

# The SAGE Handbook of E-learning Research



Second Edition

Edited by  
Caroline Haythornthwaite, Richard  
Andrews, Jude Fransman and  
Eric M. Meyers

 SAGE reference

Los Angeles | London | New Delhi | Singapore | Washington DC | Melbourne



Los Angeles | London | New Delhi  
Singapore | Washington DC | Melbourne

SAGE Publications Ltd  
1 Oliver's Yard  
55 City Road  
London EC1Y 1SP

SAGE Publications Inc.  
2455 Teller Road  
Thousand Oaks, California 91320

SAGE Publications India Pvt Ltd  
B 1/1 1 Mohan Cooperative Industrial Area  
Mathura Road  
New Delhi 110 044

SAGE Publications Asia-Pacific Pte Ltd  
3 Church Street  
#10-04 Samsung Hub  
Singapore 049483

---

Editor: Marianne Lagrange  
Editorial Assistant: Colette Wilson  
Production editor: Sushant Nailwal  
Copyeditor: Sharon Cawood  
Proofreader: Dick Davis  
Indexer: Avril Ehrlich  
Marketing manager: Dilhara Attygalle  
Cover design: Wendy Scott  
Typeset by: Cenveo Publisher Services  
Printed and bound by CPI Group (UK) Ltd,  
Croydon, CR0 4YY

At SAGE we take sustainability seriously. Most of our products are printed in the UK using FSC papers and boards. When we print overseas we ensure sustainable papers are used as measured by the PREPS grading system. We undertake an annual audit to monitor our sustainability.

Editorial arrangement © Caroline Haythornthwaite, Richard Andrews, Jude Fransman and Eric M. Meyers 2016

- |   |   |
|---|---|
| Chapter 1 © Caroline Haythornthwaite, Richard Andrews, Jude Fransman and Eric Meyers 2016 | Chapter 15 © Lesley Jane Gourlay and Martin Oliver 2016   |
| Chapter 2 © Christopher Hoadley 2016  | Chapter 16 © Andrew Whitworth 2016  |
| Chapter 3 © Chris Jones and, Maarten de Laat 2016   | Chapter 17 © Lori Lockyer, Shirley Agostinho and Sue Bennett 2016                               |
| Chapter 4 © Mike Sharples, Josie Taylor and Giasemi Vavoula 2016                          | Chapter 18 © Drew Paulin and Sarah Gilbert 2016   |
| Chapter 5 © Sian Bayne 2016   | Chapter 19 © Richard Halverson and Constance Steinkuehler 2016                                  |
| Chapter 6 © Terry Locke 2016  | Chapter 20 © Maggi Savin-Baden and Gemma Tombs 2016   |
| Chapter 7 © Andrew Burn 2016  | Chapter 21 © Robin Goodfellow and Mary R. Lea 2016  |
| Chapter 8 © Myrrh Domingo 2016  | Chapter 22 © Gráinne C. Conole, Giles Pepler, Paul Bacsich, Brenda Padilla and Terese Bird 2016 |
| Chapter 9 © Carol A. Chapelle 2016  | Chapter 23 © Nazlin Bhimani 2016  |
| Chapter 10 © Janina Brutt-Griffler and Namsook Kim 2016                                   | Chapter 24 © Rhiannon Looseley and Juno Rae 2016  |
| Chapter 11 © Rebecca Eynon, Ralph Schroeder and Jenny Fry 2016                            | Chapter 25 © John Cook 2016   |
| Chapter 12 © Tim Rogers, Shane Dawson and Dragan Gašević 2016                             | Chapter 26 © Jon Dron and Terry Anderson 2016   |
| Chapter 13 © Caroline Haythornthwaite, Maarten de Laat and Bieke Schreurs 2016            |   |
| Chapter 14 © Alyssa Friend Wise and Trena M. Paulus 2016                                  |   |

First edition published in 2007

Apart from any fair dealing for the purposes of research or private study, or criticism or review, as permitted under the Copyright, Designs and Patents Act, 1988, this publication may be reproduced, stored or transmitted in any form, or by any means, only with the prior permission in writing of the publishers, or in the case of reprographic reproduction, in accordance with the terms of licences issued by the Copyright Licensing Agency. Enquiries concerning reproduction outside those terms should be sent to the publishers.

**Library of Congress Control Number: 2015949311**

**British Library Cataloguing in Publication data**

A catalogue record for this book is available from the British Library

ISBN 978-1-4739-0232-9

# Introduction to the *SAGE Handbook of E-learning Research*, Second Edition

Caroline Haythornthwaite, Richard Andrews,  
Jude Fransman and Eric M. Meyers

## **INTRODUCTION**

The publication of the second edition of the *SAGE Handbook of E-learning Research* attests to the continued need for study and understanding of learning practices in contemporary technology-supported and technology-enabled educational, work and social settings. In preparing the first edition (Andrews & Haythornthwaite, 2007a), we found that while there had been considerable development in teaching and learning online, and in learning design, there was no coherent view of what constituted research in the field. Writing for this 2016 edition, we find there has been much progress in research, but it has taken many new directions, each wrestling with how to analyze and represent learning in an era of continuing change in technologies, learning practices, and knowledge distribution. This volume, like the last, takes stock of progress in e-learning research, highlighting advances as well as new directions in studies and methods for approaching and keeping up with changes in learning in an e-society.

## **SITUATING E-LEARNING**

The term e-learning has at times been equated with the implementation of institutional learning management systems (LMS), also known as virtual learning environments (VLE). Yet, e-learning encompasses far more than the technology alone and more than educational institutional environments. While we were cognizant of wider social impacts when the earlier edition of the Handbook was in

production, major e-learning issues and attention at the time were directed to how to teach online, how to bring resources from the institution into the service of learning for distributed learners, and how to study and practice at the technology–learning interface. While these remain major concerns, research and interest is now wider, grappling with how technology use can be blended with and complement traditional in-class education, and how to blend contemporary youth media practices with established educational perspectives as a wired – and wireless – generation enters university and then the workplace. The reach of the Internet has generated a desire and a vision for providing education to wider audiences, most recently expressed in the development of massively open online courses (MOOCs), yet also enacted daily on a global scale through social media, online news, open access journals, peer production, crowdsourcing, and collaborative information projects such as Wikipedia.

In the e-learning sphere, developments that have garnered attention include the greater adoption of video-based resources for teaching and learning (Burn, 2007; Sherer & Shea, 2011; Tan, 2013; Meyers, 2014a; Meyers, 2014b; Pesina, Beaumont & Parkes, 2014); games and gamification of learning (Halverson & Steinkeuhler, this volume; Burn, this volume; including use of virtual worlds: Savin-Baden & Tombs, this volume); and MOOCs (though see Laurillard, 2014). Other developments include implementation of more enhanced means of helping learners navigate their way through materials, such as lecture recordings that can be annotated (e.g. the collaborative lecture annotation system described in Risko, Foulsham, Dawson & Kingstone, 2013); adaptive learning systems that determine next steps according to learner progress and types of error; and dashboards that show progress or effort in comparison to other learners (e.g. Verbert, Duval, Klerkx, Govaerts & Santos, 2013).

The era of ‘big data’ has arrived since our first edition, and it is quickly changing the landscape in the learning field. Particular attention has been given to the way every online use of information and communication technology leaves digital traces of engagement, interaction, communication, argumentation, and learning. These data provide views of different aspects of learners’ activities, such as: networks of conversation that can show the patterns of social learning; counts of reading downloads or time spent viewing readings that can indicate attention to resources; and highlighting, re-reading, or commentary on online resources that can indicate areas of learning difficulty.

Several major areas of research and institutional practice are emerging that collect or design for the use of such data to examine learning. These include research associated with more established areas of the learning sciences (Hoadley, this volume), computer-supported collaborative learning (e.g. Koschmann, 1996), and networked learning (Jones & de Laat, this volume; Carvalho & Goodyear, 2014); and newer areas such as educational data mining (Baker & Yacef, 2009; Romero, Ventura, Pechenizkiy & Baker, 2011), learning@scale (e.g. Fox, Hearst & Chi, 2014), and learning analytics (Rogers, Dawson & Gašević, this volume; Haythornthwaite, de Laat & Schreurs, this volume; Wise & Paulus, this volume;

Ferguson, 2012). The similar area of academic analytics provides overviews at the institutional level, such as mapping student trajectories across courses and programs, and looking at success and retention rates. Early alert systems for students in academic trouble have been an important development in this area (van Barneveld, Arnold & Campbell, 2012).

Other expansions include engagement of more types of institutions and professions in e-learning. Research for libraries (Bhimani, this volume) and museums (Looseley & Rae, this volume), for example, examines the effects of e-learning on their services and how to bring e-learning practices into their realms. Research into public engagement with research has also explored how digital resources and practices can improve the accessibility of research and incorporate practitioners and the broader public into research processes (see, for example, Holliman, 2011 and Holliman & Curtis, 2015, on science communication and resources from the 'Connected Communities' program funded by the Arts and Humanities Research Council in the UK).

Each new technology brings with it a number of issues relating to social implementation and use. In our earlier introduction (Andrews & Haythornthwaite, 2007b), we emphasized a socio-technical perspective to acknowledge and highlight the interacting effects of social practice and technology. A number of theoretical perspectives are bound up with the idea of examining the social and the technical. Some are more technologically deterministic, seeing the technology's design as expanding or limiting practice. Others (the vast majority) privilege human agency, seeing social practices as driving how, where, when and with whom we use technologies to work, socialize and learn. Still others argue that the social and technical act together, shaping both the forms of technology and the social practices that emerge. Approaches can be even more nuanced when 'technology' is interpreted as the way of doing things, for instance in established rules and routines. For example, in education, the university degree system might be considered such a 'technology' – a technology potentially open to disruption with open online courses that bypass the degree system for certification of knowledge or skills. We return to the socio-technical perspective below (but see also Andrews & Haythornthwaite, 2007b; Whitworth, 2007; and Leonardi, 2012, which offers a useful history of the concepts and use of the terms materiality, sociomateriality and socio-technical systems). Research and perspectives are now rapidly expanding to consider further influences, such as how context, values, design choices, adoption patterns, and/or devices affect use, with an increasing interest in how these affect learning opportunities and practices.

These ideas and their application to e-learning research are considered throughout this Handbook. Chapters address theory, literacy, methods, pedagogy, practice in educational settings and beyond, and a view of the future. As a complement to these chapters, we present here a brief look at current and emerging trends in e-learning theories, perspectives and research, beginning with a review of the socio-technical perspective which we put forward in our first edition, and moving into e-learning research perspectives that have gained momentum since the first edition, and then some we see as upcoming for the near future.

## SOCIO-TECHNICAL PERSPECTIVES

Applied to e-learning, socio-technical perspectives draw attention to the complex of interacting elements that make up an e-learning case: the array of technologies; the individual and collective practices of teachers, learners, and educational institutions; the meaning associated with degrees, universities, and higher education; the technological readiness of stakeholders; the identity and accepted practice associated with the roles of teacher and student; and more. This perspective heightens our awareness of the number and complexity of interacting elements. It steers us away from simple analyses of the use of a single technology in teaching or learning to consider the array of connections and influences at work in different contexts, acting on different levels – individual, group, organization, and society (Kling, Rosenbaum & Sawyer, 2005).

Examples of approaches that deal with such complexity that have been applied to learning include activity theory (Engeström, Mietinen & Punamäki, 1999; Engeström, 2009), communities of practice (Wenger, 1998), and more recent work addressing online social learning (Buckingham Shum & Ferguson, 2012), and learning analytics (Ferguson, 2012; Siemens, 2013). Also relevant is more classic work on learning, such as that of Dewey, Vygotsky and others about learning and context, and social learning (e.g. Dewey, 1938; Vygotsky & Kozulin, 1986; Wertsch, 1998; Kress, 2010; Jewitt & Bezemer, 2015; Illeris, 2007, 2008; Bandura, 2001, 2004).

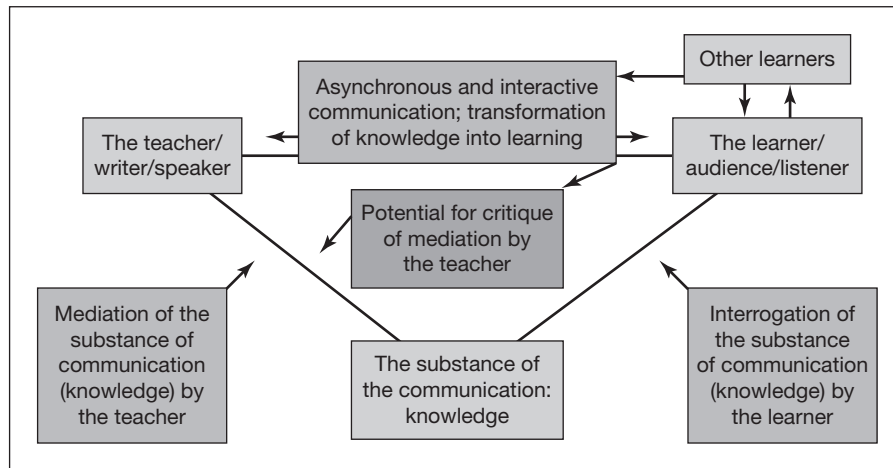
For e-learning, the socio-technical perspective takes us beyond the directed teacher-to-learner relation to consider the wider range of actors involved in the learning process, the way these very practices shape further practice, and the way new roles emerge for teachers and learners when the dyad is no longer viewed as one-directional, nor the learning relationship as only dyadic.

In our earlier writing, Andrews applied this perspective through the lens of rhetorical theory to highlight the more active role of the learner in communication models that emphasize a triad of speaker, audience, and message. Andrews adapted Kinneavy's (1971) model to incorporate more multi-directional communication and influence:

In this adapted model, learning is conceived as a dialogic and dialectical exchange, not only between the learner and the teacher, but also between the learner and the body of knowledge that is being explored. Whereas, in Kinneavy's original model, the 'audience' was relatively passive; in this model, the learner as audience is in a more powerful, active position in relation to the social dynamics of learning. He/she can even critique the teacher's mediation of existing knowledge, as indicated by the box in the middle of the communicative triangle. Furthermore, he/she is part of a community of enquiry with other learners.

(Andrews & Haythornthwaite, 2007b, p. 26)

This adaptation resonates well with concurrent and subsequent research and writing on new online learning practices, including participatory culture (Jenkins,



**Figure 1.1** Adaptation of Kinneavy's (1971) model

Purushotma, Clinton, Weigel & Robinson, 2006), social learning (Buckingham Shum & Ferguson, 2012), connectivism (Siemens, 2005a, 2005b), and studies examining learner and teacher roles in online learning communities (Haythornthwaite, Andrews, Kazmer, Bruce, Montague & Preston, 2007; Pollock et al., 2014). Expanding on the Handbook introduction from 2007, we examined these effects in more detail in *E-learning Theory and Practice* (Haythornthwaite & Andrews, 2011). In that book, and in an article in 2011, Andrews asks provocatively whether all this change calls for a new theory of learning. He concludes that it does. In considering traditional learning theory, social learning, multimodality, and digital media theory, he concludes that 'in terms of learning as (a) a psycho-social construct, (b) an epistemologically-informed practice, and (c) a multimodal social semiotic process, e-learning is gradually bringing about a new theory of learning' (Andrews, 2011, p. 120).

## LITERACY

The literacy necessary to navigate this new e-learning landscape is an increasing topic of research interest. What it means to be literate in and for e-learning is not just a matter of mastering the use of a particular technology or of one particular set of course conventions. As we wrote in the introduction to the first edition of the Handbook (Andrews & Haythornthwaite, 2007b), and subsequently (Haythornthwaite & Andrews, 2011), it is the socio-technical co-evolutionary process that is changing learning practices. Resources for learning and communication have evolved from heavily text-based to multimodal, and from expert-generated and disseminated to user-generated and conversational. What it means to be literate is shifting daily based on the type of resources, people, and settings involved

(Gee & Hayes, 2011; Meyers, Erickson & Small, 2013; Gourlay, Hamilton & Lea, 2014). Thus, there are many avenues for research from a literacy perspective (Goodfellow & Lea, 2013; Haythornthwaite & Meyers, 2012).

Research on multimodality engages with the nature of post-textual literacy (Kress, 1997, 2010; Jewitt, 2008; Domingo, this volume; Gourlay & Oliver, this volume). Research on resource production engages with questions of where expertise resides when anyone can contribute online (Benkler, 2006; Jenkins et al., 2006; Haythornthwaite, 2009, 2011; Budhathoki & Haythornthwaite, 2013), how new knowledge is co-constructed (Scardamalia & Bereiter, 2006) across distance and through computer media (Hine, 2006; Bruce, 2008, 2010), and how to prepare next-generation learners to be productive participatory citizens (Jenkins et al., 2006). Research on institutional response reveals that major challenges are how these now-digital educational entities will engage with literacy (Goodfellow & Lea, 2013, this volume; Siemens, Gašević & Dawson, 2015; Whitworth, this volume), and how educational institutions will learn to be nimble and agile in an age of technological fluidity (Twidale & Nicols, 2013). Research on digital scholarship queries what new academic literacies are required for more open research practices (Weller, 2011; Goodfellow & Lea, 2013; Goodfellow, 2014). Research on contemporary literacy practices looks at the way adults from all walks of life approach learning and design and use a multitude of literacies to accomplish their goals (Barton & Tusting, 2005; Barton, Ivanic, Appleby, Hodge & Tusting, 2007; Weller, 2011; Goodfellow & Lea, 2013; Goodfellow, 2014). These are approaches that have an applicability to e-learning as lifelong literacy continues to require fluency and practice with online interaction and engagement (Hawisher & Selfe, 1999; Cook, this volume).

## CONNECTIVITY

Together, these research streams point to a significant *transformation* in how, where, when and with whom we learn. A growing number of researchers working at the intersection of learning and technology have been researching and addressing the substantial changes that are happening to our formal, informal and non-formal learning environments and practices. The work is coming together around ideas of *connectivity* – across sites, resources, technologies, and people – driven not just by the technology of communication networks, but also by social change in the production, distribution, and engagement with learning and knowledge (Siemens, 2005a, 2005b; Andrews & Haythornthwaite, 2007a; Haythornthwaite & Andrews, 2011; Rainie & Wellman, 2012; Carvahlo & Goodyear, 2014; Jones, 2015).

Researchers of *networked learning* have been engaged with connectivity from the start. Jones (2015) provides this core definition, first published in Steeples and Jones (2002; see also Jones & de Laat, this volume). Networked learning is:



... learning in which information and communications technology (ICT) is used to promote connections: between one learner and other learners, between learners and tutors; between a learning community and its learning resources

(Jones, 2015, p.5)

Kalantzis and Cope (2009) aptly capture the transformation in their characterization of *ubiquitous learning*:

As we use web technology to make sense of the world around us through blogs, wikis, mash-ups, podcasts, social software, online worlds, open-source and open-access media, and a whole host of other current and emergent online practices, the constructions of our own evolving understandings become information in the public sphere. In essence, the process of learning and the products of learning are rapidly merging into ubiquitous knowledge engagement. The implications of this profound transformation – for formal schooling, for online communities, for evolving definitions of public knowledge, and for global interconnectedness and economic development – cannot be underestimated.

(2009, p. x)

Here, we follow our earlier writing to continue to promote the term *e-learning* as signifying not just online programs or learning management systems, but the transformation of learning practice at individual, group, institutional, and societal levels. As presented in Haythornthwaite & Andrews (2011):

First, we see e-learning as a transformative movement in learning, not just the transfer of learning to an online stage, and we use the prefix 'e-' in keeping with use in the emerging areas of e-research and e-science. Second, we do not see e-learning as bounded by institutional structures of courses, programs or degrees, but instead embracing the way learning flows across physical, geographical, and disciplinary borders. Third, we see e-learning as perpetual, sustained over a lifetime, and enacted in multiple, daily occurrences as we search for information to satisfy our learning needs and contribute content that promotes our and others' understanding. This kind of learning is mobile, in the sense of learning from and in new and different locations as needed and on the devices at hand. Fourth, we see e-learning as an engaged act created through both technical and social decisions. A technology does not make e-learning, but rather teachers and learners use technology to create the social space in which learning occurs. This may be a psychological space, sustained across multiple devices and activities; it may be a cyberspace, providing one stop entry into the learning experience; and it may be a physical space, using technology to connect learning to locations or objects in cities and museums.

(2011, p. 2)

Connectivity is not just the passive connection of networks, but the active connection of people, ideas, and resources. This connectivity embraces social activity, including the conversational practices of online interaction, the learning of argumentation and discourse community norms, enculturation in the epistemic community or community of practice; and it includes connectivity to applicable local and/or distributed contexts. Learning theories that pertain are those that emphasize the way working out problems with others helps individuals to master content and context (situated cognition, e.g. Brown, Collins & Duguid, 1989),

connecting it to their lived experience (e.g. the writings of John Dewey; Bruce, 2008, 2009), and carrying it with them as they move (Sharples, Taylor & Vavoula, this volume). Also relevant is research and theory on how this helps communities to create shared understanding, common knowledge, shared vocabularies, shared spaces, and new knowledge (Miller, 1994; Wenger, 1998; Cook & Brown, 1999; Scardamalia & Berierer, 2006; Bruce, 2010; Locke, this volume). If learning was 'an effect of community' in the early 1990s (Rogoff, 1991), it is now an effect of communities, including e-communities, and the individual's interaction with and between these communities.

A recent perspective to emerge in relation to e-learning, in the wider definition used here, is *connectivism*, from the work of George Siemens and Steven Downes (Downes, 2005; Siemens, 2005a, 2005b). Their theoretical perspective underpins the idea of cMOOCs, i.e. connectivist MOOCs, where the pedagogical intent is to engage learners in making connections across multiple resources, platforms, and actors. MOOC as a term was first introduced by Dave Cormier (2008) in conversation with Siemens and Downes, and in connection with the first cMOOC; in terms of pedagogy and delivery, cMOOCs are commonly contrasted with the later xMOOCs that have been oriented to course delivery in a more typical university course format. E-learning advocates have lamented the lack of attention to the social in xMOOCs, with recent calls to 'bring back the social' (Bryant, 2015).

But the idea and utility of connectivism is more than just about conversation or social interaction among learning participants. Connection is also to be made across resources and platforms, forming the basis of an understanding that is balanced in the network of interconnected ideas, actors, and authors. As such, it supports a more dynamic, continuously emergent state of knowledge, one that matches the intent of activity theory (Engeström, 2009) and communities of practice (Wenger, 1998) in embracing the changing nature of knowledge, the underpinning resources, and their meaning in any particular context or for any particular community. It resonates with research and system development that supports personal learning environments, personal learning networks, and learner-generated contexts (Luckin, 2008, 2010; see also Conole, Pepler, Bacsich, Padilla & Bird, this volume; Sharples, Taylor & Vavoula, this volume); and the growing global connectivity that directs us to understand both new language acquisition and the new multilingual nature of our global interactions (Brutt-Griffler, this volume; Chapelle, this volume).

## HUMANS IN THE MIX

Discussions emerging in the mid-2010s are focusing more on the role of humans in the socio-technical mix. This direction of inquiry responds to a need to understand the unique contribution that humans make in a time of what appears to be technology-driven change, and the impact this has on the kinds of work humans

can do and will be doing. Commentary on human skills in combination with learning and technology appear in research in labor, computer science, and e-learning.

Research in economics and labor suggest an increased need for human skills in teaching, as one example of work where basic education and vocational skills are combined in the role of ‘new artisans’ (Autor & Dorn, 2013, attributing the term to Lawrence F. Katz; see also Autor, 2014). Autor and Dorn (2013) write:

we expect to see growing employment among the ranks of the ‘new artisans’: licensed practical nurses and medical assistants; *teachers, tutors and learning guides at all educational levels*; kitchen designers, construction supervisors and skilled tradespeople of every variety; expert repair and support technicians; and the many people who offer personal training and assistance, like physical therapists, personal trainers, coaches and guides. These workers will adeptly combine technical skills with interpersonal interaction, flexibility and adaptability to offer services that are uniquely human.

(Autor & Dorn, 2013, online, emphasis added)

This attention to the new artisans dovetails with directions in computing that engage with optimizing the fit between what computers do best and what humans do best. Human computation (MIT Technology Review, 2015; Michelucci, 2013) has been employed for a while in a number of crowdsourced projects, particularly those associated with citizen science. Perhaps one of the best known is GalaxyZoo where individuals identify galaxies from images of star clusters ([www.galaxyzoo.org/](http://www.galaxyzoo.org/)). However, attention to the role of humans in computation is becoming more established as a research agenda, and may help address the question of where, when, and how humans and technologies best support learning. The push–pull between technology and humans is captured in recent articles which extol the virtues of ‘machine teaching’ for creating individual learner pathways in adaptive learning environments (McIntire, 2015), in terms that echo earlier speculation about online tutoring systems. Other work is showing where the human may be most relevant, perhaps as the human contact point after a computerized early alert system shows the student is falling behind. Work on human embodied cognition (Kirsh, 2013, 2015) is interesting with regard to human–computer interaction as it emphasizes the way our physical interactions with the world shape our understanding and learning:

[Kirsh] suggests that tools shape cognition and vice-versa; that our ability to think is the product of our interaction with the outside world and the prosthetics we use to interact with and act upon that world. Furthermore, there is thinking within the confines of the body that is partly determined by the way the body reacts to outside stimuli. There is also the fact that the body, in collaboration with its tools, can act on the environment and engender new ways of thinking.

(Andrews, forthcoming)

The human is, of course, intricately involved in teaching and learning. As Garrison and Anderson wrote in 2003, teacher presence is a necessary part of

successful e-learning implementations, along with cognitive and social presence. Recent work by Pollock and colleagues (2014) adds to our understanding of the role of the human teacher in e-learning. In their research, they found a variety of roles for the teacher in e-learning settings: as explainer of technology, in digesting, explaining, extending content, and in working with the learner and their learning experience. However, work should not stop at considering the work of the teachers and teaching in e-learning, but should attend also to the e-learners. These humans sit at the center of their personal learning environment and their personal learning network. What is it they do best in the e-learning setting? Earlier work on e-learner roles highlighted their ability to work with other learners through explaining and synthesizing content, giving context to content, and acting as peer supporters regarding the e-learning experience (Haythornthwaite & Kazmer, 2004; Haythornthwaite et al., 2007).

We also need to ask what work and responsibilities fall to the e-learner, particularly as e-learning practices continue as part of work, personal, social, and recreational activities. We have written elsewhere about how individuals learn the language and practices of online interaction on their way to becoming e-learners, often through joint definition with other participants (Haythornthwaite, 2013; Haythornthwaite & Andrews, 2011). New norms have arisen and are arising about being an e-learner. As online conversation quantity quickly overwhelms the capacity of a single teacher to monitor and respond, responsibility for conversation is often passed to or taken up by learning participants, such as in the roles described above. MOOC course instructors are now facing this challenge on a massive scale, as well as wondering how to grade thousands of assignments. Research and experimental courses are now beginning to address how participants can be drawn into the operation and conduct of the course, including as part of their responsibility engagement in activities from curriculum definition (e.g. see [connectedcourses.net](http://connectedcourses.net)) to assignment evaluation (Paulin & Haythornthwaite, forthcoming).

The newly emerging field of *learning analytics* is particularly focused on optimizing this mix from a data collection, analysis, and use perspective, making the most of what it can for learning based on data streams that are designed into or result as byproducts of online learning systems. As stated in conjunction with the first Learning Analytics and Knowledge Conference: 'Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs' (LAK, 2011, online).

Rogers, Dawson and Gašević (this volume) discuss this area further, emphasizing the need to undertake such research by starting with educational theory rather than diving blindly into massive quantities of data. (For more on learning analytics, see Long & Siemens, 2011; Siemens & Gašević, 2012; Haythornthwaite, de Laat & Dawson, 2013.) This emphasis brings learning to the forefront in these examinations of analytics, and gives a counterpoint to research that aims

to collect every piece of data for some unspecified future use. A growing body of research is taking a broader look at pedagogical methods and their success with these new forms of e-learning (e.g. Lockyer, this volume; Savin-Baden & Tombs, this volume), with an overall aim of supporting the design of productive, networked learning environments (Carvalho & Goodyear, 2014).

Eynon (this volume) also cautions against such blanket data collection, considering the ethical issue for e-learning researchers and their responsibility to proper research conduct. The human is thus again brought into the process by considering the role of the human researcher. Elsewhere, Slade and Prinsloo (2013) also discuss ethical considerations for research and design relating to learning analytics in relation to issues of student confidentiality, data ownership, and data use. Their research and work in the area of human–computer interaction remind us that when we design, we inscribe values into technologies (e.g. Knobel & Bowker, 2011; JafariNaimi, Nathan, & Hargraves, forthcoming). This perspective provides valuable input for learning design so that systems can reach and be used appropriately by a wide range of learners.

## MATERIALITY

Another new factor entering discussions is the role of material artifacts. This shares some commonality with the concepts associated with human embodied cognition, but here with attention paid to the physical objects and settings.

The role of physical environments in learning was first described by Gibson (1979) who originated the concept of affordances, since picked up for discussion of the design of objects and computer systems (Norman, 1988; Gaver, 1996a, 1996b), and computer-mediated communication. An ‘affordance’ is that which a physical environment or object ‘affords’ or ‘allows’ for the possibility of. Researchers addressing collaborative work and computer-mediated communication applied the concept to ‘social affordances’, where the design of the environment or object enables particular kinds of interaction among members of a group (Bradner, Kellogg & Erickson, 1999; Haythornthwaite & Bregman, 2004).

The role of physical campuses and school environments have been discussed for a while, particularly around the loss of such physicality with the move to online educational programs (Marsden, 1996; Bayne, Gallagher & Lamb, 2013), as has the ‘takeover’ of classrooms by the distractions of Internet access (e.g. Gourlay, 2012). However, the role and communicative meaning of the artifact – mobile phone, laptop, e-reader, etc. – has been less well explored in relation to learning. Research addressing *materiality*, *sociomateriality*, and *posthumanism* provide interesting opportunities to explore the role of artifacts and features of technology in relation to education, learning, and social interaction (Hayles, 1999; Hine, 2000; Savage, Ruppert & Law, 2010; Edwards, Tracy & Jordan, 2011; Fenwick, Edwards &

Sawchuk, 2011; Leonardi, 2012). Chapters in this volume that address this area include Bayne; Gourlay and Oliver; and Goodfellow and Lea.

## CONCLUSION

We have aimed in this Handbook to cover what we see as key areas in the field of e-learning research. In addition to the topics discussed above, we have borne in mind, through our structuring of the Handbook: theories for e-learning; literacy and e-learning; methods and perspectives on e-learning research; pedagogy and practice; learning beyond the classroom (in informal as well as formal contexts); and future prospects. We have wished to avoid future-gazing and over-claiming the potential impact of new advances in digital technologies on learning and social interaction. Indeed, we still hold to the principle, set out in the first edition, of a reciprocal and co-evolutionary relationship between new technologies, social engagement, and learning. If anything, the significant change we have seen in the eight years since the first edition is the different patterning in individual and social learning, rather than any step-change in digital technology development.

The Handbook retains the dual function of reviewing the best research *about* e-learning and also providing pointers and guidance *for* e-learning research. In those senses we hope to have served both theory and practice in the field. Although the focus of the Handbook is on e-learning research in these two senses, it is also about research *per se*. Little research is conducted today without recourse to digital applications. There is a spectrum of practice in research from the scholar working through documents in a library archive at one end, to the researcher dealing with digital media and hardly touching the printed word at the other (see Weller, 2011). All researchers find their position on the spectrum through a combination of material and ethereal data and evidence, and in a range and combination of modes and media.

One aspect of research that we feel deserves further work is that of ethics in the digital age. There are at least two main aspects to ethical consideration: one involves a wide scope and includes matters of intellectual property, storage, and distribution in the digital age; the other is more local, involving the considerations that any student or researcher embarking on research has to take into account when undertaking e-research. Ethical considerations have to be at least considered by any student or researcher from final-year undergraduate project upwards, whether they are students working individually or teams of researchers working across the world. Moreover, such thought needs to go into practice early in research consideration, i.e. rather than just paying lip service to ethics in the design, conduct, and dissemination of research (see Rogers, Dawson & Gašević, this volume, on web analytics; and Eynon, this volume, on the implications of new technologies for ethics). Ethical implications thus come into play not just in terms of informed consent with human participants, but in terms of intellectual

property worldwide. In our view, there is a place for further work on ethics in e-learning research, not least because of its intrinsic interest, and for more publication on this issue.

Another issue of growing importance, particularly in the area of e-learning practice, is that of assessment. As learning increasingly becomes independent, distributed, and mediated by technology, how do we develop models and methods for assessing the quality of learning experiences and the evidence of student learning? Furthermore, how do we provide new forms of summative and formative feedback to learners as they navigate the curriculum, either socially or independently? Several contributions to this volume offer insights into these challenges, particularly those working in open education systems, whether formal and informal, such as MOOCs (Siemens, 2013), social media-based pedagogies (Paulin & Gilbert, this volume), or classrooms set in virtual space (Savin-Baden & Tombs, this volume). The growing field of learning analytics (Rogers, Dawson & Gašević, this volume) is pushing scholars to explore new ideas for incorporating data on the student experience of learning. In addition to providing guidance for educators to design more effective and efficacious programs of learning, assessment offers valuable feedback to learners. New ways of incorporating assessment directly in online learning experience, such as game telemetry (Halverson & Steinkeuler, this volume) and epistemic network analysis (Shaffer et al., 2009), offer new techniques for connecting assessment directly to the context of engagement. In large online classes, such as MOOCs, some are also turning to means of assessment that are ‘crowd-sourced’, i.e. cooperating with the learning crowd in peer assessment models (Paulin & Haythornthwaite, forthcoming). At present, we are just scratching the surface of how we might better integrate the new forms of learning made possible by contemporary digital tools and techniques with the ever-present call for evaluation of and accountability for learning.

Another aspect of all research, and one which is brought into particularly sharp focus in e-learning or e-research, is the involvement of the participants and users of research. Some of the most successful research, in terms of application, has been conceived in collaboration with potential users and then disseminated in a way that is of practical use. The model of research which saw the research process as sealed off hermetically within universities is fast giving way to a more grounded, interactive model in which dissemination of intention and even of emerging results begins at the start of the research, rather than *post facto*. Furthermore, in terms of dissemination, we have seen how important the abstract and keywords are in the summarizing and framing of research, and how they have become the principal search genres for research internationally. Such distillation of (often complex) concepts is an art that has become more refined since the advent of digitization, and mirrors the need for quick access to lucid summaries of research: from keywords to abstracts, and thence to one- or two-page summaries, 10- to 20-page summaries for professional and other interested parties, and access to the full report, dissertation, or thesis for those that desire a deeper look.

Finally, if we are to allow ourselves to speculate briefly on the future of e-learning research, we would predict the following changes over the coming years (see also Dron & Anderson, this volume): greater attention to learning in part or whole in environments outside traditional educational degree-based contexts; greater attention to analytics and their use for evaluation of individual and program-level outcomes; greater attention to connectivity across media, resources, experts, and locations, aided by online access, participatory practices, and mobile computing; an expanded role for learners as active course constructors and leaders in e-learning environments; more emphasis on human-embodied cognition and materiality, aided by advances in prosthetic and other devices; greater recognition of multimodality in the conduct and presentation of research, including more use of film, images, and sound; more demand for research which gets upstream of policy and practice, in addition to conventional *ex post facto* research; a continued transformation of library provision and use to enable off-site engagement with sources and data; and advances in serious gaming. We look forward to taking part in these developments as well as to witnessing them, and hope the present edition of the Handbook provides some of the frameworks and insights for taking forward learning and research.

## REFERENCES

- Andrews, R. (2011). Does e-learning require a new theory of learning? Some initial thoughts. *Journal for Educational Research Online*, 3(1), 104–121.
- Andrews, R. (forthcoming). *A prosody of free verse: Explorations in rhythm*. New York: Routledge.
- Andrews, R. & Haythornthwaite, C. (eds) (2007a). *The SAGE handbook of e-learning research*. London: Sage.
- Andrews, R. & Haythornthwaite, C. (2007b). Introduction to e-learning research. In R. Andrews & C. Haythornthwaite (eds), *The SAGE handbook of e-learning research* (pp. 1–52). London: Sage.
- Autor, D. H. (2014). Polanyi's paradox and the shape of employment growth, 3 September. Retrieved 11 August 2015 from <http://economics.mit.edu/files/9835>
- Autor, D. H. & Dorn, D. (2013). How technology wrecks the middle class. *New York Times*, 24 August. Retrieved 11 August 2015 from [http://opinionator.blogs.nytimes.com/2013/08/24/how-technology-wrecks-the-middle-class/?\\_r=0](http://opinionator.blogs.nytimes.com/2013/08/24/how-technology-wrecks-the-middle-class/?_r=0)
- Baker, R. S. J. d. & Yacef, K. (2009). The state of educational data mining in 2009: A review and future visions. *Journal of Educational Data Mining*, 1(1), 3–17.
- Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, 52, 1–26.
- Bandura, A. (2004). Social cognitive theory for personal and social change by enabling media. In A. Singhal, M. J. Cody, E. M. Rogers & M. Sabido (eds), *Entertainment-education and social change: History, research, and practice* (pp. 75–96). Mahwah, NJ: Lawrence Erlbaum.
- Barton, D. & Tusting, K. (2005). *Beyond communities of practice: Language, power and social context*. Cambridge: Cambridge University Press.
- Barton, D., Ivanic, R., Appleby, Y., Hodge, R. & Tusting, K. (2007). *Literacy, lives and learning*. London: Routledge.
- Bayne, S., Gallagher, M. & Lamb, J. (2013). Being 'at' university: The social topologies of distance students. *Higher Education*, 67(5), 569–583.



- Benkler, Y. (2006). *The wealth of networks: How social production transforms markets and freedom*. New Haven, CT: Yale University Press.
- Bradner, E., Kellogg, W. & Erickson, T. (1999). The adoption and use of 'Babble': A field study of chat in the workplace. *Proceedings of the 6th European Conference on Computer Supported Cooperative Work (ECSCW'99)* (pp. 139–158). Copenhagen, Denmark.
- Brown, J. S., Collins, A. & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32–42.
- Bruce, B. C. (2008). Coffee cups, frogs, and lived experience. *International Journal of Progressive Education*, 4(2), 22–39.
- Bruce, B. C. (2009). Ubiquitous learning, ubiquitous computing, and lived experience. In B. Cope & M. Kalantzis, *Ubiquitous Learning*. Champaign, IL: University of Illinois Press.
- Bruce, B. C. (2010). 'Building an airplane in the air': The life of the inquiry group. In B. Drayton & J. Falk (eds), *Creating and facilitating effective on-line professional development for educators*. New York: Teachers College Press.
- Bryant, T. (2015). Bringing the social back to MOOCs. *Educause Review*, 22 June. Retrieved 18 August 2015 from <http://er.educause.edu/articles/2015/6/bringing-the-social-back-to-moocs>
- Buckingham Shum, S. & Ferguson, R. (2012). Social learning analytics. *Educational Technology & Society*, 15(3), 3–26.
- Budhathoki, N. R. & Haythornthwaite, C. (2013). Motivation for open collaboration: Crowd and community models and the case of OpenStreetMap. *American Behavioral Scientist*, 57(5), 548–575.
- Burn, A. (2007). The place of digital video in the curriculum. In R. Andrews and C. Haythornthwaite (eds), *The SAGE handbook of e-learning research* (pp. 504–523). London: Sage.
- Carvalho, L. & Goodyear, P. (2014). *The architecture of productive learning networks*. New York: Routledge.
- Cook, S. D. N. & Brown, J. S. (1999). Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing. *Organization Science*, 10(4), 381–400.
- Cormier, D. (2008). The CCK08 MOOC: Connectivism course, 1/4 way. Retrieved 18 August 2015 from <http://davecormier.com/edblog/2008/10/02/the-cck08-mooc-connectivism-course-14-way/>
- Dewey, J. (1938). *Experience and education*. New York: Kappa Delta Phi.
- Downes, S. (2005). An introduction to connective knowledge. Retrieved 18 August 2015 from [www.downes.ca/post/33034](http://www.downes.ca/post/33034).
- Edwards, R., Tracy, F. & Jordan, K. (2011). Mobilities, moorings and boundary marking in developing semantic technologies in educational practices. *Research in Learning Technology*, 19(3), 219–232.
- Engeström, Y. (2009). The future of activity theory: A rough draft. In A. Sannino, H. Daniels & K. D. Gutiérrez (eds), *Learning and expanding with activity theory* (pp. 303–328). Cambridge: Cambridge University Press.
- Engeström, Y., Miettinen, R. & Punamäki, R. (eds) (1999). *Perspectives on activity theory*. Cambridge: Cambridge University Press.
- Fenwick, T., Edwards, R. & Sawchuk, P. (eds) (2011). *Emerging approaches to educational research: Tracing the socio-material*. London: Routledge.
- Ferguson, R. (2012). *The state of learning analytics in 2012: A review and future challenges*. Technical Report KMI-12-01, Knowledge Media Institute, The Open University, UK. Retrieved 20 August 2015 from <http://kmi.open.ac.uk/publications/techreport/kmi-12-01>
- Fox, A., Hearst, M. A. and Chi, M. T. H. (eds) (2014). *Proceedings of the first ACM conference on Learning @ Scale*. New York: The Association for Computing Machinery.
- Garrison, D. R. & Anderson, T. (2003). *E-learning in the 21st century: A framework for research and practice*. New York: RoutledgeFalmer.
- Gaver, W. (1996a). Affordances for interaction: The social is material for design. *Ecological Psychology*, 8(2), 111–129.
- Gaver, W. (1996b). Situating action II: Affordances for interaction – The social is material for design. *Ecological Psychology*, 8, 111–129.

- Gee, J. P. & Hayes, E. R. (2011). *Language and learning in the digital age*. New York: Routledge.
- Gibson, J. J. (1979). *The ecological approach to visual perception*. Boston: Houghton Mifflin.
- Goodfellow, R. (2014). Scholarly, digital, open: An impossible triangle? *Research in Learning Technology*, 21, article 21366.
- Goodfellow, R. & Lea, M. R. (eds) (2013). *Literacy in the digital university*. London: Routledge.
- Gourlay, L. (2012). Cyborg ontologies and the lecturer's voice: A posthuman reading of 'face-to-face'. *Learning, Media and Technology*, 37(2), 198–211.
- Gourlay, L., Hamilton, M. & Lea, M. (2014). Textual practices in the new media digital landscape: Messing with digital literacies. *Research in Learning Technology*, 21, 21438. Available online at: <http://www.researchinlearningtechnology.net/index.php/rlt/article/view/21438>.
- Hawisher, G. & Selfe, C. L. (eds) (1999). *Passions, pedagogies, and 21st century technologies*. Logan, UT and Urbana, IL: Utah State University Press and NCTE.
- Hayles, N. K. (1999). *How we became posthuman: Virtual bodies in cybernetics, literature, and informatics*. Chicago: University of Chicago Press.
- Haythornthwaite, C. (2009). Crowds and communities: Light and heavyweight models of peer production. *Proceedings of the 42nd Hawaii International Conference on System Sciences*. Los Alamitos, CA: IEEE Computer Society.
- Haythornthwaite, C. (2011). Online knowledge crowds and communities. In J. Echeverria, A. Alonso & P. J. Oiarzabal (eds), *Knowledge communities* (pp. 193–209). Reno, NV: Center for Basque Studies.
- Haythornthwaite, C. & Andrews, R. (2011). *E-learning theory and practice*. London: Sage.
- Haythornthwaite, C. & Bregman, A. (2004). Affordances of persistent conversation: Promoting communities that work. In C. Haythornthwaite & M. M. Kazmer (eds), *Learning, culture and community in online education: Research and practice* (pp. 129–143). New York: Peter Lang.
- Haythornthwaite, C. & Kazmer, M. M. (eds) (2004) *Learning, culture and community in online education: Research and practice*. New York: Peter Lang.
- Haythornthwaite, C. & Meyers, E. (2012). New media, new literacies and new forms of learning. *International Journal of Learning and Media*, 4 (3-4), whole issue.
- Haythornthwaite, C., Andrews, R., Kazmer, M. M., Bruce, B. C., Montague, R.-A. & Preston, C. (2007). New theories and models of and for online learning, *First Monday*, 12(8). Retrieved 14 September 2015 from <http://firstmonday.org/ojs/index.php/fm/article/view/1976>
- Haythornthwaite, C., De Laat, M. & Dawson, S. (2013). Learning analytics. *American Behavioral Scientist*, 57(10), whole issue.
- Hine, C. (2000). *Virtual ethnography*. London: Sage.
- Hine, C. (ed.) (2006). *New infrastructures for science knowledge production*. Hershey, PA: Idea Group.
- Holliman, R. (2011). Telling science stories in an evolving digital media ecosystem: From communication to conversation and confrontation. *Journal of Science Communication*, 10(4), 1–4.
- Holliman, R. & Curtis, V. (2015). Online media. In R. Gunstone (ed.), *Encyclopedia of science education*. Dordrecht: Springer.
- Illeris, K. (2007). *How we learn: Learning and non-learning in school and beyond*. London: Routledge.
- Illeris, K. (ed) (2008). *Contemporary theories of learning: Learning theorists ... in their own words*. London: Routledge.
- JafariNaimi, N., Nathan, L.P. & Hargraves, I. (forthcoming). Values as hypotheses: The service of values and design. *Design Issues*.
- Jenkins, H., Purushotma, R., Clinton, K., Weigel, M. & Robinson, A. (2006). *Confronting the challenges of participatory culture: Media education for the 21st century*. The John D. and Catherine T. MacArthur Foundation Reports on Digital Media and Learning. Cambridge, MA: MIT Press.
- Jewitt, C. (2008). *Technology, literacy, learning: A multimodal approach*. Abingdon: Routledge.
- Jewitt, C. & Bezemer, J. (2015) *An introduction to multimodality*. Abingdon: Routledge.

- Jones, C. (2015). *Networked learning: An educational paradigm for the age of digital networks*. London: Springer.
- Kalantzis, M. & Cope, W. (2009). Introduction: The beginnings of an idea. In W. Cope & M. Kalantzis, *Ubiquitous Learning* (pp. ix–xii). Champaign, IL: University of Illinois Press.
- Kinneavy, J. (1971). *A theory of discourse*. Englewood Cliffs, NJ: Prentice-Hall.
- Kirsh D. (2013). Embodied cognition and the magical future of interaction design. *ACM Transactions on Computer–Human Interaction*, 20(1), Article 3.
- Kirsh, D. (2015). *Thinking with your body and other things*. Retrieved 9 July 2015 from [www.youtube.com/watch?v=EU6gSMLsCrg](http://www.youtube.com/watch?v=EU6gSMLsCrg)
- Kling, R., Rosenbaum, H. & Sawyer, S. (2005). *Understanding and communicating social informatics*. Medford, NJ: Information Today.
- Knobel, C. & Bowker, G. C. (2011). Values in design. *Communications of the ACM*, 54(7), 26–28.
- Koschmann, T. (ed.) (1996). *CSSL: Theory and practice of an emerging paradigm*. Mahwah, NJ: Lawrence Erlbaum.
- Kress, G. (1997). *Before writing: Rethinking the paths to literacy*. London: Routledge.
- Kress, G. (2010). *Multimodality: A social semiotic approach to contemporary communication*. London: Routledge.
- Laurillard, D. (2014). Five myths about MOOCs. Retrieved 1 August 2015 from [www.timeshighereducation.co.uk/comment/opinion/five-myths-about-moocs/2010480.article](http://www.timeshighereducation.co.uk/comment/opinion/five-myths-about-moocs/2010480.article)
- Learning Analytics and Knowledge (LAK) Conference (2011). Learning analytics and knowledge. Retrieved 17 August 2014 from <https://tekri.athabascau.ca/analytics/>
- Leonardi, P. M. (2012). Materiality, sociomateriality, and socio-technical systems: What do these terms mean? How are they different? Do we need them? In P. M. Leonardi, B. A. Nardi & J. Kallinikos (eds), *Materiality and organizing: Social interaction in a technological world*. Oxford: Oxford University Press.
- Long, P. & Siemens, G. (2011). Penetrating the fog: Analytics in learning and education. *Educause Review*, Sept./Oct., 31–40. Retrieved 1 September, 2015 from [www.educause.edu/ero/article/penetrating-fog-analytics-learning-and-education](http://www.educause.edu/ero/article/penetrating-fog-analytics-learning-and-education)
- Luckin, R. (2008). The learner centric ecology of resources: A framework for using technology to scaffold learning. *Computers in Education*, 50, 449–462.
- Luckin, R. (2010). *Re-designing learning contexts: Technology-rich, learner-centred ecologies*. Abingdon: Routledge.
- Marsden, R. (1996). Time, space and distance education. *Distance Education*, 17(2), 222–246.
- McIntire, M. E. (2015). ‘Machine teaching’ is seen as way to develop personalized curricula. *Chronicle of Higher Education*, 12 August. Retrieved 17 August 2015 from <http://chronicle.com.ezproxy.library.ubc.ca/blogs/wiredcampus/machine-teaching-is-seen-as-way-to-develop-personalized-curricula/57209>
- Meyers, E. M. (2014a). A comment on learning: Media literacy practices in YouTube. *International Journal of Learning and Media*, 4(3–4): 33–46.
- Meyers, E. M. (2014b). Designing a collaborative, video-enhanced LIS pedagogy. In *Association for Library and Information Science Education (ALISE’14) Conference*, Philadelphia, PA, USA, 24 January 2013.
- Meyers, E. M., Erickson, I. & Small, R. V. (2013). Digital literacy and informal learning environments: An introduction. *Learning, Media and Technology*, 38(4), 355–367.
- Michelucci, P. (ed.) (2013). *Handbook of human computation*. New York: Springer.
- Miller, C. (1994). Rhetorical community: The cultural basis of genre. In A. Freedman & P. Medway (eds), *Genre and the new rhetoric* (pp. 67–78). Basingstoke: Taylor & Francis.
- MIT Technology Review (2015). The emerging science of human computation. *MIT Technology Review*, 4 June. Retrieved 17 August 2015 from [www.technologyreview.com/view/538101/the-emerging-science-of-human-computation/](http://www.technologyreview.com/view/538101/the-emerging-science-of-human-computation/)
- Norman, D. (1988). *The design of everyday things*. New York: Basic Books.

- Paulin, D. & Haythornthwaite, C. (forthcoming). Crowdsourcing the curriculum: Redefining e-learning practices through peer-generated approaches. *The Information Society*.
- Pesina, J., Beaumont, T. & Parkes, A. (2014). In-house creation of video in higher education: A worthwhile endeavor? *International Journal of Learning and Media*, 4(3–4). Retrieved 7 September 2015 from <http://scalar.usc.edu/works/in-house-creation-of-video-in-higher-education-a-worthwhile-endeavour/index>
- Pollock, M., Yonezawa, S., Gay, H., Rodriguez, L., Garcia, G. & Qassimyar, M. with Gilkison, T., Hernandez, R. and the Early Academic Outreach Program (2014). Innovating toward equity with online courses: Testing the optimal 'blend' of in-person human supports with low-income youth and teachers in California. CREATE Equity Research Report 1, March. Retrieved 14 August 2015 from [https://create.ucsd.edu/research/CREATE%20Equity%20RR\\_1Mar2014.pdf](https://create.ucsd.edu/research/CREATE%20Equity%20RR_1Mar2014.pdf)
- Rainie, L. & Wellman, B. (2012). *Networked: The new social network operating system*. Cambridge, MA: MIT Press.
- Risko, E. F., Foulsham, T., Dawson, S. & Kingstone, A. (2013). The collaborative lecture annotation system (CLAS): A new tool for distributed learning. *IEEE Transactions on Learning Technologies*, 6(1), 4–13.
- Rogoff, B. (1991). *Apprenticeship in thinking: Cognitive development in social context*. New York: Oxford University Press.
- Romero, C., Ventura, S., Pechenizkiy, M. & Baker, R. S. J. d. (eds) (2011). *Handbook of educational data mining*. Boca Raton, FL: CRC Press, Taylor & Francis.
- Savage, M., Ruppert, E. & Law, J. (2010). Digital devices: Nine theses. Manchester and the Open University: CRESC, Working Paper 86. Retrieved 9 September 2015 from [www.cresc.ac.uk/publications/digital-devices-nine-theses](http://www.cresc.ac.uk/publications/digital-devices-nine-theses)
- Scardamalia, M. & Bereiter, C. (2006). Knowledge building: Theory, pedagogy and technology. In R. K. Sawyer (ed.), *The Cambridge handbook of the learning sciences* (pp. 97–118). New York: Cambridge University Press.
- Shaffer, D. W., Hatfield, D., Svarovsky, G. N., Nash, P., Nulty, A., Bagley, E., et al. (2009). Epistemic network analysis: A prototype for 21st-century assessment of learning. *International Journal of Learning and Media*, 1(2), 33–53.
- Sherer, P. & Shea, T. (2011). Using online video to support student learning and engagement. *College Teaching*, 59(2), 56–59.
- Siemens, G. (2005a). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2(1). Available online at: [www.itdl.org/journal/jan\\_05/article01.htm](http://www.itdl.org/journal/jan_05/article01.htm)
- Siemens, G. (2005b). Connectivism: Learning as network-creation. Retrieved 14 August 2015 from [www.elearnspace.org/Articles/networks.htm](http://www.elearnspace.org/Articles/networks.htm)
- Siemens, G. (2013). Learning analytics: The emergence of a discipline. *American Behavioral Scientist*, 57(10), 1380–1400.
- Siemens, G. & Gašević, D. (2012). Special issue on learning and knowledge analytics. *Journal of Educational Technology & Society*, 15(3). Available online at: [www.ifets.info/journals/15\\_3/ets\\_15\\_3.pdf](http://www.ifets.info/journals/15_3/ets_15_3.pdf)
- Siemens, G., Gašević, D. & Dawson, S. (2015). Preparing for the digital university: A review of the history and current state of distance, blended, and online learning. Retrieved 17 August 2015 from [linkresearchlab.org/PreparingDigitalUniversity.pdf](http://linkresearchlab.org/PreparingDigitalUniversity.pdf)
- Slade, S. & Prinsloo, P. (2013). Learning analytics: Ethical issues and dilemmas. *American Behavioral Scientist*, 57(10), 1510–1529.
- Steeple, C. & Jones, C. (2002). *Networked learning: Perspectives and issues*. London: Springer.
- Tan, E. (2013). Informal learning on YouTube: Exploring digital literacy in independent online learning. *Learning, Media and Technology*, 38(4): 463–477.
- Twidale, M. B. & Nichols, D. M. (2013). Agile methods for agile universities. In T. A. C. Besley & M. A. Peters (eds), *Re-imagining the creative university for the 21st century* (pp. 27–48). Rotterdam: Sense Publishers.