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Gutenberg's effects on universities

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Gutenberg's effects on universities¹

This article considers the effects on universities of Gutenberg's invention of printing. It considers four major effects: the gradual displacement of Latin as the language of scholarship with vernacular languages, the expansion and eventual opening of libraries, major changes to curriculum and major changes to pedagogy including lectures. The paper does not find that the ubiquity of books changed the role of university teachers as was proposed in the late fifteenth century. The paper also considers a fifth change: the eventual replacement of oral disputations with written examinations as the main form of assessment for admission to a degree. While this was radical, it owed little to the direct effects of printing. The paper concludes with brief observations on the implications of the earlier information revolution for understanding the effects on universities of the current information revolution.

Keywords: Gutenberg, printing, university, moocs, curriculum.

Introduction

In a frequently quoted statement launching the massive open online course provider edX on 2 May 2012 its president Anant Agarwal said that 'Online education for students around the world will be the next big thing in education. This is the single biggest change in education since the printing press'.² Not only has Agarwal's claim been cited frequently, it was anticipated by 15 years by the management guru Peter Drucker: 'Thirty years from now the big university campuses will be relics. Universities won't survive. It's as large a change as when we first got the printed book.'³ Similar views have been expressed by several others,⁴ also in apocalyptic terms: 'An avalanche is coming',⁵ 'The campus tsunami',⁶ 'tectonic shift',⁷ 'The end of the university as we

¹ An early sketch of some of these findings was presented in Gavin Moodie, 'From Gutenberg to Google books: "disruptive technology" and the disruption of pedagogy', paper prepared for the Australian Historical Association's 31st annual conference, 12 July 2012, Adelaide. I thank two anonymous reviewers for *History of Education* for their most valuable comments and for their most constructive suggestions. I also thank the journal's previous and current editors for their support and encouragement in revising the manuscript. The text has been improved substantially as a result.

² edX (2012) edX: the future of online education is now, video, 2 min., 23 sec., uploaded 2 May, <http://www.youtube.com/watch?v=yn5MkE-djxA> (accessed 24 September 2013).

³ Peter Drucker, quoted in Robert Lenzner and Stephen S Johnson, 'Seeing things as they really are', *Forbes Magazine*, 03.10.97, <http://www.forbes.com/forbes/1997/0310/5905122a.html> (accessed 19 October 2010).

⁴ Jeb Bush and Jim Hunt, 'New higher education model', *Inside Higher Ed*, 6 October 2011, http://www.insidehighered.com/views/2011/10/06/bush_hunt_essay_on_why_public_universities_need_to_embrace_online_education (accessed 12 October 2011); The Economist, 'Learning new lessons', *The Economist*, 22 December 2012, <http://www.economist.com/news/international/21568738-online-courses-are-transforming-higher-education-creating-new-opportunities-best> (accessed 20 January 2013).

⁵ Michael Barber, Katelyn Donnelly and Saad Rizvi, 'An avalanche is coming: higher education and the revolution ahead', Institute for Public Policy Research, London, 2013,

know it',⁸ 'Revolution hits universities',⁹ 'disruptive innovation',¹⁰ 'Higher education's online revolution',¹¹ and 'game changer'.¹² This raises the questions of how and why the introduction of printing affected universities. The answers to those questions may inform an understanding of the effects on universities of the current information revolution.

Johannes Gutenberg's invention or at least proving of printing with moveable type in around 1450 had many substantial immediate, medium and long term effects on society that have been described by several others, most notably by Elizabeth Eisenstein in her magisterial study in two volumes on *The printing press as an agent of change*.¹³ But printing's effects on education and particularly on universities have been considered only incidentally. Eisenstein notes that printing's influence 'is especially likely to be underplayed in connection with the history of education' but unfortunately does not remedy this with an extended consideration of printing's effects on education.¹⁴

This paper surveys several secondary sources on the history of printing and the history of education and assembles the published snippets and incidental observations to try to build a coherent account of how and why printing affected universities. It concentrates on universities in western Europe and particularly in England since these or their successors are thought to be most affected by massive open online courses and by the digital revolution generally. Its starting point is western European universities as they were when printing began spreading throughout Europe in the middle of the

<http://www.ippr.org/publication/55/10432/an-avalanche-is-coming-higher-education-and-the-revolution-ahead> (accessed 12 March 2013).

⁶ David Brooks, 'The campus tsunami', *New York Times*, 3 May 2012, http://www.nytimes.com/2012/05/04/opinion/brooks-the-campus-tsunami.html?_r=1 (accessed 10 July 2013).

⁷ William Lawton and Llex Katsomitros, 'MOOCs and disruptive innovation: the challenge to HE business models', The Observatory on Borderless Higher Education, London, 2012, http://www.obhe.ac.uk/documents/view_details?id=929 (accessed 21 August 2012).

⁸ Nathan Harden, 'The end of the university as we know it', *The American Interest*, January/February 2013, <http://the-american-interest.com/article.cfm?piece=1352> (accessed 20 December 2012); Don Tapscott, 'The week the university (as we know it) ended', *Globe and Mail*, 27 January 2013, <http://www.theglobeandmail.com/report-on-business/economy/the-week-university-as-we-know-it-ended/article7896507/#dashboard/follows/> (accessed 22 December 2013).

⁹ Thomas L Friedman, 'Revolution hits universities', *New York Times*, 26 January 2013, http://www.nytimes.com/2013/01/27/opinion/sunday/friedman-revolution-hits-the-universities.html?pagewanted=1&_r=2 (accessed 9 March 2013).

¹⁰ Clayton M Christensen and Henry J Eyring, 'How disruptive innovation is remaking the university', *Harvard Business School Newsletter*, 25 July 2011, <http://hbswk.hbs.edu/item/6746.html> (accessed 28 May 2012).

¹¹ John E Chubb and Terry E Moe, 'Higher education's online revolution', *Wall Street Journal*, 31 May 2012, page A17, <http://online.wsj.com/article/SB10001424052702304019404577416631206583286.html> (accessed 27 June 2012).

¹² Simon Marginson, 'Yes, MOOC is the global higher education game changer', *University World News*, 12 August 2012, <http://www.universityworldnews.com/article.php?story=2012080915084470> (accessed 13 August 2012).

¹³ Elizabeth L. Eisenstein, *The printing press as an agent of change: communications and cultural transformations in early modern Europe: volumes I and II* (Cambridge: Cambridge University Press, 1997 [1979]).

¹⁴ Eisenstein, *The printing press as an agent of change*, 61, footnote 61.

fifteenth century, but because of the paucity of accounts of universities during this period it is necessary to extrapolate from accounts of universities in earlier times. The survey ends with the Scientific Revolution since it and by then so many other changes had affected European universities that it is hard to trace any specific change back to printing.

Early modern Europe is identified as an epoch precisely because it was a period of substantial economic and social changes, many of which effected universities. But only some of these changes were a direct result of printing. Salaried lecturers replaced 'necessary regents', who were masters and doctors who lectured from one to two years after graduation and charged fees from the students who attended their lectures.¹⁵ In some universities colleges became more important than their associated universities for teaching students, developing the tutorial system.¹⁶ University students greatly increased in number.¹⁷ The proportion of students from modest backgrounds fell and the proportion from the nobility greatly increased.¹⁸ The number of universities greatly increased, many rulers prohibited their subjects from studying in other jurisdictions, Europe was split by religion and Latin lost importance as a *lingua franca*. These changes in turn resulted in fewer students travelling beyond their region to study.¹⁹ Identifying which of the several changes to western European universities during the early modern period were the direct result of the earlier information revolution is the aim of the next part of this paper.

Discerning changes in education in late Medieval and early Renaissance Europe is not easy due to the incompleteness and obscurity of surviving records. As Stone observes in his paper positing an educational revolution in England from 1560 to 1640, if historians of a society seriously want to pluck at the skirts of truth, they are obliged to use common sense and arguments of probability to apply correctives and supply lacunae.²⁰ But while inferences from the few solid facts known may be necessary to make general points, as Hill notes about the disagreement over the persistence of scholasticism in late Tudor and early Stuart education: 'on evidence like this – one tutor's notes . . . the social contacts of some others, the books owned by and the subsequent interests of a few dons and undergraduates – it would be easy to argue that

¹⁵ Alan B. Cobban, *The medieval English universities: Oxford and Cambridge to c. 1500* (Aldershot: Scholar Press, 1988): 171.

¹⁶ Peter A. Vandermeersch, 'Teachers', in *A history of the university in Europe: volume II, universities in early modern Europe*, ed. Hilde De Ridder-Symoens, (Cambridge: Cambridge University Press, 1996): 210-255 at 212; Rainer A. Müller, 'Student education, student life', *A history of the university in Europe*: 335.

¹⁷ Peter Burke, *A social history of knowledge: from Gutenberg to Diderot* (Cambridge: Polity Press, 2000): 23; Lawrence Stone, 'The educational revolution in England, 1560-1640', *Past and Present* 28 (1964): 41-80.

¹⁸ Maria Rosa Di Simone, 'Admission', in *A history of the university in Europe: volume II, universities in early modern Europe*, ed. Hilde De Ridder-Symoens, (Cambridge: Cambridge University Press, 1996): 285-325 at 312; Rosemary O'Day, *Education and society 1500-1800. The social foundations of education in early modern Britain* (London and New York: Longman, 1982): 90; Mark Curtis, *Oxford and Cambridge in transition 1558-1642: an essay on changing relations between the English universities and English society* (Oxford: Clarendon Press, 1959): 38.

¹⁹ Rainer A. Müller, 'Student education, student life', in *A history of the university in Europe: volume II, universities in early modern Europe*, Hilde De Ridder-Symoens, (Cambridge: Cambridge University Press, 1996): 326-354 at 328.

²⁰ Lawrence Stone, 'The educational revolution in England, 1560-1640', *Past and Present* 28 (1964), no. 1: 41.

Marxism was being taught to undergraduates at Oxford and Cambridge in the nineteen-thirties'.²¹ Accordingly, while this paper draws inferences from the scanty evidence reported, it is live to the risk of over interpreting fragments in favour of just one of several possible contributors to change.

Printing's effects on universities

This section considers five changes to western European universities which seem to have been influenced by printing: the language of scholarship, libraries, curriculum, pedagogy and in particular lectures, and assessment.

Language of scholarship

Many manuscript books were produced in vernacular languages. Narrative fiction in German was circulated in the late Middle Ages.²² Teachers and preachers published manuscripts in vernaculars to popularise their ideas²³ and by 1400 most English readers preferred their books in the vernacular.²⁴ But most European manuscripts were written in Latin and Latin was the language of scholarship in Europe: European universities taught in Latin and scholarly writing was in Latin. In many places during the Middle Ages Latin was the only language taught in schools.²⁵

Printing greatly expanded the number of books produced and their readership. Vernacular languages were more accessible to this broadened readership – 'every man, as well rude as learned' – and printers followed their commercial interest to produce books in the vernacular dialect they chose as the standard for each major language group.²⁶ Vernaculars grew in prestige and popularity.²⁷ But vernaculars' displacement

²¹ Christopher Hill, *Intellectual Origins of the English Revolution* (Oxford, 1965), 301, cited in Jefferson Looney, 'Undergraduate education at early Stuart Cambridge', *History of Education: Journal of the History of Education Society* 10 (1981), no. 1: 10-11.

²² Stephan Füssel, *Gutenberg and the impact of printing*, trans. Douglas Martin (Aldershot: Ashgate Publishing, 2005 [1999]): 113.

²³ Thomas Norton, *The Ordinall of Alchemy* (1477: 68), cited in Richard Foster Jones, *The triumph of the English language: a survey of opinions concerning the vernacular from the introduction of printing to the Restoration* (Stanford: Stanford University Press, 1953): 5, note 8; Elizabeth L. Eisenstein, *The printing press as an agent of change: communications and cultural transformations in early modern Europe: volumes I and II* (Cambridge: Cambridge University Press, 1997 [1979]): 546.

²⁴ Andrew Taylor, 'Into his secret chamber: reading and privacy in late medieval England', in James Raven, Helen Small and Naomi Tadmor, eds, *The practice and representation of reading in England* (Cambridge: Cambridge University Press, 2007): 41-61 at 48.

²⁵ Marc Bloch, *Feudal society*, volume 1, trans. I.A. Manyon (Chicago: University of Chicago Press, 1961): 77, cited in Benedict Anderson, *Imagined communities: reflections on the origin and spread of nationalism*, revised edition, (London: Verso, Anderson, 1991 [1983]): 18.

²⁶ 'And whereas afore, learned men only did get out both pleasure and great fruit in reading this book, every man, as well rude as learned, may have this sermon *Of the mercy of God* as common unto him as the mercy of God itself is.' Gentian Hervet, 'Preface to Erasmus' "Sermon on the mercy of God", in *The thought and culture of the English Renaissance: an anthology of Tudor prose 1481-1555*, ed. Elizabeth M. Nugent (Cambridge: Cambridge University Press, 1956 [1526]): 348.

of Latin was not quick. Three quarters of books were printed in Latin for the first 50 years of printing; the rest were printed in various vernaculars. Hirsch estimates that probably more than half of books were printed in vernaculars by the end of the sixteenth century.²⁸ Latin remained an international language even for mathematics until the eighteenth century.²⁹

Latin persisted partly because many languages such as Dutch and even German were rarely learned by foreigners³⁰ and Latin remained the language of international communication.³¹ While reformers such as the head of the Zurich church Heinrich Bullinger (1504–1575) preached in German when addressing the people, the voluminous printed compilations of his sermons are all in Latin.³² Febvre and Martin suggest that the ‘final blow’ against Latin was the decline of the Frankfurt book fair around 1630 and the fragmentation of the book trade: ‘But, in a number of areas, it was not entirely displaced by the modern vernaculars until the end of the seventeenth and even the beginning of the eighteenth centuries’.³³

While the nature of the Latin and the way in which it was taught in schools changed in the Renaissance, Latin continued to be important in European schools at least until the sixteenth century. English schools started teaching in English by increasingly using bilingual – Latin and English – versions of classical texts in the sixteenth and seventeenth centuries.³⁴ Holt’s *Lac Puerorum* published in 1510 explained the rules of Latin in English and English was the medium of instruction in grammars written by Linacre which was published in 1523, Vaus (1528) and Wolsey (1529). These were followed by several texts teaching Latin in other European vernaculars.³⁵ However, change was limited in the schools that prepared pupils for admission to Oxford and Cambridge by those universities’ conservative admission procedures and requirements which in turn reflected the importance of ancient Latin and Greek authors in undergraduate studies at Oxford and to a lesser extent at Cambridge into the eighteenth century.³⁶ Oxford and Cambridge were unusual, however, and Continental universities were not so constrained.

Grendler reports that the first vernacular language chair in Europe was the University of Siena’s chair of Tuscan which was not established until 1588, over a century after the development of printing, and even then, lectures were restricted to

²⁷ Ian Maclean, *Scholarship, commerce, religion: the learned book in the age of confessions, 1560-1630* (Cambridge, Mass.: Harvard University Press, 2012): 19, 54.

²⁸ Rudolf Hirsch, *Printing, selling and reading, 1450-1550* (Otto Harrassowitz: Wiesbaden, 1967).

²⁹ Maclean, *Scholarship, commerce, religion*: 230.

³⁰ Lucien Febvre and Henri-Jean Martin, *The coming of the book: the impact of printing 1450-1800*, trans. David Gerard (London: Verso, 1990 [1958]): 330.

³¹ Maclean, *Scholarship, commerce, religion*: 56.

³² Peter Stotz, ‘Heinrich Bullinger (1504-1575) and the ancient languages’, in *Scholarly knowledge. Textbooks in early modern Europe*, ed. Emidio Campi, Simone De Angelis, Anja-Silvia Goeing and Anthony Grafton, (Geneva: Librairie Droz, 2008): 113-138 at 131.

³³ Lucien Febvre and Henri-Jean Martin, *The coming of the book: the impact of printing 1450-1800*, trans. David Gerard (London: Verso, 1990 [1958]): 330.

³⁴ Ian M Green, *Humanism and Protestantism in Early Modern English education* (Ashgate: Farnham, 2009): 55, 261.

³⁵ Daniel Murphy, *Comenius: a critical reassessment of his life and work* (Dublin: Irish Academic Press, 1995): 64.

³⁶ Green, *Humanism and Protestantism in Early Modern English education*: 84.

German students.³⁷ Lectures and debates were always held in Latin until the mid seventeenth century, when exigencies arose to justify the use of the vernacular language. However, vernaculars did not prevail generally until the end of the eighteenth century.³⁸ Stray cites a letter from Horace Walpole describing an examination at Cambridge University as evidence that Latin was still being used in 1735. He suggests that the shift to English occurred in the 1750s and 1760s, three centuries after Gutenberg, not because of the ubiquity of books printed in the vernacular, but probably because the new heavily mathematicised curriculum of Newtonian natural philosophy was more easily handled in the vernacular.³⁹

There was not a direct switch from manuscripts copied in Latin to books printed in vernaculars. Many manuscripts were written in vernaculars. Books continued to be copied by scribes into the seventeenth century.⁴⁰ Most books were printed in Latin in the early years of printing and books continued to be printed in Latin in the following centuries, particularly if they were addressed to an international audience. Universities persisted with Latin for a long time after Gutenberg and eventually relinquished Latin to better handle a new curriculum whose introduction was due to printing only indirectly.

Libraries

Early Medieval Oxford colleges owned manuscript books which were loaned to fellows ‘*in electione sociorum*’: they were made available for selection or borrowing by fellows in order of seniority for a year or sometimes longer. Manuscripts were kept in locked chests until needed. By the high Middle Ages colleges set aside rooms in which manuscripts not *in electione* were chained to sloping lectern desks so they may be read by any fellow.⁴¹ About one fifth of books were chained at the Paris college of the Sorbonne in 1338 and King’s Hall, Cambridge, chained a similar proportion of its 101 books in 1391. Likewise, Oxford’s Merton College chained far fewer books than those it made available for borrowing. But Cambridge’s Peterhouse chained just under half of its 302 books in 1418.⁴²

These arrangements changed by the sixteenth century when the *electione* system came to an end.⁴³ Cobban writes that ‘the reasons for this are not wholly understood’ but at least one possibility is that after half a century of printing books had become inexpensive enough for fellows to be able to afford to buy for themselves their own copy of the books they needed for an extended time.⁴⁴ Kerr reports from English probate inventories in the 1570s and 1580s that Oxford men often had 300 or more

³⁷ Paul F Grendler, *The universities of the Italian Renaissance* (Baltimore: The Johns Hopkins University Press, 2002): 54.

³⁸ Rainer A. Müller, ‘Student education, student life’, in *A history of the university in Europe: volume II, universities in early modern Europe*, ed. Hilde De Ridder-Symoens, (Cambridge, Cambridge University Press, 1996): 326-354 at 345.

³⁹ Christopher Stray, ‘The shift from oral to written examination: Cambridge and Oxford 1700–1900’, *Assessment in Education: Principles, Policy & Practice* 8 (2001): 37.

⁴⁰ p 92 James Raven, (2007) *The business of books: booksellers and the English book trade 1450-1850* (New Haven and London: Yale University Press, 2007): 83, 91-92.

⁴¹ N.R. Ker, ‘The provision of books’, in *The history of the University of Oxford volume III: the collegiate university*, ed. James McConica (Clarendon Press: Oxford, 1968): 441-477, at 477.

⁴² Alan B. Cobban, *The medieval English universities: Oxford and Cambridge to c. 1500* (Aldershot: Scholar Press, 1988): 386.

⁴³ Ker, ‘The provision of books’, 477.

⁴⁴ Cobban, *The medieval English universities*: 386.

books.⁴⁵ Also by the sixteenth century universities started establishing libraries, complementing those of their colleges, and nearly every new university had a public library.⁴⁶ Uppsala University was an exception; it was founded in 1477 but did not get a library until 1620.⁴⁷ In 1412 Oxford established the new office of librarian, fulfilled by the chaplain. Cambridge also made the chaplain responsible for the library in the fifteenth century but this position was abolished in 1570 and in 1577 Cambridge established the new office of university librarian.⁴⁸ The function of the librarian was mostly performed by a professor, fellow or even a graduate student as a separate job.⁴⁹ In 1650 The Scottish Calvinist John Durie (1596–1680) published a short treatise on the function of the ‘library-keeper’ in which he argued that one of his duties should be to give an annual account of his acquisitions which Durie described as the ‘stock of learning’.⁵⁰ However, the University of Leuven still claimed in 1639 that it was unnecessary to have a library ‘because the professors were walking libraries’.⁵¹

Libraries obtained books by gifts, bequests, purchase and also from printers’ compulsory deposits. In 1537 Francis I of France required printers to lodge a copy all books they printed with the royal library and that other princes quickly followed. In 1610 Oxford’s Bodleian Library had an agreement with the Stationers’ Company for a free copy of every book entered in the Stationers’ registers and the *Press Licensing Act* of 1662 and subsequently the *Copyright Act* of 1709 required free deposits with the royal library and the libraries of Oxford, Cambridge and later the Scottish universities of St Andrews, Glasgow, Aberdeen and Edinburgh.⁵² Libraries’ collections of books thus greatly expanded with the introduction of printing which led to a lack of space in what Kerr writes ‘were still medieval library rooms’: ‘The problem was solved by Merton in 1589 by putting the books on horizontal shelves instead of sloping lectern desks, and similarly in other colleges more or less soon thereafter’.⁵³ Nonetheless, De Ridder-Symoens reports that chains were still used in some libraries ‘well into the eighteenth century’.⁵⁴

Libraries were closed to undergraduates who at Cambridge were subject to a fine even for entering them in the early seventeenth century.⁵⁵ De Ridder-Symoens argues

⁴⁵ N.R. Ker, ‘The provision of books’, 477.

⁴⁶ Hilde De Ridder-Symoens, ‘Management and resources’, in *A history of the university in Europe: volume II, universities in early modern Europe*, ed. De Ridder-Symoens, Hilde (Cambridge: Cambridge University Press, 1996): 154-209, at 195.

⁴⁷ Andrew Pettegree, *The book in the Renaissance* (New Haven and London: Yale University Press, 2010): Kindle location 6052.

⁴⁸ Cobban, *The medieval English universities*: 94.

⁴⁹ De Ridder-Symoens, ‘Management and resources’, 199.

⁵⁰ Peter Burke, *A social history of knowledge: from Gutenberg to Diderot* (Cambridge: Polity Press, 2000): 114.

⁵¹ Burke, *A social history of knowledge*, 56.

⁵² Hilde De Ridder-Symoens, ‘Management and resources’, in *A history of the university in Europe: volume II, universities in early modern Europe*, ed. Hilde De Ridder-Symoens, (Cambridge: Cambridge University Press, 1996): 154-209 at 198.

⁵³ N.R. Ker, ‘The provision of books’, in *The history of the University of Oxford volume III: the collegiate university*, ed. James McConica (Oxford: Clarendon Press, 1968): 441-477, at 441.

⁵⁴ De Ridder-Symoens, ‘Management and resources’, 201.

⁵⁵ Jefferson Looney, ‘Undergraduate education at early Stuart Cambridge’, *History of Education: Journal of the History of Education Society* 10 (1981): 9-19 at 15; Hilde De Ridder-Symoens, ‘Management and resources’, in *A History of the university in Europe: volume II, universities in early modern Europe*, ed. Hilde De Ridder-Symoens (Cambridge:

that with the partial exception of Oxford's Bodleian 'right up to the eighteenth century nearly all university libraries remained small and of little importance'.⁵⁶ And while the Bodleian's collection was sizeable and recent in 1625, it did not reflect at least Oxford's art curriculum at the time, leading Maclean to suggest that 'the Bodleian Library was seen to be somewhat distanced from the immediate pedagogical concerns of the University'.⁵⁷ Indeed, Pettegree observes that 'the library had struggled to find a role in the new age of print'.⁵⁸

Printing thus transformed libraries: their lending, collecting, cataloguing and storage of books. However, libraries were not important parts of universities until after their curriculum and pedagogy had changed in response to the ready availability of books. Developing libraries' pedagogical role was an outcome of printing, but was not achieved until more than two and a half centuries after the introduction of print.

Curriculum

The relative scarcity of manuscript books limited universities' curriculum in two ways: their subjects and their organisation. There were few key texts to be studied so universities studied many of the same texts and thus followed much the same curriculum. Burke states that from Coimbra to Cracow universities' curriculum 'was remarkably uniform, thus allowing students to move with relative ease from one institution to another (a practice known as the *peregrinatio academica*).⁵⁹ Grendler argues similarly.⁶⁰ Secondly, each course of lectures was limited to an intensive examination of just one text or part of a text.

Eisenstein notes that printing not only made existing books much cheaper, it also made it economic to increase greatly the number of different texts. Instead of a master having to concentrate on one text in a series of lectures and analyse just it in great and exclusive depth, it was now much easier to compare different authorities.⁶¹ This supported the development of a new organisation of the curriculum pioneered by the Jesuits which surveyed different authorities on one subject rather than one authority possibly on different subjects.⁶² Brockliss states that from the end of the sixteenth century there was a gradual abandonment of the traditional method of teaching the standard texts. He gives the example of Padua between 1540 and 1768 which did not follow the order in which the *Justinian Code*, for example, was compiled, but offered a

Cambridge University Press, 1996): 154-209 at 201; James McConica, 'The rise of the undergraduate college', in *The history of the University of Oxford volume III: the collegiate university*, ed. James McConica (Cambridge: Clarendon Press, 1986): 1-68 at 67.

⁵⁶ De Ridder-Symoens, 'Management and resources', 197.

⁵⁷ Ian Maclean, *Learning in the market place: essays in early modern book history* (Leiden: Brill, 2009), 20.

⁵⁸ Andrew Pettegree, *The book in the Renaissance* (New Haven and London: Yale University Press, 2010), Kindle location 5873.

⁵⁹ Peter Burke, *A social history of knowledge: from Gutenberg to Diderot* (Cambridge: Polity Press, 2000): 91.

⁶⁰ Paul F. Grendler, *The universities of the Italian Renaissance* (Baltimore: The Johns Hopkins University Press, 2002): 148.

⁶¹ Elizabeth L. Eisenstein, *The printing press as an agent of change: communications and cultural transformations in early modern Europe: volumes I and II* (Cambridge: Cambridge University Press, 1997 [1979]: 432.

⁶² Grendler, *The universities of the Italian Renaissance*, 482.

course specifically in criminal law based extracts of texts from the *Digest* and the *Code*.⁶³

Universities' arts curriculum changed substantially from the middle of the fifteenth century to the sixteenth century which may be described broadly as the replacement of medieval logic and scholastic philosophy with humanist logic and *litterae humaniores*.⁶⁴ Grafton and Jardine observe more specifically a change in the method of reasoning and the method of teaching following Ramus. They also observe a change in the ends of education by 1550, 'part of the gradual shift from humanism as the practice of an exemplary individual, to humanism as an institutionalised curriculum subject – a distinctive discipline in the arts', in which 'humanism' became 'the humanities'.⁶⁵ But while printing spread Humanism probably more widely and certainly faster than was achieved in the manuscript era – Erasmus was a bestselling author in the sixteenth century as well as Luther – Humanism and its consequent changes to universities' curriculum were not a result of printing since Humanist thought was spreading, perhaps slowly, throughout universities during the manuscript era. Ong argues that printing reduced universities' effort in oral rhetoric.⁶⁶

Printing thus had a major role in changing universities' curriculum, broadly, from one organised around authorities who addressed various subjects, to more diverse curricula organised around subjects which were informed by various authorities. But the subjects studied in universities were changing anyway during the early modern period due to broader intellectual movements which emerged before printing which printing extended and amplified, but did not change fundamentally.

Pedagogy

While educational institutions were increasingly differentiated in the later Middle Ages after the thirteenth century, the curriculum was not explicitly sequenced by level.⁶⁷ Accordingly Eisenstein notes that during the middle ages the *trivium* and *quadrivium* disciplines could be taught at both elementary and advanced levels to young and mature

⁶³ Laurence Brockliss, 'Curricula', in *A history of the university in Europe: volume II, universities in early modern Europe*, ed. Hilde De Ridder-Symoens, (Cambridge: Cambridge University Press, 1996): 563-620 at 600.

⁶⁴ Damian Riehl Leader, 'Professorships and academic reform at Cambridge: 1488-1520', *The Sixteenth Century Journal* 14 (1983): 215-227 at 218; Damian Riehl Leader, 'Teaching in Tudor Cambridge', *History of Education: Journal of the History of Education Society* 13 (1984): 105-119 at 105; James McConica, 'The rise of the undergraduate college', in *The history of the University of Oxford volume III: the collegiate university*, ed. James McConica (Cambridge: Clarendon Press, 1986): 1-68 at 65; James McConica, 'Elizabethan Oxford: the collegiate society', in *The history of the University of Oxford volume III: the collegiate university*, ed. James McConica (Cambridge: Clarendon Press, 1986): 645-732 at 708.

⁶⁵ Anthony Grafton and Lisa Jardine, *From Humanism to the humanities: education and the liberal arts in fifteenth- and sixteenth century Europe* (Cambridge, Massachusetts: Harvard University Press, 1986): 124, 162, 168.

⁶⁶ Walter J. Ong, *Orality and literacy. The technologizing of the world* (London and New York: Routledge, 2003 [1982]): 127.

⁶⁷ Rainer Christoph Schwinges, 'Admission', in *A history of the university in Europe: universities in the Middle Ages*, volume I, ed. Hilde De Ridder-Symoens, (Cambridge: Cambridge University Press, 1992): 171-194 at 175.

students.⁶⁸ Printing made it feasible and indeed profitable to produce texts of graded difficulty instead of having just one introductory text on grammar or logic. Textbooks were newly designed to take students in sequence from the most elementary to the most advanced level of a subject. For example, Eisenstein reports that the Welsh physician and mathematician Robert Recorde (c. 1512–1558) wrote a carefully ordered sequence of textbooks which took the reader from the ‘grounde of arts’ along the ‘pathway to knowledge’ to the ‘castle of knowledge’.⁶⁹ The availability of multiple texts supported the division of classes by level of attainment and the sequencing of the curriculum by level of difficulty.⁷⁰ In the Middle Ages languages curricula were structured on the parts of speech: students would first learn completely how to conjugate and decline, and then proceed to study syntax. In the 1520s in Paris a small group of teachers started teaching languages from the simplest to the most difficult grammatical elements, demonstrating their use in classical texts and getting students to practice them with oral exercises and prose compositions. They divided the course into classes according to level of competence. This entirely novel form of instruction was known as the *modus Parisiensis*.⁷¹

One might expect that the greatly increased availability of books would reduce the emphasis on memorisation inherited from Medieval pedagogy. Indeed, the Venetian Humanist and editor Hieronimo Squarciafico argued in 1477 that the ‘abundance of books makes men less studious’, enfeebling the mind by relieving it of the exercise of memory.⁷² Plato made the same criticism of writing in *Phaedrus*.⁷³ But memorisation was still important in the early seventeenth century. Many student manuscripts from early seventeenth century Paris contain identical full text of a course of lectures, indicating that these lecture notes were taken by dictation. Blair argues that dictation became the accepted norm for teaching in the arts faculties: ‘Student note-taking was thought to aid the memory in two different ways: not only by creating a written record to return to, but also by forcing the mind to dwell on the material and to retain better what was read or heard by writing it down. Francesco Sacchini [1570-1625] and Jeremias Drexel [1581–1638], the Jesuit authors of the two most reprinted manuals on note-taking, make this point repeatedly’.⁷⁴ University authorities may also have insisted

⁶⁸ Elizabeth L. Eisenstein, *The printing press as an agent of change: communications and cultural transformations in early modern Europe*: volumes I and II (Cambridge: Cambridge University Press, 1997 [1979]): 432.

⁶⁹ Eisenstein, *The printing press as an agent of change*, 432.

⁷⁰ James McConica, ‘The rise of the undergraduate college’, in *The history of the University of Oxford volume III: the collegiate university*, ed. James McConica (Oxford: Clarendon Press, 1986): 1-68 at 65.

⁷¹ Laurence Brockliss, ‘Curricula’, in *A History of the university in Europe: volume II, universities in early modern Europe*, ed. Hilde De Ridder-Symoens (Cambridge: Cambridge University Press, 1996): 563-620 at 572.

⁷² Martin Lowry, *The world of Aldus Manutius: business and scholarship in Renaissance Venice* (Ithaca, NY: Cornell University Press, 1979): 31-2, cited by Walter J. Ong, *Orality and literacy. The technologizing of the world* (London and New York: Routledge, 2003 [1982]): 79.

⁷³ Plato, ‘Phaedrus’, *Plato in twelve volumes*, volume 9, trans. Harold N. Fowler (Cambridge, MA: Harvard University Press; London: William Heinemann Ltd, 1925, <http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.01.0174%3Atext%3DPhaedrus%3Apage%3D274> (accessed 18 July 2012).

⁷⁴ Ann Blair, ‘Student manuscripts and the textbook’ in *Scholarly knowledge. Textbooks in early modern Europe* ed. Emidio Campi, Simone De Angelis, Anja-Silvia Goeing and Anthony Grafton, (Geneva: Librairie Droz, 2008): 39-72 at 49-50, 64.

that when presenting themselves for their degree candidates show evidence of taking dictation at lectures as a way of maintaining attendance at lectures or checking the orthodoxy of the lectures students attended. In about 1700 a commission of the University of Paris inspected a master's *cahiers* (a dictated transcription of his lectures) to ensure that he was conforming to the Aristotelian orthodoxy.⁷⁵

At least some Medieval universities had '*cursorie*' or cursory lectures in which bachelors read set texts to undergraduates to take notes or dictation.⁷⁶ At least some universities had dictation sessions (*pronunciare*).⁷⁷ Fletcher argues that Oxford University's statute imposing on bachelors a duty to give cursory lectures on texts required by undergraduates had ancient origins recognised by an alternative phrase often used to describe admission to the Bachelor of Arts: 'to be admitted to read some book of the faculty of arts' (*admitti ad lecturam alicuius libri facultatis atrium*).⁷⁸ Cursory lectures were necessary when undergraduates did not have access to set texts because manuscripts were far too expensive to be afforded by most students.⁷⁹ Printing greatly increased the availability and affordability of texts, thus removing the need for cursory lectures.⁸⁰ Cursory lectures were therefore ended at Oxford at least by 1584.⁸¹

Masters at all Medieval universities offered at least one other type of lecture, '*cum questionibus*' – with questions, or expository lectures which posed problems and questions arising from the text. In lectures *cum questionibus* the master might begin by reading out the section of the text to be discussed in the lecture, followed by a brief general explanation of its meaning. He (all masters and students were men until the modern period) would then analyse each word of the text, explaining grammatical, rhetorical, historical and interpretive points and debating key points.⁸² Durkheim states that masters delivered another type of lecture, the *exposito*, which was restricted to

⁷⁵ Laurence Brockliss, 'The moment of no return: the University of Paris and the death of Aristotelianism', *Science & Education* 15 (2006):259-278 at 268.

⁷⁶ Damian Riehl Leader, *A history of the University of Cambridge: volume 1, the university to 1546* (Cambridge: Cambridge University Press, 1988): 32; John M. Fletcher, 'The teaching of arts at Oxford, 1400-1520', *Paedagogica Historica: International Journal of the History of Education* 7 (1967), no. 1-2: 421; J.I. Katto, 'Wyclif and Wycliffism at Oxford 1356-143' in *The history of the University of Oxford volume II: Late Medieval Oxford* ed. J.I. Catto and T.A.R. Evans (Oxford: Clarendon Press, 1992), 175-261 at 196.<http://ukcatalogue.oup.com/product/9780199510122.do>

⁷⁷ Christoph Rainer Schwinges, 'Student education, student life', in *A History of the university in Europe: universities in the Middle Ages*, volume I, ed. Hilde De Ridder-Symoens (Cambridge: Cambridge University Press, 1992): 195-243 at 232.

⁷⁸ J.M Fletcher, 'Developments in the Faculty of Arts 1370-1520', in *The history of the University of Oxford volume II: Late Medieval Oxford*, ed. J.I. Catto and T.A.R. Evans (Oxford: Clarendon Press, 1992), 315-345 at 330.

⁷⁹ J.M. Fletcher, 'The Faculty of Arts', in *The history of the University of Oxford volume III: the collegiate university*, ed. James McConica (Oxford: Clarendon Press, 1986), 157-199 at 167.

⁸⁰ Mark Curtis, *Oxford and Cambridge in transition 1558-1642: an essay on changing relations between the English universities and English society* (Oxford: Clarendon Press, 1959), page 100.

⁸¹ Fletcher, 'Developments in the Faculty of Arts 1370-1520', 331; John M. Fletcher, 'The teaching of arts at Oxford, 1400-1520', *Paedagogica Historica: International Journal of the History of Education* 7 (1967): 427.

⁸² Paul F. Grendler, *The universities of the Italian Renaissance*, (Baltimore: The Johns Hopkins University Press, 2002): 241; Emile Durkheim, *The evolution of educational thought. Lectures on the formation and development of secondary education in France*, translated by Peter Collins, (Abingdon: Routledge, 2006 [1902]): 141.

elucidating the arguments of the author being presented. Durkheim observes that *exposito* lectures fell into disuse. He cites Cardinal D'Estouville who in 1452 reminded teachers at the University of Paris that they ought to expound Aristotle's text point by point, which Durkheim argues demonstrates that this kind of exposition was being neglected.⁸³

Mercuriale's (1530–1606) lectures in practical medicine at Padua broadly adopted the traditional practice of following the sequence of topics in the assigned texts, but rather than providing the traditional textual commentary he gave a general discussion of the subject matter, thus adopting innovative trends in medical pedagogy.⁸⁴ Mercuriale seems to have been part of a transition to a new method of lecturing adopted in the late sixteenth and early seventeenth centuries. Brockliss observes:

Although Aristotle was retained, professors agreed that his *oeuvre* could no longer be treated as if it were some vast diamond mine full of individual uncut gems that the exegete might extract, polish and display according to whim. Instead, the professor was expected to treat the Aristotelian text as an integrated whole, outlining its general argument, proceeding through it in order, and expiating at length only the significant points that the master raised.⁸⁵

While this new lecturing style was adopted a century and more after Gutenberg, it responded to Humanists' trenchant and sustained criticisms of the scholastic method rather than to the introduction of printing *per se*.

One should not assume that classic texts in a familiar modern form were available soon after the spread of printing. Leonhardt reports that there were, surprisingly in his view, almost no bound editions of ancient literature printed for scholars or libraries between 1480 and 1515 in at least German cities, which of course were the home of printing. 'Rather, what we find, almost without exception, are very limited editions of texts quite obviously intended for use in the classroom, generally in the form of "lecture texts" with large interlinear spacing and wide margins.'⁸⁶ Grafton and Jardine describe 'a large number of ephemeral editions, pamphlet-sized and unpretentious, were run off to meet students' needs'.⁸⁷

Less surprisingly, Füßel reports that it was difficult to obtain Greek and Hebrew texts for teaching for a long time: 'In 1524 Melanchthon had access to just a single copy for his lectures on Demosthenes, from which he had to dictate a few lines at the start of

⁸³ Emile Durkheim, *The evolution of educational thought. Lectures on the formation and development of secondary education in France*, trans. by Peter Collins (Abingdon: Routledge, 2006 [1902]): 141.

⁸⁴ Nancy G. Siraisi, 'Medicina practica. Girolamo Mercuriale as teacher and textbook author', in *Scholarly knowledge. Textbooks in early modern Europe*, ed. Emidio Campi, Simone De Angelis, Anja-Silvia Goeing and Anthony Grafton (Geneva: Librairie Droz, 2008): 288-305 at 289.

⁸⁵ Laurence Brockliss, 'Curricula', in *A history of the university in Europe: volume II, universities in early modern Europe*, ed. Hilde De Ridder-Symoens, (Cambridge, Cambridge University Press, 1996): 563-620, at 580, 597.

⁸⁶ Jürgen Leonhardt, 'Classics as textbooks. A study of the humanist lectures on Cicero at the University of Leipzig, ca. 1515', in *Scholarly knowledge. Textbooks in early modern Europe*, ed. Emidio Campi, Simone De Angelis, Anja-Silvia Goeing and Anthony Grafton (Geneva: Librairie Droz, 2008): 90-112, at page 105.

⁸⁷ Anthony Grafton and Lisa Jardine, *From Humanism to the humanities: education and the liberal arts in fifteenth- and sixteenth century Europe* (Cambridge, Massachusetts: Harvard University Press, 1986): 111.

each lecture in order to be able to comment on them.’⁸⁸ Students of Camerte at Florence (in 1494?) did not have copies of his texts. Grafton and Jardine report that ‘as late as 1572 students in the Collège de Reims in Paris were trying to follow Claude Mignault’s lectures on Demosthenes on the basis of printed texts that disagreed with the one that he was using, so that his parsings did not fit the verbs in front of them.’⁸⁹ A friend of the Flemish grammarian Clenardus (1495–1542) who was teaching Greek at Salamanca sought Clenardus’ advice on his plan to teach Demosthenes *On the crown*. Clenardus advised him to reconsider –

The speech is long, and there are others you might be able to teach without boring the students so much. They do like short texts. I cannot understand why you do not teach Plato’s *Laws*, since you have fifty copies of it. It is easier, and more fun, and would get you more students. Besides, I do not think that you have fifty copies of Demosthenes there. Do not worry about the size of the work. You only have to teach one or two books of it.⁹⁰

As Grafton and Jardine who cite this correspondence note, ‘This is the language of classroom pragmatism with which any practising teacher would be familiar’.⁹¹ It also indicates the extent to which that pragmatism was shaped by the availability of texts, even more than half a century after the invention of printing. Masters continued to dictate at least some of their lectures, perhaps partly due to the patchy availability of standard texts but also presumably as a conservative hangover from earlier times when dictation was necessary. Müller reports that despite criticism dictation (*pronunciare ad pennam*) remained common during lectures until well into the eighteenth century.⁹²

Some contemporaries suggested that even expository lectures would be made redundant by printing. Autodidacticism or at least the pretence of autodidacticism was one of the points raised by the Benedictine scribe Filippo de Strata in his *Polemic against printing* published in 1473.⁹³ In 1483 the Augustinian biblical scholar Jacobo Filippo Foresti da Bergamo (1434–1520) in his oft reprinted *Supplementum Chronicarum* asked: ‘Why should old men be preferred to their juniors now that it is

⁸⁸ Stephan Füssel, *Gutenberg and the impact of printing*, trans. Douglas Martin (Aldershot: Ashgate Publishing, 2005 [1999]): 106.

⁸⁹ Anthony Grafton and Lisa Jardine, *From Humanism to the humanities: education and the liberal arts in fifteenth- and sixteenth century Europe* (Cambridge, Massachusetts: Harvard University Press, 1986): 111.

⁹⁰ Grafton and Jardine, *From Humanism to the humanities*, 112.

⁹¹ Grafton and Jardine, *From Humanism to the humanities*, 113.

⁹² Rainer A. Müller, ‘Student education, student life’, in *A history of the university in Europe: volume II, universities in early modern Europe*, ed. Hilde De Ridder-Symoens (Cambridge: Cambridge University Press, 1996): 326–354 at 344.

⁹³ ‘This is what the printing presses do: they corrupt susceptible hearts. The silly asses do not see this, and brutes rejoice in the fraudulent title of teachers, exalting themselves with a song like this (be so good as to listen): “O good citizen, rejoice: your city is well stuffed with books. For a small sum, men turn themselves into doctors in three years. Let thanks be rendered to the printers!” Any uncultured person without Latin bawls these things.’ Filippo de Strata, *Polemic against printing*, trans. Shelagh Grier with an introduction by Martin Lowry (Birmingham: Hayloft Press, 1986), cited in Andrew Pettegree, *The book in the Renaissance* (New Haven and London: Yale University Press, 2010): Kindle location 989.

possible for the young by diligent study to acquire the same knowledge?⁹⁴ In the second half of the sixteenth century Isaac Joubert, who taught medicine at Montpellier University, edited a new French edition of Guy de Chauliac's *Inventarium sive chirurgia magna* (Great inventory of surgery) so that 'those who have a natural bent for the surgeon's calling' could take advantage of 'books which are silent instructors' and 'nowadays carry farther than public lectures'.⁹⁵ Yet lectures *cum questionibus* persisted after printed books became ubiquitous despite problems with attendance (then, as ever!).⁹⁶

So printing led to important changes in pedagogy in the sequencing of the curriculum in schools and universities. But it did not revolutionise university teaching by, for example, replacing lecturers or their lectures.

Assessment

To be admitted to a degree Medieval students had to attend prescribed lectures and possibly *repetitiones* wherein masters recapitulated and explained the preceding day's lectures, and some statutes prescribed exercises such as the *repetitio* (memorization) and *resumptio* (recapitulation) of earlier material.⁹⁷ But the most important form of assessment was the disputation, which may have developed out of *quaestiones* – lectures in which masters debated contested propositions in texts they were expounding.⁹⁸ Disputations were required not only of bachelors, masters and doctoral candidates but professors were also expected to dispute as part of their scholarly duties.⁹⁹ Durkheim quotes the Valencian Humanist Juan Luis Vives (1493–1540) writing in 1531 that 'They debate during dinner, they debate after dinner; they debate in public, in private, everywhere all the time', although this was probably coloured by

⁹⁴ Cited in Elizabeth L. Eisenstein, *The printing press as an agent of change: communications and cultural transformations in early modern Europe*: volumes I and II (Cambridge: Cambridge University Press, 1997 [1979]): 66.

⁹⁵ Charles Sherrington, *The endeavour of Jean Fernel* (Cambridge: Cambridge University Press, 1946): 111, cited in Eisenstein, *The printing press as an agent of change*: 539.

⁹⁶ Mark Curtis, *Oxford and Cambridge in transition 1558-1642: an essay on changing relations between the English universities and English society* (Oxford: Clarendon Press, 1959): 97; Damian Riehl Leader, *A history of the University of Cambridge. Volume 1 the university to 1546* (Cambridge: Cambridge University Press, 1988): 246.

⁹⁷ Damian Riehl Leader, *A history of the University of Cambridge: volume 1, the university to 1546* (Cambridge: Cambridge University Press, 1988): 261; Rainer A Müller, 'Student education, student life', in *A History of the university in Europe: volume II, universities in early modern Europe*, ed. Hilde De Ridder-Symoens (Cambridge: Cambridge University Press, 1996): 326-354 at 345.

⁹⁸ Damian Riehl Leader, *A history of the University of Cambridge: volume 1, the university to 1546* (Cambridge: Cambridge University Press, 1988): 261, 287; Emile Durkheim, *The evolution of educational thought. Lectures on the formation and development of secondary education in France*, trans. Peter Collins (Abingdon: Routledge, 2006 [1902]): 142; Paul F Grendler, *The universities of the Italian Renaissance* (Baltimore: The Johns Hopkins University Press, 2002): 152; Herbert S. Matsen, 'Students' "Arts" disputations at Bologna around 1500, illustrated from the career of Alessandro Achillini (1463-1512)', *History of Education: Journal of the History of Education Society* 6 (1977): 169-181 at 170.

⁹⁹ Grendler, *The universities of the Italian Renaissance*, 177; John M. Fletcher, 'The teaching of arts at Oxford, 1400-1520', *Paedagogica Historica: International Journal of the History of Education* 7 (1967): 417-454 at 448.

Vives' strong opposition to scholasticism.¹⁰⁰

Disputations followed a common form throughout Europe: an opponent (*opponens*) advanced a proposition and defended it, then the respondent (*respondens*) challenged the opponent's position. The opponent and respondent exchanged arguments, which might be joined by any graduate who chose to intervene. A disputation might last for two hours or more.¹⁰¹ Some accounts mention a 'replicator' who delivered a *determination* or 'summed up the disputation and awarded praise or blame'.¹⁰² In 1669 Oxford's disputation questions and the position to be adopted by the *opponens* included in medicine 'Do contraries best cure contraries? Affirmative.', in philosophy 'Is knowledge reminiscence? Negative.' and 'Are the planets inhabitable? Negative.'; and in 1693 in philosophy 'Is the world made of atoms? Negative.', and 'Is the safety of the State the supreme law? Affirmative.'. ¹⁰³ There were three types of disputation: the big weekly disputation the *disputatio ordinaria*, the *disputatio de quodlibet* (about anything) held once or twice a year and the disputations for beginners, the *simplices*.¹⁰⁴

Bachelor disputants in theology at Paris in the second half of the fourteenth century exchanged their points in writing.¹⁰⁵ But most disputations were oral, public and were well attended, being popular as a form of scholarly jousting.¹⁰⁶ Assessment was not by an individual examiner but was the communal or collective responsibility of the masters attending.¹⁰⁷ Disputations enabled junior students to get a sense both of how their major form of assessment was conducted and the level required to perform passably and with distinction.¹⁰⁸ Trinity College, Cambridge's statutes of 1560 indicate that by then its fellowship examination contained a written element.¹⁰⁹ But oral disputations remained the main form of assessment until at least the end of the sixteenth century. A professor of the University of Siena advocated the benefits of disputations in

¹⁰⁰ Durkheim, *The evolution of educational thought*, 142.

¹⁰¹ Christopher Stray, 'The shift from oral to written examination: Cambridge and Oxford 1700–1900', *Assessment in Education: Principles, Policy & Practice* 8 (2001): 33–50 at 34.

¹⁰² Alan R. Perreiah, 'Logic examinations in Padua circa 1400', *History of Education: Journal of the History of Education Society* 13 (1984): 85–103 at 97; John M. Fletcher, (1967) 'The teaching of Arts at Oxford, 1400–1520', *Paedagogica Historica: International Journal of the History of Education* 7 (1967): 417–454 at 446; Rainer A. Müller, 'Student education, student life', in *A history of the university in Europe: volume II, universities in early modern Europe*, ed. Hilde De Ridder-Symoens, (Cambridge: Cambridge University Press, 1996): 326–354 at 345; Alan B. Cobban, *The medieval English universities: Oxford and Cambridge to c. 1500* (Aldershot: Scholar Press, 1988): 171.

¹⁰³ Keith Hoskin, 'The examination, disciplinary power and rational schooling', *History of Education: Journal of the History of Education Society* 8 (1979): 135–146 at 139.

¹⁰⁴ Rainer Christoph Schwinges, 'Student education, student life', in *A history of the university in Europe: universities in the Middle Ages*, volume I, ed. Hilde De Ridder-Symoens, (Cambridge: Cambridge University Press, 1992): 195–243 at 232–233.

¹⁰⁵ Alan R. Perreiah, 'Logic examinations in Padua circa 1400', *History of Education: Journal of the History of Education Society* 13 (1984): 85–103 at 99.

¹⁰⁶ Paul F. Grendler, *The universities of the Italian Renaissance* (Baltimore: The Johns Hopkins University Press, 2002): 285; Walter J. Ong, *Orality and literacy. The technologizing of the world* (London and New York: Routledge, 2003 [1982]): 113.

¹⁰⁷ Christopher Stray, 'The shift from oral to written examination: Cambridge and Oxford 1700–1900', *Assessment in Education: Principles, Policy & Practice* 8 (2001): 33–50 at 47.

¹⁰⁸ Damian Riehl Leader, *A history of the University of Cambridge. Volume 1 the university to 1546* (Cambridge: Cambridge University Press, 1988): 95–107.

¹⁰⁹ Stray, 'The shift from oral to written examination', 36.

1578 and a commentator defended disputations in 1588.¹¹⁰ Disputations became perfunctory by the eighteenth century and they were ended in Cambridge's arts faculty in 1839 and in divinity, law and physics in 1858.¹¹¹

Disputations fell into disuse because they were unsuitable for the mathematical curriculum adopted first at Cambridge from Newton's influence; they were unsuitable to class, classify or rank at least the leading candidates as became the practice, again first at Cambridge; and because they could not handle the increasing number of candidates being examined.¹¹² The modern written examination may be 'one of the most significant transformations in the history of educational practice' as Hoskin claims, but its introduction owes little if any to the direct impact of printing.¹¹³ But it may be an indirect result of printing.

Durkheim argues that scholarly disputation was not just a form of assessment and still less was it an arid scholastic exercise, but was the best method for testing knowledge claims in the Middle Ages.¹¹⁴ Thus the Saxon theologian Hugh of St Victor (c. 1096-1141) argued that logic should be the first of the seven liberal arts because it 'provides ways of distinguishing between modes of argument and the trains of reasoning themselves . . . It teaches the nature of words and concepts, without both of which no treatise of philosophy can be explained rationally'.¹¹⁵ Eisenstein argues that printing enabled the accurate reproduction of formulae, tables of figures, diagrams, illustrations and maps and hence was crucial to the emergence of the scientific revolution.¹¹⁶ It may therefore be possible to argue that printing fostered replacement of the scholastic epistemology of the Middle Ages with the modern scientific method and therefore indirectly changed universities' curriculum and assessment.

Conclusion

It is hard to overestimate the importance of printing to society as a whole. Conversely, printing has had such profound and widespread effects that it is hard to identify its effects and appreciate the nature and extent of the changes from a manuscript to print society. Manuscripts were – and still are – rare as well as extremely expensive. Even maintaining the existing store of recorded knowledge in manuscript required a major investment of resources, organisation and effort. Most of the dissemination of the knowledge recorded in manuscripts was not by their copying and distribution to

¹¹⁰ Grendler, *The universities of the Italian Renaissance*, 153.

¹¹¹ Christopher Stray, 'The shift from oral to written examination: Cambridge and Oxford 1700–1900', *Assessment in Education: Principles, Policy & Practice* 8 (2001): 33-50 at 38.

¹¹² Stray, 'The shift from oral to written examination', 33-50; Roy Porter, 'The scientific revolution and universities', in *A history of the university in Europe: volume II, universities in early modern Europe*, ed. De Ridder-Symoens, Hilde (Cambridge: Cambridge University Press, 1996): 531-562 at 558.

¹¹³ Keith Hoskin, 'The examination, disciplinary power and rational schooling', *History of Education: Journal of the History of Education Society* 8 (1979): 135-146 at 135.

¹¹⁴ Emile Durkheim, *The evolution of educational thought. Lectures on the formation and development of secondary education in France*, trans. Peter Collins (Abingdon: Routledge, 2006 [1902]: 152.

¹¹⁵ Toby E Huff, *The rise of early modern science: Islam, China, and the West* (Cambridge, Cambridge University Press, 1993): 229.

¹¹⁶ Elizabeth L. Eisenstein, *The printing press as an agent of change: communications and cultural transformations in early modern Europe: volumes I and II* (Cambridge: Cambridge University Press, 1997 [1979]): 507.

individual readers, but by one person – usually a cleric – reading or recounting their contents to an audience. Manual copying of manuscripts was not only slow and expensive, but also uncertain. The dissemination of knowledge, either by reciting or copying manuscripts, introduced errors and inaccuracies which were repeated and multiplied in subsequent retellings and copies. Science was particularly inhibited since inaccuracies were often introduced into copies of formulae, tables of figures, diagrams, illustrations and maps.

Printing most obviously greatly increased the number of books available. Buringh and van Zanden estimate that about 2.7 million books were produced in western Europe in the fourteenth century, 50 years before Gutenberg. This increased by almost 100 times to 217.4 million some 50 years after Gutenberg in the sixteenth century.¹¹⁷ The number of books produced in Europe increased from about 508 per million people in the fourteenth century to 4,000 per million people in the second half of the fifteenth century and 17,500 per million people in the first half of the sixteenth century.¹¹⁸ Printing correspondingly greatly cut the cost and price of books between 1460 and 1800. Estimates of printing's saving in the cost of books by the end of the eighteenth century range from two thirds¹¹⁹ to ninety percent.¹²⁰

Printing transformed Europe, in multiple ways. With the advent of printing people could read books for themselves rather than have them read or retold to them. Printing is therefore central to the Reformation which emphasised the penitent reading the bible for themselves rather than through the mediation of priests and the Catholic church. Some languages that were written in manuscripts in the Middle Ages such as Provençal and Irish were not promulgated by printers who achieved greater efficiencies and profits by having bigger editions in fewer languages, and these unfavoured languages withered in print and eventually orally.¹²¹ The vernaculars chosen by printers became fixed, not evolving as fast as they did when they were mainly oral. Printing standardised and promulgated key vernaculars which contributed to the rise of nationalism.¹²²

The increased availability of books encouraged literacy, although of course the extent of literacy in any period before good records were kept in the nineteenth century is uncertain and much disputed. It led to the expansion of education which in turn expanded the demand for books. Yet while printing transformed society generally, the new technology was absorbed into existing university practices rather than revolutionised them. This is because as important as printing was, it did not essentially change universities' core activities of extending, testing and transferring knowledge.

¹¹⁷ Eltjo Buringh and Jan Luiten van Zanden, 'Charting the "Rise of the West": manuscripts and printed books in Europe, a long-term perspective from the sixth through eighteenth centuries, *The Journal of Economic History*, 69 (2009): 409-445, at 416-7.

¹¹⁸ Buringh and van Zanden, 'Charting the "Rise of the West"': 420-1.

¹¹⁹ Buringh and van Zanden, 'Charting the "Rise of the West"': 440.

¹²⁰ Joerg Baten and Jan Luiten van Zanden, 'The impact of human capital on early modern welfare growth, 1450-1913: book production as human capital indicator, http://www.cepr.org/meets/wkcn/1/1626/papers/van_zanden.pdf (accessed 13 April 2012): 12.

¹²¹ Lucien Febvre and Henri-Jean Martin, *The coming of the book: the impact of printing 1450-1800*, trans. David Gerard (London: Verso, 1990 [1958]): 319.

¹²² Benedict Anderson, *Imagined communities: reflections on the origin and spread of nationalism* (London: Verso, revised edition, (1991) [1983]).

Printing's changes to universities were mixed, gradual, and some were unexpected. Latin was replaced as the language of scholarship by the major vernacular languages supported by printing, but this was not complete until the eighteenth century and owed at least as much to the change of curriculum introduced by the scientific revolution as to the introduction of printing *per se*. Libraries were greatly expanded and many new libraries were established, but most university libraries remained small and relatively unimportant until the eighteenth century. Printing stimulated a new organisation of the curriculum which surveyed different authorities on one subject rather than one authority possibly on different subjects, but at least equally big curriculum changes were achieved by the Humanists, who were active in universities well before printing. Printing introduced a major change in pedagogy, the sequencing of subjects by level of difficulty, but it did not as it might be expected end dictation for memorisation until at least the early seventeenth century. 'Cursory' lectures to dictate key texts to students ended at least at Oxford at least by 1584, yet dictation within ordinary lectures persisted until well into the eighteenth century. And university lectures have been as important in the five and half centuries after the invention of printing as they presumably were for the three and a half centuries before printing.

Printing greatly expanded the provision of information but did not change the way people learn. In 1450 a few people had access to libraries in which they could read most of the key texts expounding scholarly knowledge, yet they still attended universities to acquire that knowledge. In 1650 many more people had access to many more libraries better stocked with authoritative texts yet they still needed the structured learning program and support provided by universities. Printing made learning resources more accessible, but did not thereby change its method. The replacement of oral disputations with written examinations was a major change in university assessment which arguably had many important ramifications, yet it was not a direct result of the introduction of printing.

Universities extended knowledge during the Middle Ages by reading closely and analysing the authoritative books then available, which were importantly expanded during the Renaissance. The rediscovery of original or at least much earlier versions of these texts and the rediscovery of classical texts new to European scholars facilitated a new technique for extending knowledge – what is now called 'research' – by returning *ad fontes* (back to the sources): reading and analysing authoritative texts in their initial form without subsequent glosses, preferably in their original language. By the seventeenth century a new method of natural philosophy was developed that came to be termed 'experimental philosophy'.¹²³ While printing greatly facilitated the dissemination of the newly rediscovered texts and the reproduction of scientific tables and diagrams, it did not change investigatory methods. Those changed as the result of other developments.

Universities tested knowledge claims during the Middle Ages by the scholastic method derived from Aristotle's *Analytics*.¹²⁴ This was displaced by rhetoric in the Renaissance and later by analysis and observation.¹²⁵ These developments owed even less to printing.

¹²³ Stephen Gaukroger, *The emergence of a scientific culture. Science and the shaping of modernity, 1210-1685* (Oxford: Clarendon Press, 2006): 352.

¹²⁴ Emile Durkheim, *The evolution of educational thought. Lectures on the formation and development of secondary education in France*, translated by Peter Collins, (Abingdon: Routledge, 2006 [1902]): 133-8; Gaukroger, *The emergence of a scientific culture*: 160.

¹²⁵ Andrew Pettegree, *The book in the Renaissance* (New Haven and London: Yale University Press, 2010): Kindle location 3421; Gaukroger, *The emergence of a scientific culture*: 164.

It is clear that the current information revolution is transforming society and that it is at least facilitating contemporary universities' core activities of research, teaching and serving society. But by extension from printing's effects on early modern universities, the central issue is the extent to which the current information revolution is transforming in addition to facilitating universities' core activities. Digital technologies may end printed research monographs and may even end journals, but these are methods for disseminating research results, not finding them. Likewise, online learning is a considerable advance on open learning by print and post. But thus far it is an advance in transmitting information, not teaching it.

Notes on contributor

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Gutenberg's effects on universities

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