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Introduction: Science, Technologies and Material Culture in the History of Education

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Too often the history of science and technology and the history of education have been written at a remove from each other despite being intimately connected. This state of affairs is linked to broader divisions in the history of knowledge, which has, for many years, been carved up into sections reflective of the academic subject divisions which structure modern universities and higher education in the West. Most significant here is the division of the history of knowledge into the history of science, on the one hand, and the more recent history of humanities, on the other.¹ This division is comparable with that between women's history and the history of masculinity. The history of masculinity developed in the 1990s as a conscious response to the rise of feminist and women's history in the 1970s and 80s.² Just as the history of gender has been developed to direct scholarly attention to the particular facet of identity – gender – which underlies (and brings together) both women's history and the history of masculinity, so there is a need for an overarching history of knowledge which is capable of embracing both the history of science and the history of the humanities (together, of course, with the history of the social sciences and other distinct bodies of knowledge).³

An overarching history of education, focused not so much on the history of knowledge formation as on the history of knowledge transmission and of teaching and learning, is equally needed - a history of education, broad enough to include the history of scientific instruction

¹ For the history of humanities, see Rens Bod, *A New History of the Humanities: The Search for Principles and Patterns from Antiquity to the Present* (Oxford: Oxford University Press, 2013).

² For the history of masculinity, see John Tosh, 'What Should Historians Do with Masculinity? Reflections on Nineteenth-Century Britain', *History Workshop Journal* 38 (1994): 179-202; John Tosh, 'The History of Masculinity: An Outdated Concept?' in Sean Brady and John Arnold eds. *What is Masculinity? Historical Dynamics from Antiquity to the Contemporary World* (Basingstoke: Palgrave Macmillan, 2011), 17-34.

³ See William C. Lubenow, '*Only Connect*': *Learned Societies in Nineteenth-Century Britain* (Boydell Press, 2015).

alongside the history of instruction in the arts, humanities, social sciences and other departments of knowledge. A history of education, so conceived, has the potential to be a valuable corrective to the still powerful notion of ‘two cultures’, an assumption of fundamental difference between the natural and physical sciences, on the one hand, and arts and humanities, on the other, most famously put forward by C.P. Snow in his 1959 Rede Lecture.⁴

Questioning this assumption of fundamental difference and helping to bridge the scholarly gap which still divides much work on the history of scientific instruction and the broader history of education was an important aim of the conference out of which this special issue has developed. ‘Science, Technologies and Material Culture in the History of Education,’ which was the theme of the 2015 annual conference of the History of Education Society UK, held at Liverpool Hope University, was chosen with the aim of highlighting the importance, not only of science and scientific approaches to education, but also of the roles which applied science (in the form of technologies) and material culture have played in shaping educational experiences and practices in the past.

From its beginnings in the 1960s, the history of science (and science and technology studies, more broadly) has been strongly inflected by the parallel development of women’s history. Some of the most significant work which has sought to draw connections between the history of science and the history of education has focused on questions of gender, in particular, of women’s roles in scientific instruction and the kinds of science education available to women and girls in different historical periods.⁵ Two of the three keynote papers delivered at the

⁴ C.P. Snow, *The Two Cultures and the Scientific Revolution: The Rede Lecture, 1959* (University Press, 1959).

⁵ See, for example, Ruth Watts, ‘Science and Women in the History of Education: Expanding the Archive’, *History of Education* 32, no. 2 (2003): 189–199; Ruth Watts, *Women in Science: A Social and Cultural History* (Abingdon: Routledge, 2007).

conference in November 2015 focused on these questions – papers by Ruth Watts and Claire Jones – and versions of these papers appear as the first two articles in this special issue.

In her article, Ruth Watts examines the life and work of three prominent women scientists – Marianne North, Rachel Carson and Alice Stewart – who each, in their own times, used their scientific investigations and role as public educators to raise powerful questions about the destructive effect of human beings upon the environment and to pioneer a more responsible and reflective approach to the natural world and the plants and animals living in it. Focusing on the careers of prominent women, who often followed unorthodox routes to success in the world of scientific research, encourages us to adopt broader definitions of science and of education. Marianne North, for example, held no professional research or teaching post; and yet, her friendship with Joseph Hooker, who controlled access to the facilities of Kew Gardens, and the mid-Victorian scientific establishment, allowed her to develop an unprecedented role as a public educator through her art.

Claire Jones's article which explores the role of women scientists in Britain in the years around 1900 points to a similar disconnect between femininity and science. While women attending university and studying for degrees in science was becoming increasingly common by the turn of the twentieth century, it argues that science, as a field of research and education, remained distinctly resistant to infiltration by women. The increasing professionalization of scientific research and training in the universities drew an even sharper distinction than previously existed between scientific practice and the domestic sphere. Under these conditions, the laboratory emerged as a peculiarly masculine space. As well as providing an overview of educational opportunities in science open to women, the article uses fictional texts depicting

female scientists to illustrate the continued difficulties faced by women wishing to pursue a career in scientific research.

Women's experiences and the gendered construction of science, both as a discourse and set of practices, provide the focus for the third article in the special issue - by Bridget Egan and Joyce Goodman. It explores the life and work of Winifred Egan (1915-2007), a graduate in household and social science, and a teacher whose career included periods working in elementary, secondary and teacher education. It examines some of the ways in which female graduates of household and social science were able to draw upon their rigorous scientific training in the field of nutrition to adapt to and flourish within a variety of different research and teaching contexts, from the ostensibly masculine space of the laboratory to the more traditionally female arenas of the elementary and secondary school.

Another focus of Bridget Egan and Joyce Goodman's article is upon the technical proficiency and craft skill cultivated by graduates in household and social science. Here, they pay serious attention to the material culture of the spaces in which teachers like Winifred Egan worked. This concentration on the interconnections between material objects and pedagogy is a distinguishing feature of several articles in this special issue. The fourth article – by Joanna Behrman – examines the importance of object lessons using electrical appliances such as toasters and vacuum cleaners in the context of 'household physics' textbooks aimed at white, female home economics students in the USA between the 1910s and 1950s. Like Egan and Goodman, Joanna Behrman investigates the intersection between the typically masculine language of science and the traditionally female subject of home economics. As she argues, a training in physics was given and legitimated in terms of the need for the housewife to

understand the new technologies coming into the home sufficiently in order to operate them safely and effectively.

The fifth article - by Jane Insley - continues this focus on object lessons as a pedagogical strategy in the teaching of science. While many historians find biography or life histories a useful way of approaching research in the history of education,⁶ Jane Insley traces instead the genealogy of a particular set of 3D models of mineralogical crystals originally intended as pedagogical tools for teaching the principles of crystallography. Drawing on actor-network theory, she considers the set of 3D models made of pasteboard (and currently held in the collection of the National Museums Scotland) as an ‘object-actor’ capable of influencing developments in crystallography and mineralogy pedagogy in late nineteenth-century Britain. As well as the use of such models in formal educational contexts, the article also considers the significant ‘popular’ role played by inexpensive card models in extending basic instruction in the principles of crystallography to a much wider audience.

Diana Vidal’s article focuses similarly on the history and circulation of educational objects used as pedagogical tools – specifically, in the context of the late nineteenth-century Museu Escolar Brasileiro or Brazilian School Museum. The article concentrates on the activities and initiatives of the Maison Deyrolle, a Paris-based institution specialising in natural sciences and pedagogy which produced many wall charts and other teaching aids for schools both in France and overseas. Here, Diana Vidal examines the movement and circulation not only of the objects themselves (for example, the wall charts

⁶ See, for example, Joyce Goodman, ‘Transatlantic crossings and professional lives: Ellen Knox’s travel between Canada and England’, *History of Education Researcher* 89 (2012): 36-45.

comprising the ‘School Museum’) between France, Portugal and Brazil, but also of the pedagogical concept of the object lesson as a tool for teaching the natural sciences in schools.

The seventh article in this special issue – by Laura Newman – continues the focus on object lessons as one possible means of exploring connections between the history of science and the history of education. It looks in detail at the notion of ‘familiar science’, or the use of everyday items to teach scientific principles.⁷ Its specific focus is upon the important role which education played in the anti-tuberculosis movement in Britain in the early twentieth century, especially in the context of sanatoria operated by the Post Office Sanatorium Society (POSS). In particular, Laura Newman explores the development of educational strategies using familiar objects, such as cutlery, crockery and other personal items, to impart knowledge about the science of hygiene with a view to minimising the risk of infecting other people with TB when patients returned home.

The final article by Alexander Clarkson explores the ways in which university curricula, teaching practices and institutional reputations can be mobilised in support of a range of competing and conflicting ideas about historical identity and memory. Focusing on the education provided by the universities in the Russian Baltic exclave of Kaliningrad in the post-Cold-War era, the article examines the ways in which local cultural identity, constructed in the context of a city strategically located between the Russian Federation and the European Union, has been negotiated through the educational programmes of its universities and the experiences of both its teachers and students.

The articles collected in this special issue demonstrate the diversity and originality of research currently being conducted into the connections between the history of

⁷ For ‘familiar science’, see Melanie Keene, ‘Familiar Science in Nineteenth Century Britain’, *History of Science* 52, no. 1 (March 2014): 53-71.

science and the history of education. The importance of objects in teaching and their value as a pedagogical tool emerges as a particularly significant area of research located at the intersection between the two fields of enquiry. Indeed, it is the materiality of education, a focus on the use of objects, pedagogical practices, and particular spaces, which seems to offer some of the most promising avenues for exploring further the relationship between the history of science and education.