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Advances in Developing Human
Resources

2014, Vol. 16(3) 320–334

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DOI: 10.1177/1523422314532094

adhr.sagepub.com



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Abstract

The Problem.

Technology is creating immersive digital ecosystems that will radically transform the way humans communicate, collaborate, and create. Virtual human resource development (VHRD) is an example of this phenomenon in the field of HRD. With the emergence of VHRD, HRD scholars need to develop more robust conceptualizations of technology, and HRD practitioners need to play a larger role in technology development. Enhanced theoretical perspectives on technology are needed to support these endeavors.

The Solution.

A sociomaterial perspective on technology, which is being used for the study and development of phenomena such as virtual worlds in other disciplines, can help HRD practitioners and scholars develop a more robust understanding of VHRD and participate more effectively in technology development.

The Stakeholders.

HRD practitioners and scholars can use a sociomaterial perspective on technology to facilitate their engagement in VHRD development and scholarship.

Keywords

virtual human resource development, VHRD, sociomateriality, technology, information technology, technology development

Technology has enabled humans to interact and to enhance their performance in myriad ways. It has been used to automate many business processes so that work can be

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accomplished more quickly and at reduced cost. However, the new techno-economic paradigm brought about by the information and telecommunications revolution has not just provided a means to increase workplace efficiency (Castells, 2011). The new paradigm enabled by advanced information technologies is creating ubiquitous immersive digital ecosystems that will radically transform the way humans communicate, collaborate, and create (Bennett & Bierema, 2010).

Technology is often a key aspect of Human Resource Development (HRD) efforts. The importance of technology to the field is reflected by a growing body of technology-related HRD scholarship (Bennett, 2010; Githens, Dirani, Gitonga, & Teng, 2008; McWhorter, 2010; McWhorter & Bennett, 2010). Much of the existing technology-related HRD literature focuses on how a particular technology can be used to accomplish a specific HRD endeavor such as virtual mentoring, virtual learning, virtual teams, and so on, which results in a micro or tool-level perspective rather than a larger systems perspective (Bennett, 2009, 2010). Prior to more recent discussions, the HRD research stream reflected much of the research literature on technology in organizations in that it often takes a perspective that either privileges humans or technology by focusing primarily on the effects of one entity upon the other (Orlikowski, 2007). Scholars in other disciplines have pointed out that conceptual approaches built on these limited perspectives can affect their utility for exploring novel, complex, and emergent phenomena involving technology and organizational life (Orlikowski, 2010).

Virtual human resource development (VHRD), an emerging area of HRD inquiry, is a “media rich and culturally relevant web environment that strategically improves expertise, performance, innovation and community building through formal and informal learning” (Bennett, 2009, p. 364). VHRD represents a paradigm shift in that it focuses attention on the critical importance of these novel web environments for the HRD field and on the increasing need for members of the HRD field to participate in VHRD technology development efforts (Bennett, 2010, 2014a; Bennett & McWhorter, in press; McWhorter, 2014). There has been a call to study the ecology of VHRD and the sociocultural complexity of virtual environments in which people work and learn (Bennett & Bierema, 2010). Recent research suggests that complex, novel digital ecosystems such as VHRD are fruitfully explored by employing a sociomaterial perspective that views “reality not as composed as fixed and independent entities, but as constituted by fluid, dynamic, multiple and emergent phenomena” (Schultze & Orlikowski, 2010, p. 8). The World Wide Web is an example of this type of phenomena along with other rapidly evolving technologies such as social media, virtual worlds, mobile computing, and wearable computing (each of which can be seen as both part of and distinct from the global Web digital ecosystem). A sociomaterial perspective builds upon research in sociology, the philosophy of technology, science and technology studies, and quantum physics (Barad, 2007) and emphasizes how the social and the material elements of systems are mutually entangled in a way that does not over-emphasize the role of technology on one hand or overstate the role of humans on the other.

To further conceptual development of VHRD, the purpose of this article is to explore perspectives that may help HRD scholars and practitioners to understand and

develop novel complex digital ecosystems such as VHRD, which require sound perspectives on HRD's role in technology development (Bennett, 2014a). First, the article explores perspectives on technology development from the fields of Information Systems (IS) and HRD. Next, the article explores emerging perspectives for the study of technology. The article then provides an overview of the emerging sociomaterial perspective and recommends approaches for developing a sociomaterial perspective in HRD. Finally, the article concludes with suggestions for future endeavors related to this area of study.

Perspectives on Technology Development in IS and HRD

A wide range of disciplines are engaged in studies on how technology is developed and utilized by individuals, groups, organizations, and societies, and each discipline that addresses technology development is likely to have a different perspective depending on whether the area of study is more learning-oriented, as in HRD, or more technology-oriented, as in IS. In VHRD, technology development involves building learning capacity by integrating technology and traditional HRD techniques and theories (Bennett, 2014b; Bennett & McWhorter, in press; McWhorter, 2014), which suggests a larger and more complex perspective involving the confluence of people and technology. This section explores how IS and HRD have evolved to share a concern with effective technology development and how an enhanced understanding of technology and technology development can enable the field of HRD to more effectively contribute to the design, deployment, and evolution of novel emergent digital systems such as VHRD in the future.

The IS discipline developed in the 1960s when it was known as Management Information Systems. The IS discipline built initially upon the reference disciplines of management and organization theory, computer science, operations research, and accounting. The emerging IS discipline focused on the use of computers in organizations, and IS research sought to identify the best practices for the design and development of business computer systems. Swanson (2001) described HRD as "a process of developing and/or unleashing human expertise through organization development (OD) and personal training and development (T&D) for the purpose of improving performance" (p. 304). An analysis of IS and HRD indicates they share some commonalities that can enable fruitful interdisciplinary conversations including (a) an orientation to practice, (b) a grounding in systems theory, (c) a recognition of the changing nature of technology, and (d) a concern with technology development.

An Orientation to Practice

Both IS and HRD had their origin in the work of practitioners to improve organizational functioning (Ruona & Gilley, 2009). In IS, the study of best practices evolved into a systems development methodology that is viewed as a critical tool to describe best practices, communicate these practices among all those involved in systems development, and as a means to help ensure a successful systems development

process. In HRD, a systematic approach for instructional systems design was created that helps ensure talent is developed in a way that supports a high-performance workplace (McClernon, 2006). Both IS and HRD have a keen focus on practice and have used an adaptation of a systems engineering approach to transform practitioner best practices into systematic methodologies for improving both technology and instructional development.

A Grounding in Systems Theory

Systems theory plays an integral role in both IS and HRD. In HRD, systems theory is one of the three theories that underlie the field, where it “captures the complex and dynamic interactions of environments, organizations, work process and group/individual variables operating at any point in time and over time” (Swanson, 2001, p. 305). As the field of IS matured, IS scholars also built upon systems theory as a foundation for a comprehensive research framework for the discipline (Nolan & Wetherbe, 1980). Bennett and Bierema (2010) extended the discussion of systems theory in VHRD to include systems of innovation that must balance creativity and control, harmony, and constraints within one system. Their perspective underpins how systems theory continues to be relevant today, especially from a sociomaterial perspective.

A Recognition of the Changing Nature of Technology

The traditional IS development methodology was originally designed for the production of standalone custom products created by IS developers in response to their organization’s user requirements. Early IS applications were relatively self-contained and discrete (e.g., payroll) and could be analyzed in terms of their return on investment. Thus, if a system enabled an organization to perform a task in a way that saved money and/or time, it could be deemed a success.

However, IS are increasingly composed of assemblages of custom developed, purchased, and pre-existing technologies that are dynamically evolving as new elements are incorporated into the system and existing elements are adapted over time. A variety of concepts have been developed to try to capture the nature of these evolving complex and dynamic IS, and one promising approach extends systems theory to conceptualize these emergent phenomena as digital ecosystems (Hanseth & Lyytinen, 2010; Star & Ruhleder, 1996). In complex digital ecosystems, it can be difficult to separate out the different elements or components of large, potentially global, distributed systems as these elements are often ubiquitous, intertwined, and rapidly changing. VHRD is an example of this type of complex, emergent digital ecosystem in the field of HRD.

The emergence of digital ecosystems has affected IS practice and scholarship in many ways. For example, an analysis of what constitutes IS success has become much more multifaceted as humans do not only use and shape technological tools in digital ecosystems but these technological elements also shape humans and organizations in ways that are difficult to articulate and to study. As Bennett’s (2014b) study indicated, there is far more interaction occurring through sophisticated technologies such as

intranets than a one-dimensional view might show. In addition, the reach of complex systems is far beyond the typical office and is now in the hands of users through mobile technologies (see Thomas, 2014). These intertwined, complex, and dynamic digital ecosystems require increasingly sophisticated technology development methodologies if they are to be implemented successfully, and IS technology development approaches and research have been evolving to address these needs.

A Concern With Technology Development

Research has indicated that the successful design, implementation, and ongoing deployment of sophisticated IS are challenging undertakings that can have a high risk of failure ranging from 35% to 70% (Kaplan & Harris-Salamone, 2009). In the HRD literature, Arnold (1996) concluded that HRD, not IS, was responsible for many of the factors that determined whether a technology implementation lived up to expectations or not and called upon HRD to “play a more integral role in the design, development, and implementation of information systems, thus contributing in a significant way to the strategic direction, the competitiveness, and ultimately the profitability of the firm” (p. 272). Now with the emergence of VHRD, HRD practitioners are on the front lines of a paradigm shift in technology development in organizational life (Bennett, 2010; Bennett & McWhorter, in press; McWhorter, 2010). As HRD professionals are called on to participate in the design, deployment, and use of novel and emerging digital ecosystems such as VHRD, there is a need for a more robust perspective on technology and for a renewed focus on the role of HRD practitioners in technology development (McWhorter, 2014).

Emerging Perspectives for the Study of Technology

In recent years, researchers in the IS discipline have engaged in lively conversations within the discipline and with scholars in other disciplines about how technology is conceptualized in scholarship and in practice. Given the changing and important role of technology in HRD, as evidenced by the emergence of VHRD scholarship, practitioners and scholars in HRD also have a vested interest in following and contributing to these ongoing interdisciplinary conversations in regard to technology. To provide a foundation for this interdisciplinary conversation, this section first explores four conceptual perspectives on technology. Then key aspects of a sociomaterial perspective are discussed, which may be appropriate for studying complex digital ecosystems such as VHRD.

Conceptual Perspectives on Technology

In considering how technology has been incorporated in the management literature, Orlikowski (2010) identified four conceptual perspectives on technology: technology as (a) an absent presence, (b) an exogenous force, (c) an emergent process, and (d) entanglement in practice. Given the increasing importance of technology for

individuals, organizations, and society, this work called for scholars in a number of disciplines to reflect on the ways in which they understand and study technology and to utilize diverse and multiple approaches, as appropriate.

Absent presence. In the conceptual perspective where technology is treated as an absent presence, researchers do not acknowledge technology in their account (Orlikowski, 2010). For example, an article in the HRD literature might explore a particular phenomenon (e.g., creativity) and not include any mention of the role that technology may play in this domain in its analysis. Absent presence may explain HRD's historically limited view of technology, which results in a tool-level focus rather than the larger system (Bennett, 2009; Bennett & Bierema, 2010), which is paradoxical for any field that claims the criticality of systems perspectives.

Exogenous force. In the conceptual position where technology is viewed as an exogenous force, technology is "posited as distinct and separate from humans and organizations and hypothesized to directly impact human behavior and organizational characteristics" (Orlikowski, 2010, p. 129). For example, a research study designed from this perspective might use a cross-sectional survey research design to test hypotheses such as (a) use of a virtual world will improve learning outcomes, (b) use of a knowledge management system will improve job performance, or (c) providing systems that capture and share learning will be positively related to firm financial performance. Research studies which view technology as an exogenous force typically use a variance approach, where the phenomenon can be described in terms of independent and dependent variables. These research studies often also build on some form of contingency theory and hypothesize that the expected relationship between technology use and outcomes will be moderated by other factors (e.g., the type of task, the type of organization, etc.). Research in the IS discipline that builds on this perspective often explores the impact of information technology on some individual, organizational, or societal outcome, and a survey of information technology impact research in leading IS journals found that approximately 80% of the studies used a variance approach in their analyses (Paré, Bourdeau, Marsan, Nach, & Shuraida, 2008).

Research that builds on an exogenous perspective often uses a positivist approach and has made valuable contributions to knowledge about technology use that is generalizable across situations. However, while this research approach is prevalent in many disciplines, it does have limitations in some contexts. For example, by focusing on the role that technology plays as a determinant of some outcome of interest, this perspective tends to marginalize or minimize the role that human actors and historical and situational contexts play in the design, development, and use of technology. These studies may also be based upon a variety of unacknowledged assumptions including the idea that the technology is comparable across different contexts of use, stable over time, and will be used as intended. For example, a study may use a high-level concept (e.g., learning management system) to describe a particular technology in use and gather data across multiple use contexts to conduct statistical analysis designed to developed generalizable laws and predictions. This view tends to obscure the specific

materiality of the technology in use and how it varies over time and among different contexts (e.g., instructors, disciplines, institutions, etc.). A critique of this perspective suggests the need for alternative perspectives when the technology of interest is emergent, fluid, dynamic, and complex and may be viewed as part of a larger digital ecosystem, as is the case with VHRD.

Emergent process. In the conceptual perspective where technology is viewed as emergent process, the focus is “on the broader ecology of people, infrastructures, resources, policy decisions and social relations that affected the development, adoption, appropriation and adaptation of information technology” (Orlikowski, 2010, p. 131). A research study designed from this perspective might involve an ethnographic study where researchers seek to understand, for example, how members of a virtual community create and maintain their identity, share and/or withhold information, collaborate and manage conflict, and develop shared understandings of tasks and roles. This perspective appears relevant in light of the need for negotiating roles and developing swift trust in virtual teams (Germain & McGuire, 2014). Research studies which view technology as an emergent process typically use a process approach and may explore how human actors respond over time to an event such as the introduction of technology into the work environment. Oliver (2013) stated that this perspective

can be understood as a critical response to accounts that portray technology as a determining power. From a deterministic perspective, technologies do things to us: they constrain what we can do, or at best, permit us to do particular things; they have a controlling role. From a social perspective, people do things with technologies, placing people at the centre of the analysis. On this account, if people cannot do something with technology, they can choose to find a different one, or work to make a new one. (p. 35)

Studies that view technology from an exogenous perspective may use a wide range of research approaches to provide a rich and detailed understanding of how technology is shaped over time. However, while these studies emphasize the perspectives and choices of human actors, they have been criticized for inadequately addressing the material capabilities provided by specific technology in use, overemphasizing the design stage versus the change process that ensues when technology is used over time, and, in general, failing to provide generalizable insights due to a concern with context-specific micro-level technology use (Orlikowski, 2010).

Entanglement in practice. A fourth perspective, called entanglement in practice, has “the potential to help management scholars take seriously the distributed and complex sociomaterial configurations that form and perform contemporary organizations” (Orlikowski, 2010, p. 125). The interest in sociomaterial perspectives can be seen, in part, as a reaction to existing viewpoints that either focus on technology impacts (the exogenous force perspective) or place human beings and their actions at the center of analysis (the emergent process perspective). From a sociomaterial perspective, both of these perspectives, despite their apparent differences, share a common dualistic underpinning that results in either the technology or the human agency being privileged in

their accounts of a phenomenon. A sociomaterial perspective, which seeks to understand the relations between human and nonhuman elements of emergent digital ecosystems in a way that privileges neither, shows promise as an analytical framework for deepening our understanding of phenomena such as VHRD. Orlikowski (2010), for example, showed how a sociomaterial perspective would differ from an exogenous force and emergent process perspective as an analytical lens for understanding a virtual synthetic world in a contemporary workplace (an immersive workplace collaboration called MPK20 used within Sun Microsystems).

An Overview of the Emerging Sociomaterial Perspective

As interest develops in a sociomaterial perspective among various disciplines, a variety of approaches have been proposed to conceptualize and carry out studies in this area. Actor-Network Theory (ANT), which builds upon the work of Latour (1987), is a well-known approach that is viewed as sociomaterial as it assumes, as a foundation, that there should be no distinction made, a priori, between the treatment of human and nonhuman actors. A recent study of the implementation of a human resource information system (HRIS) (Dery, Hall, Wailes, & Wiblen, 2013) suggests that a technologically deterministic perspective (e.g., an exogenous approach) is overly simplistic and therefore cannot adequately address why an HRIS implementation would not only fail to provide desired functionality but, in fact, even result in a reduced strategic capability. In this study of HRIS implementation, the authors address various criticisms of ANT and illustrate how ANT can provide a useful perspective and methodology for exploring IS implementation. This research underscores the need for HRD to partner with other professions to work through technology development projects that propose to implement new systems, which is the second mode of technology development (Bennett, 2014a). The VHRD literature has already noted the expense of implementation failures (Bennett & McWhorter, in press; McWhorter & Bennett, in press), which makes understanding perspectives such as ANT and sociomateriality an important concern for HRD professionals.

As some scholars seek to build upon ANT as a means of sociomaterial analysis, other scholars have focused on developing alternative approaches that would support a sociomaterial perspective. And, just as systems theory introduced a new vocabulary to express its unique contribution (equifinality, the law of requisite variety, etc.), advocates of a sociomaterial perspective have also developed new terms and concepts in an effort to differentiate their approach from those which have gone before (e.g., affordances, assemblages, imbrication, intra-action, performativity). Detailed discussions of the value of these concepts and how they differ form the basis of animated, ongoing discussions among scholars of technology in a number of disciplines. For example, in a recent book, scholars explored a variety of perspectives (materiality as performativity, as assemblage, and as affordance) that illustrate how one can theorize about materiality and organizing in a technological world (Leonardi, Nardi, & Kallinikos, 2012). This article takes the perspective that there is no one right way in which to pursue a sociomaterial perspective and that the engagement of numerous scholars in an ongoing

discussion of how a sociomaterial perspective might be fruitfully employed is a reflection of the intense interest the topic has generated in the IS and management disciplines. Therefore, to provide a basis for discussion, this section will build upon the analysis provided by Leonardi (2011, 2012, 2013) to define the concepts of materiality and sociomateriality and related terms which are currently in use in the literature.

Materiality. Information technology is accessed by physical artifacts that have discernible properties (e.g., a computer keyboard, a smartphone screen, etc.). However, many aspects of information technology have aspects that are hard to describe in terms of their physical properties (e.g., wireless networks, information, software). In considering a complex digital ecosystem like VHRD, for example, one needs to not only consider the elements that are composed of physical matter. Thus, Leonardi (2012) stated,

“Materiality” does not solely refer to the materials out of which a technology is created and it is not a synonym with “physicality.” Instead, when we say we are focusing on a technology’s materiality, we are referring to the ways that its physical and/or digital materials are arranged into particular forms that endure across space and time. (p. 29)

When humans encounter a technology’s materiality, they can perceive the ways in which the technology affords possibilities for action in line with their goals or, conversely, how a technology’s materiality may constrain them. Affordances are constituted through the relationship between people and a technology’s materiality (which exists independently of humans). As Faraj and Azad (2012) pointed out, a relational view of an affordance implies the need to “abandon talk of a generic user or to think of technology as bundles of features” (p. 255). Thus, for example, an organization’s learning management system provides the same materiality to everyone who has access to it. However, each person who encounters the technology’s materiality perceives different possibilities for action based upon their goals and their specific context of use. Based upon their perception of technology affordances, individuals may then exercise their human agency and choose among various alternatives (e.g., changing their routines, changing the technology). An exploration of technology materiality, human agency, and affordances can provide insight into how a technology can be used in variety of ways with diverse results by individuals in organizational contexts.

Sociomateriality. Some scholars espouse a relational ontology based upon Barad (2007) where “entities (whether humans or technologies) have no inherent properties, but acquire form, attributes, and capabilities through their interpenetration” (Orlikowski & Scott, 2008, pp. 455-456). The creation and use of the term *sociomaterial* was proposed to emphasize and signal the fact that organizational practices are neither social nor material but that these two aspects are viewed as constitutively entangled or recursively intertwined. To illustrate this perspective, Orlikowski (2007) analyzed the use of Google for information search to show how the “temporally emergent results are not dependent on either materiality or sociality, nor on some interaction between them (to the extent that these are seen as distinct domains). Rather the performance and

results of a Google-based search are sociomaterial” (p. 1140). In a similar way, Orlikowski (2007) also described how the use of a mobile device (a BlackBerry) in one organizational context is sociomaterial and emerges from sociomaterial practices and not as a result of the material features or affordances of the technology. This view is consistent with the cultural relevance (Bennett, 2009) of network technology that creates the environment for VHRD and what Bennett (2010) termed the “ineffable human element” (p. 730). Thomas (2014) also asks about the role of cultural expectations and boundaries given the virtually unlimited access to network technologies. In addition, McWhorter and Lynham (2014) draw attention to the need to adapt technology to accomplish virtuality in virtual scenario planning (see also Fazarro & McWhorter, 2011). In essence, sociomateriality helps conceptualize virtuality and may help answer some of these concerns and challenges as HRD wrestles with organizational complexity.

Recommendations for Developing a Sociomaterial Perspective in HRD

HRD practitioners are on the front line of a paradigm shift in how technology is being employed in organizations. Therefore, HRD practitioners have a unique ability to both observe and shape how VHRD is implemented in the future. However, if HRD practitioners and scholars do not proactively engage in technology development and in scholarship related to the emergence of VHRD, then they run the risk of replicating the situation which Orlikowski and Scott (2008) found when they identified the absent presence perspective on technology in the management discipline. They suggested that the fact that management researchers did not consider themselves scholars of technology, along with the fact that it was challenging for scholars to stay up with rapid changes in technology, contributed to the fact that technology was only directly considered in under 5% of the articles published in top management journals. To help HRD scholars and practitioners develop a sociomaterial perspective, this section suggests efforts to (a) reflect on perspectives used to conceptualize technology, (b) engage in critical conversations about VHRD developments, (c) develop theoretical accounts that incorporate a sociomaterial perspective, and (d) engage in a sociomaterial bricolage.

Reflect on Perspectives Used to Conceptualize Technology

Practitioners can begin to incorporate a more sociomaterial perspective by developing a reflective and critical perspective on the ways in which technology has been conceptualized in the past, on how technology is being conceptualized in current implementations in their organizations, and on how technology is conceptualized in plans and visions for future development. Both in their own experiences and by critically reviewing both popular and research literature, HRD professionals can analyze the different perspectives on technology that are espoused by asking questions about how, for example, the materiality of a particular technology is described, marginalized, or omitted from an account.

Engage in Critical Conversations About VHRD Developments

As VHRD becomes more pervasive in organizational life, the need for HRD practitioners and scholars to effectively engage in important conversations regarding the role of technology and questions concerning its effectiveness becomes increasingly urgent. For example, when Yahoo! announced the end of telecommuting work arrangements to facilitate collaboration and communication, a news article stated that that this is “one of the country’s biggest workplace issues: whether the ability to work from home, and other flexible arrangements, leads to greater productivity or inhibits innovation and collaboration” (Miller & Rampell, 2013, para. 4). Members of the HRD profession would appear to be uniquely equipped by their training and perspective to help organizational decision makers evaluate claims that “studies show that people who work at home are significantly more productive but less innovative” (Miller & Rampell, 2013, para. 8) or that face-to-face serendipitous learning by interaction is the key to Google’s innovative culture (Henn, 2013). As HRD practitioners develop more robust perspectives on technology and participate more fully in VHRD technology development, they will become increasingly important facilitators of technology driven, strategic organizational transformations such as that undertaken by Yahoo!.

Develop Theoretical Accounts That Incorporate a Sociomaterial Perspective

As HRD scholars and practitioners reflect on technology more deeply, a sociomaterial perspective can inform more robust theoretical perspectives for use in the field. One approach toward this goal entails revising existing theories which already address technology so that they incorporate a more sociomaterial perspective. As the HRD profession values systems theory and sociomateriality can be seen as extending previous work on systems thinking and sociotechnical systems, HRD scholars and practitioners may want to explore how systems theory can support a more up-to-date and nuanced understanding of the social and technological elements of complex digital ecosystems such as VHRD. Systems theory might be extended by exploring seminal past studies, such as those that formed the genesis for the sociotechnical systems tradition (Trist & Bamforth, 1951) and repurposing key insights in the light of a modern sociomaterial perspective. In addition, systems theory might be extended to incorporate a more sociomaterial perspective by incorporating new work on complex adaptive systems and complexity theory (Hanseth & Lyytinen, 2010; Vessey & Ward, 2013).

Engage in a Sociomaterial Bricolage

A bricolage is a metaphor that has been used to address the tension between viewing technology development and organizational design/change efforts as a rational planned process versus an assemblage that emerges from the interaction of human and technological elements in a complex system (Weick, 1993). Johri (2011) developed the idea of a sociomaterial bricolage “as an analytical framework that can assist in research and

design of learning technology by providing a pertinent lens to examine emergent socially and materially intertwined learning practices” (p. 208). Researchers in the IS discipline have also explored the idea of a bricolage to describe approaches that combine traditional and adaptive methods for technology development to promote agility and innovation in meeting system design and implementation challenges (Vessey & Ward, 2013). The bricolage metaphor addresses the agility and flexibility needed to develop digital ecosystems where traditional development methodologies with their assumptions of rational top-down design and implementation may be less appropriate, such as with VHRD. Therefore, it may provide a useful overarching metaphor to guide the efforts of HRD practitioners and scholars as they engage in both traditional and VHRD technology development endeavors. Certainly, this metaphor seems to align with prior work on dynamic harmony and dynamic constraints in the ecology of VHRD (Bennett and Bierema, 2010).

Conclusion

It is an important time for HRD as a field to heed the call to adopt technology development as priority in the field (Bennett, 2010) and in academic training programs (Bennett & McWhorter, in press), which calls for new theoretical approaches and also practical partnering with IS professionals. To effectively engage in technology development and to assist organizations in adapting to the paradigm shift represented by VHRD, HRD practitioners and scholars are encouraged to reflect upon the way in which they view technology, whether they consider it simply a tool or whether they see the potential beyond as with a sociomaterial perspective.

This article argued for both practitioners and scholars to enlarge their perspectives about the enabling technologies that create VHRD, particularly the complex digital ecosystems. As technology becomes more and more pervasive in organizational life, an absent presence perspective toward technology will be increasingly untenable. And while technology could be viewed as an endogenous force or from an emergent perspective by HRD professionals, the emergence of complex digital ecosystems such as VHRD increases the need to utilize a sociomaterial perspective on technology, which integrates the social and cultural practices that are unique to a given environment consistent with early conceptualizations of VHRD (see Bennett, 2009). A more robust understanding of VHRD will enable HRD practitioners to participate more effectively in technology development and help HRD scholars enrich their scholarship, both within HRD and in collaboration with scholars in other disciplines.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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