries in account books. As Geijsbeek [1914, p. 33] translates Pacioli's Chapter 1 of De Scripturis [1494, f. 198v]:

I have written this treatise, in which, step by step, the method is given of making all sorts of entries. Although one cannot write out every essential detail for all cases, nevertheless a careful mind will be able, from what is given, to make the application to any particular case.

Pacioli was not alone. Roger North [1714, p. 13] and Malachy Postlethwayt [1751, p. 317] expressed similar views concerning
the importance of learning principles, understanding them, and then applying them, and that this is achievable with the support of an appropriate (and small) number of examples.

We suggest that Yamey places too much emphasis on the learning that may be obtained from the inclusion of a model set of account books. Such exemplars are useful for drill and practice exercises, and their presence in Manzoni’s text may even have encouraged a standardization of the presentation of entries in account books in Venice when it was printed. But they do not teach the method; they do not engage learning even if each of them is explained in the text, which they are not in Manzoni’s exemplar ledger; and they are not a necessary condition/provison for the learning of principles. The principles of DEB are simply too straightforward to require such lengthy and detailed exposure to examples. Students learn far better by preparing the entries for themselves, applying the principles of double entry they have been taught. This is what Pacioli did and promoted, and this is what, 500 years later, we do today. De Scripturis as it stands is, we believe, sufficient for that phase of learning. As for Chapter 34, which is about closing ledgers and preparing a Summa Summarum, we address this comment in point 10.

9. Yamey [2010, pp. 146-147] complains that De Scripturis does not include any general rule or rules purporting to guide the reader as to which account to debit and which to credit in a particular case, having previously quoted Manzoni [1540]: “the whole difficulty of the art of double entry bookkeeping is to know how to discern in each transaction which account is to be debited and which to be credited.”

Many students and most accountants we have ever met, including ourselves, would agree that the difficulty in double entry lies in identifying whether to debit or credit a particular account. Yamey [2010, p. 147] initially offers a single rule given by Manzoni as a possible solution to the problem: “[The] rule is to debit the receiver or the thing received, and to credit the giver or the thing given.”

While Yamey is absolutely correct in saying that this rule is evident in many texts, and we have colleagues who were taught it, a single rule capable of use in all circumstances is something of a “holy grail” for writers and teachers of double entry. Recognizing a problem, Yamey [2010, p. 147] indicates limitations

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5As discussed by Geijsbeek [1914, pp. 84-85], this is by no means the only rule contained in Manzoni’s text.
in Manzoni's rule with a very apposite example and switches his focus to Manzoni's use of exemplar account books. Yamey seems to believe that "rules" for this purpose can only be of the style offered by Manzoni, but rules can be presented in the form of generalizable guidance, which is what Pacioli does. His approach is very simple. Within the space of six pages, Pacioli [1494, ff.201r-204r] indicates when to credit the capital account (when it increases), when to credit the cash account (when its value decreases), when to credit a personal account (when its value to the business decreases), when to debit a merchandise account (when its value increases) and when to debit the cash account (when its value increases). He thus focuses upon capital, cash, and credit in explaining how to decide whether to make a credit or debit entry to a particular account. It is then simply a matter of identifying how these principles apply to each transaction and treating the entries accordingly. The correct entries for Yamey's example of giving discount to a debtor who pays his debt early, which cannot be correctly posted using Manzoni's rule, are obvious – a personal account has decreased in value to the business, so you credit the account of the debtor; the debit entry must be to the other account involved in the transaction – discount.

Modern textbooks do not mirror Manzoni's approach of rules plus exemplar account books; they more commonly mirror Pacioli's with, in some cases, the inclusion of explicit rules. For example, Wood and Sangster [2008], the largest selling introductory financial accounting textbook outside North America, has seven pages dedicated to double entry, containing simple rules for debiting and crediting accounts for assets, liabilities, and capital, which is many fewer than the number of rules offered by Manzoni – his general rule in four parts and then eight more rules in one chapter [Geijsbeek, 1914, p. 85]. As in Pacioli's treatise, the side of an account on which entries are made depends solely upon whether the account amount increases or decreases. These simple rules are then followed by a worked example involving four transactions relating to a simple business start-up. A second worked example follows, looking at recording a month's trading involving nine transactions. There is not a single compound journal entry among them. At that point, the authors state that the student should now be able to record transactions in T-accounts. The basic principles of double entry are contained in those seven pages, virtually as many pages as that used by Pacioli in covering those same points.

This comparison suggested that Pacioli's approach might
work with modern-day students, with worked examples being added by the instructor, just as they were likely to have been added by teachers of bookkeeping 500 years ago. Accordingly, in order to assess whether Pacioli’s approach to teaching double entry was effective, De Scripturis was used as the sole text in a series of classes on DEB to over 200 first-year U.K. undergraduate students [Sangster et al., 2010]. The students outperformed the previous year’s cohort (which had used a modern text) on all aspects of their assessment.

We therefore find no grounds for accepting Yamey’s assertion that Pacioli’s treatise was unfit as a teaching text, either for the lack of a “general rule” or, as discussed earlier, for the lack of exemplar account books. However, we willingly accept that had Pacioli been more explicit in the rules to follow on this topic, learning may have been facilitated in some cases. As to the addition of worked examples or a model set of account books, while the former would almost certainly have improved the ability of readers to learn from and understand the text and the latter may have helped some learners confirm their learning, neither was an essential component for De Scripturis to have been fit-for-purpose.

10. Yamey [2010, p. 147] repeats his previously expressed view [Yamey, 1994, p. 163] that Pacioli’s Summa Summarum could not serve a useful purpose and that Pacioli’s Chapter 34, in which it is described, is “confused and confusing.”

Rather than going into these points in detail, we refer to Peragallo’s extensive work on early books on accounting. Peragallo [1956] accepts a lack of clarity in Pacioli’s text concerning the distinction between the trial balance and the Summa Summarum. However, they are covered in different chapters of De Scripturis, and he believed that Pacioli knew very well how to prepare a trial balance, how to prepare a Summa Summarum, and of the differences between them. He also believed that Pacioli knew very well how to close a ledger and open a new one, the Summa Summarum being the last stage of doing so. Peragallo believed that Pacioli was describing a Venetian practice (the Summa Summarum) in Chapter 34, and that he included both the trial balance (Chapter 36) and the Summa Summarum in De Scripturis because doing so was consistent with Venetian best practice at the time.

Peragallo believed that use of the Summa Summarum was short-lived and that it was being replaced in Venice by a “bal-
ance account" (which is not included in *De Scripturis* although Peragallo [1956, p. 394] believed that Pacioli was aware of it). He noted that 40 years later, Manzoni included an example of a *Summa Summarum* after his model ledger in his text, but, unfortunately, he was under the impression that it was a trial balance.⁶

As to whether or not the *Summa Summarum* was useful,⁷ its inclusion in *De Scripturis* was appropriate at that time, and the description of it in Chapter 34 of *De Scripturis* is consistent with its presentation in Manzoni [1540], even if Manzoni thought he was presenting an example of a trial balance. Perhaps that is an example of the dangers of learning mainly from exemplar account books rather than from learning, understanding, and then applying principles.

11. Yamey [2010, pp. 152-153] comments on our description of the example entries at the end of the treatise as "journal entries" and states that they are, in fact, "four ledger accounts in which entries are shown for five inter-related transactions."

We unreservedly acknowledge that we were incorrect in describing these entries as "journal entries." We also do not believe that they are entries in the Ledger, but this is not the place for that discussion.⁸

CONCLUSION

We welcome Professor Yamey's comments on our paper [Sangster et al., 2008]. While we recognize that there is considerable room for debate on the issues raised and discussed by Yamey, we present here what we consider to be a more appropriate analysis than that offered by him. In doing so, we place *De Scripturis* firmly within its context as a part of *Summa* and consider the whole of *Summa* within the technological, cultural, educational, and mercantile context of the time and place in which it was created by Pacioli and his printer. We have demonstrated the intrinsic pedagogical merits of *De Scripturis* itself, considering it in the context of education at the time of its publication.

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⁶Peragallo [1956, pp. 392-393] describes how Manzoni discussed the trial balance (copying Pacioli verbatim) and directed readers to his model *Summa Summarum* as an example of it.

⁷Peragallo [1971] discusses Viganò [1968], the source referred to by Yamey when making this point. Peragallo does not appear to change any of his own opinions concerning the *Summa Summarum* from those he held in 1956.

⁸See Sangster et al. [2012].
and drawing attention to Pacioli's focus upon the importance of teaching students to understand (rather than simply memorize rules and practices through rote learning from cases).

Yamey's apparent treatment of 15th century Venetian accounting practice as if it were the same as Tuscan practice, as we argued at the outset of this paper, resulted in his pursuing a line of argument that is fundamentally flawed and consequently undermines his case for stating that *De Scripturis* was not fit-for-purpose. Pacioli's text focused appropriately upon the bookkeeping and accounting needs of late 15th century Venetian merchants. It was more than sufficient for someone to learn and understand the principles of DEB as was appropriate in Venice at that time. Yamey's criticisms of the treatise have been shown to be overstated or invalid, and he has demonstrably failed in his attempt to dismiss *De Scripturis* as not fit-for-purpose.

With respect to our 2008 paper, we have presented a plausible interpretation of events and text that justifies and explains Pacioli's motivation for the inclusion of *De Scripturis* in *Summa* and reinforces what we said in that paper about the intended market for *Summa* – the merchants of Venice and their sons.

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