

STEAM conference 'Thinking through Drawing', 13-15 September 2012

Collaborative drawing as a tool for learning in Craft and Medicine

1. Introduction

Drawing has arguably been one of the means by which the 'understanding of a whole range of disciplines, including science, geometry, typography, mathematics, engineering and cartography' has been advanced, notably by seminal figures such as da Vinci and Dürer (Farthing 2005: 27). Drawing has been deployed to expand the scope and shape of a field of knowledge; it can delineate new ways of thinking. It can offer a powerful sense of imaginative, speculative and ambiguous possibility through its very lack of 'finishedness' (Farthing 2005: 27). The history of drawing, complex and many-stranded as it is, suggests a form plastic and polyvalent in nature; drawing has been shaped by wider structures of belief and yet it has also adapted, shaped and extended a range of bodies of knowledge and practice¹.

Contemporary drawing practitioners and researchers have returned repeatedly to different forms of the same question: what is the potential of drawing? The level of interest in drawing over recent years underlines how rich a site of exploration this is. The research reported in this paper stems from a strong belief in the plural, generative and exploratory potential of drawing: more specifically, it emerges from the wish to investigate the effects of a particular approach to collaborative drawing in higher education. This paper attempts to provide a very brief account of a particular piece of research, which relates to a number of distinct contexts².

2. Contexts to the research

2.1 The centrality of drawing in the histories of art education and medical education

In considering the history of drawing, Petherbridge shows in some detail that it is important to understand particular drawings in relation to the ideologies of their time (2010: 24). At the same time she cautions against inaccurate historical narratives such as the notion that drawing only became definitionally problematic at the end of the 19th century (2010: 18). It is important to note a small number of key historical contexts in this report, if rather crudely, in relation to the role drawing has had in both medical and art education. It is, however, recognized that these histories are large and complex fields in their own right. There has, for example, been a long history of using drawings to represent and support the learning of scientific and medical knowledge including, notably, the Renaissance work of Vesalius, with illustrations by Jan Stephan, and the drawings of da Vinci. In art education the acquisition of mimetic drawing techniques and a focus on

¹ This relates to a key construct of Petherbridge's *The Primacy of Drawing* that 'drawing is part of a continuum of making and thinking and of invention and completion' (2010: 19).

² This paper offers a concise overview of the project, and therefore does not contain detailed descriptions, for example, of drawing tasks, the flow of key discussions, or student quotations.

representing ideal human forms and classical statuary had a core role well into the twentieth century (MacDonald 1970). Whilst it is possible to argue that the use of drawing as an essential representational tool waned to some extent in the face of digital and other imaging techniques, and art took a turn towards the expressive and non-representational, recent decades have seen drawing emerge as educationally significant in a variety of ways. Recent work by Lerner on the 19th century American scientist and educator Agassiz (2007) and the work of drawing practitioner-researchers such as MacDonald (2011) and Lyons (2008) show how practices of drawing can be deployed with historical, educational and scientific awareness, and experimented with, for example, as means of researching, revealing and understanding medical knowledge.

2.2 Contemporary indicators of the value of drawing to learning

Drawing has been highlighted as an important learning activity within compulsory education, with inspectorate admonishments that we disregard or neglect it at our peril. OFSTED's 2012 report [Online] stated that 'good skills in drawing underpinned good achievement in Key Stage 4 and in post-16 education'. The report argues that evidence of a drop in achievement and progress in drawing after the early stage of primary education has implications for future learning. In more general terms, the report makes the point that: 'Children see before they speak, make marks before they write, build before they walk. But their ability to appreciate and interpret what they observe, communicate what they think and feel, or make what they imagine and invent, is influenced by the quality of their art, craft and design education'. (2012: 4)

In recent years practice-oriented, educational and research interests in drawing have burgeoned. Debates within higher education art and design have mooted drawing as a materialised and visualised form of thinking: as a way of exploring, expressing and relating ideas; as a means of solving a problem; or as a means of generating new or developing existing ideas (TRACEY Journal [Online]). There have been explorations of whether drawing can be understood as a type of communication, and whether is possible to identify a 'grammar' of drawing; whether drawing can be seen as structured by a system of meaning-making with marks analysable as a 'syntax' (TRACEY Journal [Online]). In Rogers' doctoral study, the communicative potential of drawing is investigated and articulated within a framework of social interaction and meaning-making (Rogers 2008).

2.3 Situating HE drawing and Arts/Medicine collaborations in pedagogical theory

Research into the pedagogical value of drawing has tended to be the preserve of compulsory education or specific training and development programmes for adults rather than a key focus for university researchers, although in recent years there have been a number of important contributions (for example: Lyons 2008; Riley 2008; Ridley and Rogers 2010). Recent debates in art and design higher education have highlighted a need for more investigation into the value of different pedagogical approaches within these particular disciplines, and consideration has been given over recent years into, for example, the long-established practice of demonstration, particularly in craft subjects, the nature of object-based learning (Chatterjee 2009; Romanek and Lynch 2009; Cook 2010)

and the widely-used informal pedagogical term 'learning through doing'. This latter phrase, deeply embedded in art and design subject culture, is not entirely synonymous with 'experiential learning' (the problematics of which are usefully raised in Laurillard [2005: 19-24]). 'Learning through doing' tends to be used rather to refer to the notion that learning occurs through the enactment or performance of a process, involving experimental investigations of the potential of material and technique, of discovery through the acts of thinking and making. Investigating what occurs during the process of 'learning through doing' is extremely important for pedagogical research in art and design. It has consequently informed some of the thinking around this project, in which a concern with whether and how students learn through 'doing' drawing, was central.

2.4 Collaborative and interdisciplinary Arts/Medicine education: trends, initiatives and research

There has been a plethora of activity in the Arts/Medicine arena. A catalyst here appears to have been the 2009 publication on the training of future medics, *Tomorrow's Doctor*, in this, a minimum element of 10% student choice was established within the curriculum, the aim being to enable students' intellectual development to benefit from studying an area of interest to them. This report also stipulated that 'curriculum design and delivery must take into account modern educational theory and current research' (2009: 50). Whilst this did not cite collaboration with the arts as an overt or implied objective, optional elements ('Student Selected Components' or SSCs) in the medical curriculum have allowed medical students to study a range of humanities and arts subjects, of which there are many examples: the module discussed in this paper being just one. Aside from formal medical educational policy and structures, there are instances of drawing playing a critical role in the advancement of practice: for example, surgeon Francis Wells developed an improved surgical procedure following study of da Vinci's representations of the mitral valve (Wells and Crowe 2004; reported through BBC news [online] 2005). The growth of arts/medical interests are indicated elsewhere, too, such as through the *Medical Humanities* journal (established 2000) and the publication of a swathe of journal articles and books exploring the potential benefits of Arts/Medicine collaborations and arts interventions within medical education. This literature is varied in approach, ranging from studies using an experimental model of research and quantitative methods to assess the data, to qualitative research, historical analyses or theoretical approaches and less formal discussion. The use of different epistemologies, philosophical assumptions and methodologies in such interdisciplinary work raises some thorny and yet fascinating questions.

3. The University of Brighton project: overview

3.1 Background

The focus of the Collaborative Drawing research project, carried out early in 2012, was a module named 'Human Body Forms', developed by staff in the Faculty of Arts and Brighton and Sussex Medical School (BSMS) at the University of Brighton. This module was the result of a longer-standing teaching and research relationship between the Faculty of Arts and BSMS where collaborative learning

and teaching, bringing together design and AHP/Medical students, provided the opportunity for pedagogical research (Haq, Rose, Lee, Ainsworth: 2008; Haq, Ainsworth and Rose: 2009). The core group of staff involved in the Collaborative Drawing project discussed in this paper (Lyon, Letschka, Ainsworth, Haq) gravitated together through a mutual interest both in the educational potential of drawing and in interdisciplinary research across arts and medicine. This prior engagement and understanding across the different disciplinary domains within the University of Brighton was vital in overcoming not only the logistical problems of resources, timetabling and space but in agreeing a common vision for the project.

3.2 Module overview

The Human Body Form module aimed to develop critical understanding and experience of a range of drawing techniques, processes and approaches. It also aimed to prompt students to consider and reflect on their understanding of both drawing and the human body throughout. The module's thematic concern with the human body was chosen as of fundamental relevance and interest to students from both constituent disciplines: medical students' education is focused on the body and craft students make objects designed to appeal to, be interacted with or used by the human body. The total student group of 11 registrations comprised 6 third year BA (Hons) Design & Craft students, (referred to as 'craft' students) and 5 third year BSc (Hons) Medicine students. The gender distribution of the 6 craft students was 5 females and 1 male; of the Medicine students, 3 females and 2 male and attendance overall was good. The module spanned 8 weeks and used three different types of learning and teaching space: classrooms in one of the Faculty of Arts buildings; the Human Movement Laboratory, a teaching and research facility for allied health professional students and staff in Eastbourne; and the Brighton and Sussex Medical School's Anatomy Laboratory on the University of Sussex campus. Generally, sessions were organized around drawing exercises from 2 - 4/4.30, with approximately half an hour to an hour at the end of each session for a discussion. A table giving an overview of the module is appended.

3.3 Module assessment and feedback

As the module was optional for craft students, no formal assessment tasks were required of them. All students were, however, requested to do weekly selections of work with a short commentary, culminating in an overall selection of drawings and comments to form the basis of an end-of-course 'crit'. The 'crit' is the discussions of displayed pieces of student work, often with a short accompanying presentation from the producer of the work, for the purpose of receiving constructive criticism from student peers. For medical students, assessment comprised a 'reflective diary' of their learning throughout the module. There was no formal rubric for how this should be done or in what format and students were encouraged to decide how best to structure and design this diary to demonstrate their learning. Of the 5 diaries submitted by the medical students, 3 were presented as short documents or informal essays with some illustrations and 2 were presented as highly-worked sketchbooks, including many additional images, sketches, observations, accounts of development throughout the course and commentary about specific pieces of work. As the reflective diaries were

assessment pieces, they were not included in the data sets for the research. Anonymous feedback questionnaires including space for free commentary on the experience of the module were explicitly made part of the research data.

3.4 Approach to researching the module

The design of the research emerged from the researchers' recognition of the complexity and plurality of human experience in a specific educational setting bounded by rules, habits and mores, both formal and informal. More specifically, it arose from their recognition of the complexity of capturing and analyzing the consequences of collaborative drawing as an educational approach. The research team did not want to oversimplify the many issues, varied experiences and potential contradictions likely to emerge from such an inquiry and anticipated that the impact of drawing on student learning would be challenging to identify and express. The research design took into account the power relationships inherent within the learning and teaching setting, the added complexity of researchers' presence within the learning space; the varied educational and creative histories that individual students brought to the module; the hopes, interests and expectations of the teaching and research staff; and perhaps particularly importantly, the significance of the socio-pedagogical relationships that formed the group dynamic.

The experiences and perceptions of the student group were gathered and investigated through four different methods: observation notes and recordings (use of an overt observer-researcher and audio, video and photographic records of sessions); managed dialogue (a focus group-like method in which students' views of the sessions were elicited, although adapted to the needs and constraints of this teaching module); independent reflection (self-completed questionnaires by the students); and the drawings themselves. The research team also continually reflected throughout the course on the effect of both the drawing exercises and the research process on the student participants and their learning. They encouraged the students to be as vocal and involved as they wished in discussing the aims and progress of the module and the research. The Ethics Committee of the Faculty of Arts granted formal ethics approval for the study in November 2011.

4 Research data and analysis

4.1 Data

In considering the research data, a number of issues need to be noted. As explained under 'methodology', different types of data were captured as a means of offering different perspectives on the events, activities, experiences and discussions of the module's eight drawing sessions. Audio recordings were made of each session including the group discussions and transcribed in full by one of the team. This member of the team also made observations throughout the sessions, which she recorded in note-form. Video recordings were made of in four of the sessions where a life model was not being used, and digital photographs were taken of each session. Finally, questionnaires including 'free comment' sections were provided for the students at the beginning and end of the course to give them an opportunity to submit comments anonymously and with some time

for reflection. The respective researchers identified issues independently and then discussed and organized these into themes during meetings of the research team, until a point of saturation had been reached. The analysis section of this paper comprises brief descriptions of the key emergent themes, with further discussion in the subsequent section.

4.2 Analysis of emerging themes

The data analysis revealed six main themes, identified very briefly below.

The shift in expectations and associations with drawing

Both disciplinary groups of students gave indications of their pre-course expectations and associations with drawing and the human body theme. Craft students declared a fascination with and curiosity about the human body, particularly the opportunity to see and draw cadavers; some medicine students hoped for an 'art school' experience that would be distinctive from their medical studies, but also anticipated pressure to produce drawings with a degree of scientific accuracy and believed that there was a fixed notion of 'good drawing'. The trajectory of change to these types of beliefs and attitudes was clearly discernable over the 8 weeks. Notably, craft students were faced with a sense of their own lack of knowledge and understanding of the human body, even when, as one student commented, they 'had one' themselves; this appeared to deepen their curiosity, and led to them interacting extensively with the medical students on issues of anatomical knowledge and medical practice. Medical students quickly began to respond to the challenge the module offered to their notions of 'good' or 'accurate' drawing and reflected on the nature of drawing as 'hard work'.

Drawing and critical looking

The importance of looking carefully, critically and reflectively in order to draw and of drawing through the different senses, emerged as a very strong theme. As the course progressed, medical students became very interested in the complex, subtle and multi-dimensional nature of looking to draw, the need to be open and enquiring, and the value of engaging in extended and repetitive acts of looking and drawing in order to see and understand the body more fully. In discussion they made strong analogous connections to processes of visual and physical examination they were being taught as part of their medical training and, post-module, one medical student chose to present a 'research poster' about the benefit of drawing for clinical observation skills as an assessment piece on her course (Schamotta 2012). Three of the craft students drew on their experiences and sketches from the module in their final degree assessment show.

Collaborative drawing

The regular collaborative drawing exercises occurring throughout the module, in which paired students worked on the same easel and sheet of paper, proved a significant learning experience for many of the students. After an initial phase of harmonizing and conforming to a drawing partner's style, students began to display greater interest in exploring differences in mark-making, perspective and composition. Students indicated that they had learned about drawing specifically

through the comparative, responsive and participatory nature of the collaborative exercises, where they could see distinctions in how their partners approached the weight of mark, the scale adopted, the looseness or finished quality of the whole. The collaborative drawing also opened up the possibilities of communication through mark-making.

Drawing and embodiment

The students articulated a progressively greater awareness of their physical submergence in the process of drawing and the intimate and bodily, as well as cognitive and emotional, experience of drawing. Discussions of the sensory dimensions of drawing occurred throughout the modules, from the observations of each other's stance, to the experience of haptic drawing tasks; the tutor's style of spoken instruction during sessions also invoked an extensive range of sensory metaphors. The physical awareness that resulted from the regular drawing sessions over the eight weeks, emphasized further by the use of bodily drawing subjects, led to exploratory lines of discussion about the relationship of different bodily parts and systems to one another, and the potential for different type of collaboration with others.

Meta-cognitive awareness

Students developed a critical, creative and reflective approach to the module sessions very quickly. For the medical students in particular, there were a range of approaches and tasks that they initially found frustrating or disruptive to the dominant paradigm in which they were being trained. However several significant shifts appeared to occur in their thinking, such the early movement away from the attachment to mimetic accuracy and towards alternative ways of seeing and expressing through sensation and imagination. The students were self-reflexively aware of their learning shifts³, able to assess their potential value for future study and professional practice and to foresee how their new attitudes and knowledge might be applied.

Identity

A significant theme emerging from the data was the issue of students' developing disciplinary and professional (or pre-professional) identity in the sessions. This was presented through sartorial display and behaviour, specific comments in discussion and a range of often black-humoured banter that ran throughout the eight weeks of the module, including, for example, a mock argument about the relative qualities and benefits of each discipline. To some extent humour was used to assert identity, yet at other points in the module, identity was foregrounded as a far more emotive and sensitive issue. For some students, engaging with another discipline involved re-examining and exploring their personal relationship to their chosen path and societal perceptions of their discipline. Some medical students, for example, described how they had found themselves on the path of a medical education at an early stage, largely through

³ The informal term 'learning shift' is used to acknowledge the fact that this needs further research and analysis in relation to existing pedagogical theory such as that on threshold concepts (Meyer and Land 2003).

their success in passing the requisite exams with good grades; some described a sense of being propelled onto this path without having fully considered the implications and consequences. Two students in particular talked vividly of perceiving themselves as having a partly 'artistic' identity that didn't quite 'fit' with their medical education, yet by the end of the course they were emphasising their commitment to their existing educational and career choice of Medicine.

5 Discussion and further questions

The validity and significance of these findings needs to be considered in relation to a number of issues.

5.1 Limitations of the research

This first is to delineate some of the limitations and scope of this project. This research has taken a detailed qualitative look at the consequences of a particular approach to drawing on the learning of students over an 8 week period. In the terms of Lincoln and Guba's five criteria of authenticity, proposed by Riley as 'important pointers' for those engaged in developing models of drawing education, it can be argued that the Collaborative Drawing research met the first four criteria of fairness, ontological authenticity, educative authenticity and (to some extent) catalytic authenticity. It could not, however, be said to have met the criterion for tactical authenticity, having not set out to determine whether and in what way students carried the learning from this module into their future professional practice, other than from subsequent informal and anecdotal contacts. The research could not, with the methodology used, account for how far the type of students who chose the module or their pre-existing approach to learning affected or influenced the themes identified. As the group was very small, the findings could not yet be proposed as indicating an educational model for application elsewhere with confidence of similar results. The research team are keen to consider how some of these limitations might be dealt with in further research.

5.2 Interdisciplinary research debates

In carrying out educational research with a mixed subject group and focussing on the interdisciplinary nature of the learning, the choice of methodology and its reception within different disciplinary domains can be problematic. Issues around the preference of experimental models or specific types of qualitative approach need to be discussed in much greater detail than can be gone into here. For the purposes of this brief paper, it is proposed that openness to a range of research approaches will allow a much richer and clearer picture to be developed and that a mixture of methodologies will enable any deeper and/or longer-term benefits of collaborative arts and medical educational initiatives to be investigated.

5.3 Conditions for interdisciplinary educational drawing research

Interdisciplinary projects are logistically very challenging. When a highly structured and intensively-assessed course such as Medicine is involved, this is even more the case. Scheduling such projects and identifying resources across subject and departmental boundaries requires a high level of commitment on the part of an

institution, and a shared vision of the need to research the significance of cross-disciplinary learning. The experience of running the Collaborative Drawing project at Brighton has also highlighted the significance of two other factors in the research: first, the importance of experienced and reflective teaching; and second, the significance of developing the student group not only as a social learning community (Lave and Wenger, 1991), discussed again in 4.4 below, but as research participants.

5.4 Relationship to pedagogical theory

Some of the themes that emerged from this research project can be linked to some aspect of the drawing activities themselves: for example, the awareness of 'critical looking' as a strategy and the appreciation of looking and drawing through other senses, as well as sight. In addition, the themes need to be considered further in relation to non-drawing specific pedagogical concepts and theories: how collaborative drawing can be related to theories of experiential learning; how far any beneficial effects might be linked to particular learning styles associated with subject approaches; and the significance of peer and reflective learning components within the drawing module. As referred to above, Lave and Wenger's theory of 'communities of practice' in education highlights the significance of the relationship of the individual learner to the social and cultural group(s) and institutional setting in which they are situated. In their construct, the processes and practices of learning and teaching are not delivered solely to individuals but produced and digested as part of a wider network of significant learning influences and relationships. This emphasises the importance of viewing the individual learner as not just connected to, but in some sense formed by, the social interactions, behaviours and rules of 'normality' in operation. Much of the learning that took place in the Collaborative Drawing project, in the view of the researchers, emerged from students' fascination with an 'other' disciplinary culture, their collaborative drawing experiences and the willingness to reflect on and discuss each session.

Finally, the strength of the theme of identity that emerged from the analysis had not been anticipated. This suggests that more attention might be paid to this in any future collaborative drawing research the team conducts. This might be investigated generally in terms of how the role of medic is prepared for within the BSc Medicine and specifically, in terms of issues such as the one sometimes referred to as the 'hidden curriculum' (or 'informal curriculum') in medical Education. This refers to the notion that there are unspoken, informal but significant expectations about aspects such as behaviour, language use and skills-acquisition that students acquire alongside the formal Medicine curriculum. As can be seen from a range of medical journals, there have been studies that have explored this, for example, Lempp and Seale (2004).

6 Conclusion

This research was carried out as a first, formal attempt at the University of Brighton to take a particular range of collaborative Arts/Medicine educational initiatives onto a different footing and as a result of the project, a number of key themes were identified. The students involved in the collaborative drawing underwent distinct shifts in their learning, not only in terms of challenging their

assumptions about drawing and critiquing their notions of 'good drawing' but also in realising that through drawing, they were brought into closer relationship and understanding with the human body. They extended their ability to look in great depth and use different senses in order to draw and they developed analogous awareness of how this 'critical looking' could be applied in other situations. The comparative and participatory quality of collaborative drawing enabled students to extend their learning and to begin to investigate the issues around drawing as communication. Student developed a reflective awareness of the physicality of drawing and the experience of tapping strongly into senses other than the visual. The reflective, discursive mode that students habitually adopted on the course led to a high level of awareness of their own learning and important issues of disciplinary and pre-professional identity were exposed and developed. In combing out these themes, the researchers have set out on an exploratory path, where the attempt to identify the learning benefits of drawing in interdisciplinary HE settings has propelled them into a range of further problems and questions that need to inform future research.

Human Body Form module outline, run spring 2012

Week one

Introduction to the research project. Drawing objective: a series of drawing exercises using a paper skeleton to explore drawing as a collaborative activity.

Week two

Life drawing from the model

Drawing objective: introduction to drawing methods focusing on the external body form. Selecting two drawings from the life drawing session. Writing about what was gained from the experience of doing those drawings. Explanation of assessment for Medicine students.

Week three

Life and anatomy drawing from the body

Drawing objective: anatomy drawing. Indicating the internal body form through observation, perception and imagination.

Week four

The body absent

Drawing objective: drawing as narrative and as a communication tool, collaborative drawing.

Week five

Touch and see

Drawing objective: drawing as a means of describing touch, feeling and self by questioning pre-conceived ideas.

Week six

Life drawing from the model

Drawing objective: emphasis will be placed on the notion of preciousness within the drawing session, both as an individual and working in pairs.

Week seven

Pathology Lab visit at Sussex University

Drawing objective: observational recording and collaborative drawing using techniques previously used during the course.

Week eight

The 'crit'

Present selected drawings: one from each session with a written statement and a personal evaluation of the course. Reflection on and conclusion of the research project.

Bibliography

Books and journal articles

- Bardes, C. 2002. Learning to look: developing clinical observational skills at an art museum, *medical Education* 35(12), 1157-1161.
- Bordin, G. and D'Ambrosio, P. 2010. *Medicine in Art*. Los Angeles: Getty Publications.
- Chatterjee, H. J. (ed). 2009. *Touch in Museums: Policy and Practice in Object Handling*. Oxford: Berg.
- Cook, B. 2010. The design student experience in the museum, in *Museums and Design Education. Looking to Learn, Learning to See*, edited by B. Cook, R. Reynolds and C. Speight. Farnham: Ashgate Publishing Company.
- Cook, B., Reynolds, R and Speight, C. 2010. *Museums and Design Education. Looking to Learn, Learning to See*. Farnham: Ashgate Publishing Company.
- Day, G. 2012. *Bedside Stories*. Exhibition catalogue for medical Humanities course at Imperial College, London.
- Dyce, W. 1849. *Art Union*. 231.
- Garner, S. 2008. *Writing on Drawing. Essays on Drawing Practice and Research*. Chicago: Intellect Books, The University of Chicago Press.
- General Medical Council (GMC). 2009. *Tomorrow's Doctors*. Outcomes and standards for undergraduate medical education, GMC.
- Haq, I., Ainsworth, T. and Rose, C. 2009. *Design in the Clinical Environment*. [Online]. Available at: <http://arts.brighton.ac.uk/projects/cetld/desire,-possibility-and-pragmatism/design-in-the-clinical-environment> [accessed 13 June 2012].
- Jordanova, L. 2000. *Defining Features: Scientific and medical portraits 1660-2000*. London: Reaktion Books Ltd in association with the National Portrait Gallery.
- Laurillard, D. 2005. *Rethinking University Teaching. A Conversational Framework for the Effective Use of Learning Technologies*. London and New York: Routledge.
- Lave, J and Wenger, E. 1991. *Situated Learning. Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Lerner, N. 2007. Drawing to Learn Science: Legacies of Agassiz, *Journal of Technical Writing and Communication*, 37(4), 379-394.
- Lempp, H. and Seale, C. 2004. The hidden curriculum in undergraduate medical education: qualitative study of medical students' perceptions of teaching, *British medical Journal*, 329:770.
- Loudon, I. S. L. 1982. Sir Charles Bell and the anatomy of expression, *British medical Journal*, 285:1794.
- Lyon, P. 2011. *Design Education: Learning, Teaching and Researching Through Design*. Farnham: Gower.
- Lyons, L . 2008. 'Delineating Disease'. *The Bulletin of the Royal College of Pathologists*.
- MacDonald, J. 2011. Lines of movement, points of stillness: drawing and the figuration of bodies, *Bodies in Movement: Intersecting Discourses of Materiality in the Sciences and the Arts*, 28-29 May, University of Edinburgh.
- MacDonald, S. 1970. *A Century of Art and Design Education: From arts and crafts to conceptual art*. London: University of London Press Limited.
- Macnaughton, J. 2009. In Saunders, C., Maude, U. and Macnaughton, J. *The Body and the Arts*. Basingstoke: Palgrave Macmillan.
- Maslen, M. M. and Southern, J. 2011. *Drawing Projects. An Exploration of the Language of Drawing*. London: Black Dog Publishing.

Meyer, J.H.F. and Land, R. (2003) Threshold concepts and troublesome knowledge: linkages to ways of thinking and practising, in C. Rust (ed) *Improving Student Learning - Theory and Practice Ten Years On*. Oxford: Oxford Centre for Staff and Learning Development (OCSLD), 412-424.

The Office for Standards in Education, Children's Services and Skills (Ofsted). 2012. *Making a mark: art, craft and design education 2008-11*. Available online at www.ofsted.gov.uk/publications/110135 [accessed 2 July 2012].

Petherbridge, D. 2010. *The Primacy of Drawing: Histories and Theories of Practice*. New Haven, Connecticut: Yale University Press.

Powley, E. and Higson, R. 2005. *The Arts in medical Education: a practical guide*. Abingdon: Radcliffe Publishing Ltd.

Ridley, P. and Rogers, A. 2010. *Clinical Education, Health & Social Care*. From the series Drawing to Learn. Brighton: Centre for Learning & Teaching, University of Brighton.

Riley, H. 2008. Drawing: towards an intelligence of seeing in S. Garner, *Writing on Drawing. Essays on Drawing Practice and Research*. Chicago: Intellect Books, The University of Chicago Press.

Rogers, A. 2008. *Drawing Encounters: A practice-led investigation into collaborative drawing as a means of revealing tacit elements of one-to-one social encounters*. PhD thesis, University of the Arts, London.

Romanek, D. and Lynch, B. 2009. Touch and the value of object handling: final conclusions for a new sensory museology, in H. Chatterjee (ed), *Touch in Museums: Policy and Practice in Object Handling*. Oxford: Berg.

Scrivener, S. 2002. The art object does not embody a form of knowledge. *Working Papers in Art and Design 2* [Online]. Available at: http://sitem.herts.ac.uk/artdes_research/papers/wpades/vol2/scrivenerfull.html ISSN 1466-4917.

Wells, F. and Crowe, T. 2004. Leonardo da Vinci as a paradigm for modern clinical research, *Journal of Thoracic & Cardiovascular Surgery*, 127:929-44.

Wood, J. 1998. The culture of academic rigour: does design research really need it? *The Design Journal*, 3(1), 44-57.

Exhibitions

Art School Drawings from the 19th Century, exhibition at the V&A, 2011.

da Vinci, L. 2012. Leonardo da Vinci: Anatomist, exhibition held at The Queen's Gallery, Buckingham Palace, London.

Emin, T. 2009. Those Who Suffer Love exhibition, White Cube, London.

Farthing, S. 2005. Dirtying the Paper Delicately, inaugural lecture, 26 April 2005, University of the Arts, London.

Freud, L. 2012. Drawings, exhibition held at 21 Dering Street, London.

Hockney, D. 2012. A Bigger Picture, exhibition held at the Royal Academy, London.

Lyons, L. 2008. Delineating Disease: Drawings by Lucy Lyons. Qvist Gallery, Hunterian Museum in the Royal College of Surgeons, Lincoln's Inn Fields, London.

Educational courses, organisations and web resources

LearnHigher Centre for Excellence in Teaching and Learning [Online]. Main site available at: <http://www.learnhigher.ac.uk/> [accessed 11 June 2012]. University of Brighton Visual Learning web site [Online] available at: <http://www.brighton.ac.uk/visuallearning/> [accessed 11 June 2012].

medical Humanities course, Imperial College, London. The course is offered to BSc Biomedical Science students, and to 4th year BSc Medicine students [online], available:

<http://www3.imperial.ac.uk/ugprospectus/facultiesanddepartments/medicine/mbsmedicine> [accessed 11 June 2012].

The Big Draw Campaign for Drawing [Online]. Available at:

<http://www.campaignfordrawing.org/bigdraw/> [accessed 11 June 2012].

TRACEY Drawing and Visualisation Research and the Drawing Research Network [Both online]. Available at: <http://www.lboro.ac.uk/departments/sota/tracey/> [accessed 11 June 2012].

University of Brighton Faculty of Arts staff profiles [Online]. Available at:

<http://arts.brighton.ac.uk/faculty-of-arts-brighton/staff-finder> [accessed 11 June 2102].

Wimbledon School of Art, MA Drawing course description [Online]. Available at:

<http://www.wimbledon.arts.ac.uk/courses/coursesbylevel/graduateschoolcourses/madrawing/> [accessed 11 June 2012]

Symposia and conferences

'Drawing: The Future. A Symposium', 22 March 2006. Chaired by S. Farthing. University of the Arts.

'Perspectives on Art and Medicine Symposium', 28 May 2011. BSMS, University of Sussex, Falmer.

Schamotta, J. 2012. The Power of Observation: Drawing and the Art of Medicine. Poster presentation on BSc Medicine, BSMS.