Stepping beyond the paradigm wars: pluralist methods for research in learning technology

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This paper outlines a problem we have found in our own practice when we have been developing new researchers at post-graduate level. When students begin research training and practice, they are often confused between different levels of thinking when they are faced with methods, methodologies and research paradigms. We argue that this confusion arises from the way research methods are taught, embedded and embodied in educational systems. We set out new ways of thinking about levels of research in the field of learning technology. We argue for a problem driven/pragmatic approach to research and consider the range of methods that can be applied as diverse lenses to particular research problems. The problem of developing a coherent approach to research and research methods is not confined to research in learning technology because it is arguably a problem for all educational research and one that also affects an even wider range of disciplinary and interdisciplinary subject areas. For the purposes of this paper we will discuss the problem in relation to research in learning technologies and make a distinction between developmental and basic research that we think is particularly relevant in this field. The paradigms of research adopted have real consequences for the ways research problems are conceived and articulated, and the ways in which research is conducted. This has become an even more pressing concern in the challenging funding climate that researchers now face. We argue that there is not a simple 1 to 1 relationship between levels and most particularly that there usually is not a direct association of particular methods with either a philosophical outlook or paradigm of research. We conclude by recommending a pluralist approach to thinking about research problems and we illustrate this with the suggestion that we should encourage researchers to think in terms of counter-positives. If the researcher suggests one way of doing research in an area, we suggest that they should then set out an opposing research approach from another perspective or paradigm. We link this conclusion to the provision of research training and the kinds of curricula that might be offered and we argue against the superficial and box ticking 'coverage' of different standard research perspectives e.g. 'qualitative methods' – 'qualitative methods'

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The learning technology landscape

Learning technology is a developing field of study and an emerging area of work (for two recent reviews see Czerniewicz 2008, 2010). The field is an emerging profession with its own community of workers and a pattern of employment (Beetham, Jones, and Gornall 2001). It is also an area of academic interest, and the field has its own journals, conferences and related postgraduate qualifications. These two aspects are closely related to each other, for example through the accreditation of learning technologists (Oliver et al. 2004). The emerging professional field around learning technology is also the audience for much of the research output from the academic world concerned with learning technology. This audience for research is also the source for much of the demand for qualifications at post-graduate level supporting the successful development of a variety of Masters and Doctoral level programmes. Learning technology is a domain that has a boundary with other professional groups, including educational developers who have their own community and an overlapping area of interests (Hudson 2009).

Diversity remains in the terms used to describe this still emerging field and there are also arguments about whether the field, for many refuse to call it a discipline, remains amorphous and disjointed or is now growing up and attaining a kind of intellectual unity (Czerniewicz 2008). A unifying factor in the field is its location in relation to new technology. Jones (2004a) has argued drawing on Barley and Orr (1997), that learning technologists, in a similar way to other technologists, have a distinct relationship to theoretical and scientific knowledge because they are largely consumers rather than producers of basic knowledge. The growth of scientific and technical knowledge has had an impact on education in two distinct ways.

(1) The growth in demand for basic and applied scientific knowledge has led to the proliferation of new fields and disciplines, such as the learning technologist. In technical disciplines it is increasingly difficult for individuals to master the breadth of knowledge required and there is an increasing pressure to re-combine specialist technical functions created through a division of labour, that were once integrated in the person of the lecturer.
(2) The second impact is in the contradictory process of re-skilling and de-skilling in which routine duties are reallocated to less well trained staff alongside an increased demand for fully trained professional staff. In this context the demand for learning technologists comes in part from an increasing technical division of labour arising from the application of new technologies to teaching and learning.

The application of new technologies in an educational context means that design has become a key term for research in learning technology. Because design can be viewed as a social practice, which may be explicitly informed by scientific theory, it is a form of practical and ethically informed work. Design involves both a systematic approach, which may involve rules and protocols derived from research, and an art applied in a set of local and context based practices. Design, thought of in this way, is a skilful and creative activity which is open to improvement and development from the application of research and scholarship (Jones and Dirckinck-Holmfeld 2009). Because of the applied nature of learning technology and the

multi-disciplinary nature of the intellectual resources for the field there are those that have drawn an analogy with design in other fields:

> Understanding the character and limits of *design* is important in networked learning. I originally used analogies with ergonomics and especially with architecture to rethink educational design and I still find them useful sources of insight. Architecture involves the crafting of affordances, rather than deterministic logics of human control. Architecture has methods for managing complexity – not just complexities of construction but also complexities of representation and design. Architecture draws on multiple sources of knowledge and combines ways of knowing. It understands people from – at least – the perspectives of biology, psychology and culture. It understands – at least – the physics, geometry, economics, aesthetics and history of buildings. Its practices are imbued with epistemic fluency, to a degree that makes many educationalists look, unexpectedly, like members of the Spanish Inquisition. (Goodyear 2009, viii)

Unlike Goodyear, there are those who define the field (in this case described as 'instructional technology') more narrowly as a 'design field' (Reeves, Herrington, and Oliver 2005, 7). The suggestion these authors make is that 'design-based' research is the primary solution for research deficiencies in the field. In our opinion this kind of restriction limits the responses of researchers in the field of learning technology. We suggest that researchers pursue a variety of research goals using high quality educational technology investigations. Ross and Morrison (1989) differentiate between 'developmental' research, which "is oriented toward improving technology as an instructional tool", and 'basic' research, which is "oriented towards furthering our understanding of how these applications affect learning and motivation" (20). More recently Ross, Morrison, and Lowther concluded that:

> we encourage researchers to reduce efforts to prove the "effectiveness" of technology, while focusing on conducting *rigorous* and *relevant* mixed-methods studies to explicate which technology applications work to facilitate learning, in what ways, in which contexts, for whom, and why. (Ross, Morrison, and Lowther 2010, 31)

In essence what Ross and Morrison (1989) and Ross, Morrison, and Lowther (2010) are arguing for is that different types of inquiry, with a range of approaches and foci, should be possible under the banner of 'learning technology research'. This argument, and conflicts that have surrounded it, have to a certain extent been captured in the term 'paradigm wars' (Gage 1989).

Paradigms in learning technology research

The term normal science and the linked concept of paradigm are most commonly associated with Thomas Kuhn and his book *The Structure of Scientific Revolutions* (1970). Kuhn is remembered for providing an account of scientific progress that emphasised a form of punctuated equilibrium in which periods of normal science were occasionally disrupted and existing ways of thinking were replaced by new revolutionary changes. Kuhn described paradigms as being closely related to the idea of normal science and exhibiting two characteristics:

(1) A scientific achievement that was so unprecedented that it could attract an enduring group of adherents from other competing modes of scientific activity.
(2) It was sufficiently open-ended as to leave many problems for the new group of adherents to resolve (Adapted from Kuhn 1970, 10)

Paradigms are social phenomena in which "accepted examples of actual scientific practice – examples which include law, theory, application, and instrumentation together – provide models from which spring particular coherent traditions of scientific research" (Kuhn 1970, 10). The effect of paradigms for students is that because they join others who learned the basis of the field from the same concrete models, their subsequent practice will seldom evoke overt disagreement over fundamentals (Kuhn 1970, 11). Consensus is a pre-requisite for normal science and, by adopting a paradigm, students "are committed to the same rules and standards for scientific practice" (11).

Traditionally two separate paradigms of inquiry dominated research in education. The early years of educational research were dominated by psychology and a largely positivist understanding of scientific method. More recently a powerful counter current concentrated on the development of qualitative research using a largely interpretivist approach to analysis. These two research approaches have traditionally been seen in opposition which is well reflected in debates that took place many years ago in what have been described as the 'paradigm wars' (Gage 1989).

The paradigm wars saw researchers with particular philosophies and methods of inquiry arguing strongly that 'their way' was the most appropriate. In 1989, Gage fittingly imagined the situation 30 years in the future; hence in our recent past in 2009. He argued that there were three possible outcomes available:

- The positivist, establishment, mainstream, standard, objectivity-seeking and quantitative approach had died of the wounds inflicted by its critics.
- Peace had broken out in an earnest dialogue, lifting the discussion to a new level of insight, making progress toward workable solutions of and generating theory that fitted together.
- Nothing that was true in 1989 had really changed, and the wars were still going on.(Adapted from Gage 1989, 10)

By 2009 peace had broken out, but not in the earnest and productive way that was envisaged, rather as Kuhn might have anticipated, it had become peaceful with the restoration of a period of 'normal science' in which a single dominant paradigm settled the basis for major disputes through a division of spoils. So rather than being settled or resolved in favour of a clear winner, the paradigm of research in the social sciences embedded the distinction between quantitative and qualitative methods in a way that often implies that they are incommensurable approaches. Jones (2004b) has argued previously that the division between quantitative and qualitative methods has become overdrawn and rooted in an excessively theoretical approach to social research. One result of the division between two distinct research methods has been that, increasingly, commentators on social science research, including that undertaken by educational technologist, advocate mixed-methods and pragmatic approaches to research (e.g. Johnson and Onwuegbuzie 2004; Salomon 1991; Shulman 1988). We argue that the research agenda embraced by learning technologists should indeed be pluralistic but perhaps more importantly that the field needs to step beyond the form of 'normal science' that has become institutionalised since the paradigm wars into the quantitative-qualitative divide in social science and hence learning technology research.

Students' exposure to research and use of opposing paradigms

When students begin their research training they are often confused between the different levels of analysis when thinking about methods, methodologies and research paradigms. For example students regularly conflate quantitative methods with a positivist approach to research. These confusions arise from a number of sources, one of which is a desire or requirement to make their research plans consistent with what is often described as an overarching philosophical position in terms of ontology or epistemology. An example of this type of confusion is seen when students feel it is necessary, in their discussion of the methodology underpinning their research, to show that they have considered deep philosophical questions concerning the nature of phenomena and come to a definite conclusion. These students are frequently untrained in philosophy and are addressing profound and intractable problems, yet they feel obliged to make definitive statements. Having engaged with and 'covered' the philosophy, students often take the argument forward by the selecting an appropriate paradigm for research prior to clarifying the research problem.

When seen in this way, approaches to research become simple recipe-following, leading to a mechanical selection of a specific method. An example would be the choice of a qualitative approach to research and the adoption of one or other forms of Grounded Theory as the methodological outcome of the choice of paradigm. This kind of development in a research project is not simply the outcome of poor student choices; rather it often reflects implicit and explicit commitments within particular departments and research groups. It can be the influence of individual faculty members and the outcome of historical recruitment patterns of staff reflecting specific kinds of expertise in particular methods and research approaches.

Pathways in learning technology research training

Research training in the social sciences currently enforces the single dominant paradigm highlighted above in the agreed binary division of spoils into quantitative and qualitative research. The Economic and Social Research Council in the UK, the main funding body for social science research has until recently accredited research training in what are termed 3+1 PhD programmes. The +1 element of the four year programme is a Masters in research which provides a curriculum that generally includes modules called Quantitative and Qualitative research methods or variants on this distinction, for example Qualitative Research Practice and Introduction to Statistical Analysis. This conventional framework for research methods training is not confined to the UK. For example from the Australian context, the 2010 Charles Sturt University handbook of subject offerings, available online, shows that postgraduate students can enrol in (our emphasis).

> **Qualitative research methods** This subject introduces students to the field of qualitative research. The first half of the subject requires students to critically engage with some of the major theoretical debates, which both define the field and delineate between different kinds of qualitative research. The second half of the subject asks students to apply the ideas discussed in the first half by conducting a piece of qualitative research in an area of their own choosing... Using a structured and sequential list of readings, stimulus questions and spaces for student reflection, the subject prosecutes a single objective; *that all research method choices should derive from philosophical and theoretical principles*

which can be explained and defended, as opposed to simply conforming to taken-for-granted ideas about how research should be done.

Quantitative research methods This subject is designed to introduce students to research methodologies and statistical procedures that are commonly used in quantitative research. As the central aim of the subject is to enable students to become intelligent and critical readers of research literature, the emphasis is on the purposes and constraints of selected statistical procedures. This requires a basic understanding of fundamental constructs that underpin data collection procedures and data analysis in quantitative research. Considerable emphasis is given to statistical procedures including univariate and bivariate analysis, as well as more sophisticated multivariate techniques. From this foundation, students are required to submit a proposal for quantitative research study, which asks students to identify a problem in the broad field of education, develop a research question or hypothesis, define the inherent constructs, select appropriate methods to investigate these constructs, and determine an analysis plan.

A clear implication of our argument thus far is that graduate students undertaking research training in learning technology need to be exposed to a range of approaches to learning technology research. The standard approach to this area within postgraduate studies at university would be familiar to many: the unit, subject or course that provides students with discrete explanations of the popular historical and contemporary approaches to social science research. Many of these courses will give students an opportunity to apply the research methods they have covered in the course to their own research project or problem. Often this will result in students – perhaps after a period of reflection and consideration, perhaps after asking what their student colleagues "are using" for their research and even in consultation with their research advisors – adopting a research method that is consistent with their department, research group or advisor. In many cases this will result in research questions and aims being investigated using appropriately framed paradigms, methodological approaches and methods.

But what is often missing from this approach is a genuine consideration of alternative framings and approaches to learning technology research. When asked to apply what they have learnt in 'Research Methods' courses to their own research problems, unsurprisingly students typically gravitate towards what they, their advisors or their departments, 'know', advocate and feel comfortable with. So while students are exposed to – or told about-different flavours and styles of learning technology research, they are often not, in our experience, encouraged to think deeply about the implications of these approaches when it comes to the actual conduct of learning technology research. Given this, we offer an example of an approach to research training in learning technology that actively encourages students to consider alternative perspectives or pathways that can be taken in learning technology research. An approach Kennedy has used in advising higher degree research students is the use of *counter-positives*.

When students are describing and defining their investigations within a research project he will often ask them to clearly articulate their aims, goals or questions, their methodological approach to these questions and how they will actually go about collecting or generating data. While many students will need help in this, most will be able to come up with workable research approaches. In fact, some students are able to quickly articulate their methodology and method on the basis of their previous academic experiences. A common example of this from work in the health sciences is that students propose a clearly articulated experimental method as an approach to

investigating what are fundamentally exploratory research questions in the area of learning technology.

Regardless of what students propose in the first instance, we often find it useful for students to actively consider alternative approaches to their specific research investigation and problem. So the student who proposes an experimental method will be asked to consider how the same or similar question could be investigated using a contrasting paradigm, methodology and method. In doing this, students will see how the nature of their research aim or question may change, often quite subtly, in response to an alternative investigative approach. They will also see how an alternative methodological approach to a research question might generate data that would be neglected with the approach originally advocated; and the new type of data might seem more useful in responding to the question. This would often result in thinking more deeply about how the original question might be changed or how the methodology and approach to the research might be changed. By discussing and reflecting on *counter positive* research approaches, we hope students come to understand, whatever approach they ultimately choose, there is a need for pluralism in learning technology research.

Pressures on the current paradigm

While we are in a period of normal science there are several pressures on the current paradigm, which embeds the division between qualitative and quantitative research in learning technology. Firstly new technologies have opened up new kinds of research relevant to the field. Some of these, such as Virtual Ethnography (Hine 2000; Wittel 2000) extend the range of possibilities for researchers, but pose no great challenge to the existing paradigm of normal research in learning technology. However there are other developments that threaten to undermine existing divisions into neat methodological categories. Flyvbjerg (2004) argues for a proper and full place for case studies in social science research but notably in his conclusion he makes the point of arguing that this approach does not exclude whole population survey research, which he argues has a complimentary role to play. Herring (2008) suggests integrating discourse analysis with Social Network Analysis in an expanded form of Content Analysis and Judd and Kennedy (2010) used computer logs over a five year period to monitor students' actual rather than reported technology use and the variation in that usage over time. Commenting on the impact of internet technologies on qualitative research Baym and Markham (2009) note that:

> the internet brings into sharp relief previously assumed and invisible epistemologies and practices of inquiry. In fact, challenges of conducting internet research have prompted its researchers to confront head-on, numerous questions that lurk less visibly in traditional research contexts. Consequently internet researchers have been compelled to reconsider basic principles and practices of qualitative inquiry, with important critiques of a priori methodological certainties (Baym and Markham 2009, viii)

All these examples show how current research, especially that engaged with new technologies, questions the taught division between quantitative and qualitative research and these minor challenges to the joint quantitative-qualitative paradigm are amplified in a range of new types of research that rely on the naturally occurring data collected by computers and computer networks and access to new kinds of data.

Some of the emerging methods of research may pose a more fundamental challenge to the current paradigm. To illustrate these potential challenges we have chosen two emerging research areas.

1. Network analysis (Barabasi 2002), including SNS (e.g. Haythornthwaite 2005), learner analytics (Retalis et al. 2006) and visualizations.

Large data sets can be mined for naturally occurring data that describe patterns of interaction that have stable features in aggregate even though individual interactions remain contingent. For example Barabasi's work points to the prevalence of scale free networks in a variety of phenomena including mobile phone links, Internet and Web connections. Social Network Analysis has developed a language for research and a set of techniques as well as stable results, for example about the approximate size of personal networks. The techniques of SNS can also be applied to generate powerful visualisations (Dawson, Bakharia, and Heathcote 2010)

2. Neurological studies e.g. studies on the brain in relation to the effects of immersion in new technologies (Bavelier, Green, and Dye 2010; Dalgarno, Kennedy, and Bennett 2009; Meyler et al. 2008)

Neuroscience has an obvious connection to education but it has a specific relationship to ideas in learning technology through the claims made by authors such as Prensky (2001) about the effects of technology immersion on the brains of young people.

The suggestion to which our argument gives rise is that normal science, conducted within an overall paradigm of research allowing two different traditions to co-exist, is being challenged by a major shift in the research environment related to digital and networked technologies. There is a danger that the co-existence of two research approaches in one research area leads to a dialogue of the deaf with researchers only listening to research conducted within their own research domain and ignoring research using other approaches. It is the pressing issues and challenges that face learning technologists that will drive students and researchers to explore existing problems in new ways, using the new technologies as research instruments and platforms, and examining the novel problems that arise alongside the developing technological environment.

The drive for change in research training is most likely to be driven by research students challenging existing training and research practices. The second potential source of challenges to the existing paradigm in learning technology research lies in the topics we address. Both authors have engaged in recent years with issues concerning the relationship between new technologies and students' attitudes and behaviour, often characterised using the terms Net Generation and Digital Natives. The kinds of claims made by Prensky (2001) with regard to the brain, cannot be answered by the standard repertoire of educational research methods and require the use of additional techniques (Bavelier, Green, and Dye 2010), such as Magnetic Resonance Imaging (Dalgarno, Kennedy, and Bennett 2009). This research topic requires complex approaches incorporating standard methods, including surveys, to describe what is happening and qualitative work to explore why students act in the ways that they do, but extending beyond this normal repertoire researchers have been engaged in exploring novel methodological approaches that stretch existing

boundaries (Judd and Kennedy 2010; Dalgarno, Kennedy, and Bennett 2009; Jones and Healing 2010).

Conclusion

We have argued that learning technology research is currently dominated by a paradigm that divides research into qualitative and quantitative types. We are by no means original in suggesting that the division is no longer useful and possibly false (Layder 1993). We go on to argue that the division has become 'normal science' in learning technology and it has provided a consensus that has allowed researchers to avoid disagreements over fundamentals. It has also provided the framework for standard research training. We have argued that this standard framework is coming under pressure from developing research techniques which are particularly relevant to learning technologists. Some of these, for example neuroscience methods, stand in a more or less traditional scientific paradigm. Others such as the use of naturally recorded log data and data mining techniques applied to large corpuses of data sit less clearly within the standard framework. It is not yet clear if these new techniques will undermine the existing paradigm or simply be absorbed by it.

In practical terms we have explored ways to focus more explicitly on the tension between research approaches through the use of the example of using counter positives in postgraduate students' research training. This suggestion illustrates ways that we think it is necessary to develop research training that address the problems and confusions arising from adherence to a strong notion of the linkage between individual research methods and overall research philosophies. We argue for a pragmatic approach to method which pays greater attention to the research question being addressed rather than to any overall philosophical tradition. We conclude by highlighting that the current consensus about research methods in learning technology research may very well be under threat from the development of methods enabled by new technologies that do not fit within 'normal science' as practiced in learning technology research.

References

Barabasi, A.-L. 2002. *Linked: The new science of networks*. Cambridge, MA: Perseus Publishing.

Barley, S.R., and J.E. Orr. 1997. *Between craft and science: Technical settings in U.S. settings*. Ithaca, NY, and London: ILR/Cornell University Press.

Bavelier, D., C.S. Green, and M.W.G. Dye. 2010. Children, wired: For better and for worse. *Neuron* 67, no. 5: 692–701.

Baym, N.K. and A.N. Markham, eds 2009. *Internet inquiry: Conversations about method*. London: Sage.

Beetham, H., S. Jones, and L. Gornall. 2001. Career development of learning technology staff: Scoping study final report for the JISC JCALT. Bristol: University of Plymouth, University of Bristol. http://www.jiscinfonet.ac.uk/Resources/externalresources/LTCDSS/LTCDSS-final-report.doc (accessed July 22, 2011).

Czerniewicz, L. 2008. Distinguishing the field of educational technology. *The Electronic Journal of e-Learning* 6, no. 3: 171–178. Available online at http://www.ejel.org (accessed July 22, 2011).

Czerniewicz, L. 2010. Educational technology – Mapping the terrain with Bernstein as cartographer. *Journal of Computer Assisted Learning* 26, no. 6: 523–34.

Dalgarno, B., G. Kennedy, and S. Bennett. 2009. Using brain imaging to explore interactivity and cognition in multimedia learning environments. OZCHI'09 (November 23–27), Melbourne, Australia.

Dawson, S., A. Bakharia, and E. Heathcote. 2010. SNAPP: Realising the affordances of real-time SNA within networked learning environments. In *Proceedings of the 7th international conference on networked learning, Aalborg 3–4th May 2010*, eds. L. Dirckinck-Holmfeld, V. Hodgson, C. Jones, D. McConnell, and T. Ryberg. http://www.lancs.ac.uk/fss/organisations/netlc/past/nlc2010/abstracts/Dawson.html (accessed July 22, 2011).

Flyvbjerg, B. 2004. Five misunderstandings about case-study research. In *Qualitative research practice*, ed. C. Seale, G. Gobo, J.F. Gubrium, and D. Silverman, 420–434. London and Thousand Oaks, CA: Sage.

Gage, N.L. 1989. The paradigm wars and their aftermath: A "historical" sketch of research on teaching since 1989. *Educational Researcher* 18, no. 7: 4–10.

Goodyear, P. 2009. Foreward. In *Analysing networked learning practices in higher education and continuing professional development*, ed. L. Dirckinck-Holmfeld, C. Jones, and B. Lindström, vii–x. Rotterdam: Sense Publishers.

Haythornthwaite, C. 2005. Social networks and Internet connectivity effects. Information. *Communication & Society* 8, no. 2: 125–47.

Herring 2008. Web content analysis: Expanding the paradigm. In *The International Handbook of Internet Research*, ed. J. Hunsinger, M. Allen, and L. Klastrup, 233–45. Berlin: Springer Verlag.

Hine, C. 2000. *Virtual ethnography*. London: Sage Publications.

Hudson, A. 2009. New professionals and new technologies. PhD diss., Umea Univ. www.diva-portal.org/smash/get/diva2:236168/FULLTEXT01 (accessed July 22, 2011).

Johnson, R.B., and A.J. Onwuegbuzie. 2004. Mixed methods research: A research paradigm whose time has come. *Educational Researcher* 33, no. 7: 14–26.

Jones, C. 2004a. Theory and the practices of learning technology. In *Networked learning 2004: Proceedings of the fourth international conference on networked learning 2004*, ed. S. Banks, P. Goodyear, V. Hodgson, C. Jones, V. Lally, D. McConnell, and C. Steeples. Lancaster: Lancaster University and University of Sheffield.

Jones, C. 2004b. Quantitative and qualitative research: Conflicting paradigms or perfect partners? In *Networked learning 2004: Proceedings of the fourth international conference on networked learning 2004*, ed. S. Banks, P. Goodyear, V. Hodgson, C. Jones, V. Lally, D. McConnell, and C. Steeples, 106–12. Lancaster: Lancaster University and University of Sheffield.

Jones, C., and L. Dirckinck-Holmfeld. 2009. Analysing networked learning practices: An introduction. In *Analysing networked learning practices in higher education and continuing professional development*, ed. L. Dirckinck-Holmfeld, C. Jones, and B. Lindström, 1–27. Rotterdam: Sense Publishers.

Jones, C., and G. Healing. 2010. Networks and locations for student learning. *Learning Media and Technology* 35, no. 4: 369–85.

Judd, T., and G. Kennedy. 2010. A five-year study of on-campus Internet use by undergraduate biomedical students. *Computers & Education* 55, no. 1: 564–71.

Kuhn, T.S. 1970. *The structure of scientific revolutions*, 2nd ed. Chicago: University of Chicago Press.

Layder, D. 1993. *New strategies in social research*. Cambridge, UK: Polity Press.

Meyler, A., T.A. Keller, V.L. Cherkassky, J.D.E. Gabrieli, and M.A. Just. 2008. Modifying the brain activation of poor readers during sentence comprehension with extended remedial instruction: A longitudinal study of neuroplasticity. *Neuropsychologia* 46: 2580–92.

Oliver, M., R. Sharpe, J. Duggleby, D. Jennings, and D. Kay. 2004. Accrediting learning technologists: A review of the literature, schemes and programmes. *Final version* 6. http://www.ucl.ac.uk/calt/alt-accreditation/Initial_review.doc (accessed July 22, 2011).

Prensky, M. 2001. Digital natives, digital immigrants, part 2: Do they really think differently? *On the Horizon* 9, no. 6: 6.

Reeves, T.C., J. Herrington, and R. Oliver. 2005. Design research: A socially responsible approach to instructional technology research in higher education. *Journal of Computing in Higher Education* 16, no. 2: 97–116.

Retalis, S., A. Papasalouros, Y. Psaromiligkos, S. Siscos, and T. Kargidis. 2006. Towards networked learning analytics – A concept and a tool. In *Proceedings of the fifth international conference on networked learning 2006*, eds. S. Banks, V. Hodgson, C. Jones, B. Kemp, D. McConnell, and C. Smith. Lancaster: Lancaster University. http://www.lancs.ac.uk/fss/organisations/netlc/past/nlc2006/abstracts/Retalis.htm (accessed July 22, 2011).

Ross, S.M., and G.R. Morrison. 1989. In search of a happy medium in instructional technology research: issues concerning external validity, media replication, and learner control. *Educational Technology Research and Development* 37, no. 1: 1042–629.

Ross, S.M., G.R. Morrison, and D.L. Lowther. 2010. Educational technology research past and present: Balancing rigor and relevance to impact school learning. *Contemporary Educational Technology* 1, no. 1: 17–35.

Salomon, G. 1991. Transcending the qualitative-quantitative debate: The analytic and systemic approaches to educational research. *Educational Researcher* 20, no. 6: 10–8.

Shulman, L.S. 1988. Disciplines of inquiry in education: An overview. In *Complementary methods for research in education*, ed. R.M. Jaeger, 3–17. Washington, DC: AERA.

Wittel, A. 2000. Ethnography on the move: From field to net to Internet [23 paragraphs]. *Forum Qualitative Sozialforschung/Forum: Qualitative Research* [On-line Journal] 1, no. 1. http://qualitative-research.net/fqs (accessed July 22, 2011).