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ORIGINAL

Performativity of Materials in Learning: The Learning-Whole in Action

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ABSTRACT

Contemporary educational practices have been calling for pedagogical models that foreground flexibility, agency, ubiquity, and connectedness in learning. These models have, in turn, been stimulating redevelopments of educational infrastructure –with physical contours reconfigured into novel complex learning spaces at universities, schools, museums, and libraries. Understanding the complexity of these innovative learning spaces requires an acknowledgement of the material and digital as interconnected. A 'physical' learning space is likely to involve a range of technologies and in addition to paying attention to these 'technologies' one must understand and account for their physical sites of use as well. This paper discusses the influence of materiality in learning, using an analytical approach that situates learning activity as an emergent process. Drawing on theories that foreground socio-materiality in learning and on the relational perspective offered by networked learning, we call for a deeper understanding of the interplay between the physical (material and digital), conceptual, and social aspects of learning, and their combined influence on emergent activity. The paper argues that in order to successfully design for innovative learning, educators need to develop their capacity to trace the intricate connections between people, ideas, digital and material tools, and tasks –to see the learning-whole in action.

Keywords DESIGN FOR LEARNING, SOCIO-MATERIALISM, NETWORKED LEARNING

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1 INTRODUCTION

Understanding links between the built environment and human behaviour has long been central to the fields of architecture, urban planning and archaeology. Theoretical, empirical, and practical work in these fields often involves reflecting on human activity and culture in the past, in ways that amplify our understanding of the present. In education, the role of the built environment in learning is increasingly the focus of attention. Searches for a deeper understanding of the role of designed forms in learning –encompassing both digital and material tools and resources– have contributed to, and been fuelled by, multi-million dollars

investments in educational infrastructure redevelopment in many OECD countries (Blackmore, Bateman, Loughlin, O'Mara, & Aranda, 2011; Brown, McCormack, Reeves, Brooks, & Grajek, 2020; Cardellino & Woolner, 2020; Daniels, Tse, Stables, & Cox, 2017; Ellis & Goodyear, 2018; OECD, 2015, 2019; Woolner, 2010; Woolner, Thomas, & Tiplady, 2018). These visually arresting and technology rich twenty first century learning spaces are often claimed to support educators in creating learning opportunities that foster communication, collaboration, creative and critical thinking in their students, and stimulate a productive use of technologies for learning (Benade, 2017). However, the ways in which this is to be achieved are still under theorised, failing to engage with what it means to say that learning is physically and socially situated –or with the sociomateriality of learning.

If we pause, to watch the ebb and flow of learners and educators as they carry out daily routines of learning in these bright new learning landscapes, the leap from shared space to shared knowledge is often not so easy to see. Teaching in innovative spaces can be challenging, with some educators still struggling to understand how they can create opportunities for the participatory practices of a networked world or adopt innovative pedagogical models more attuned to the contours of their new learning spaces (Carvalho, Nicholson, Yeoman, & Thibaut, 2020; Deed, Blake, & Henriksen, 2020; Kokko & Hirsto, 2020). Indeed, the move from traditional to flexible spaces for learning requires educational designers (e.g., teachers, space planners, architects, instructional designers and others) to re-think their practices, in pursuit of more productive ways of connecting the physicality of the space to theoretical developments in teaching and learning (Beetham & Sharpe, 2019). We argue that to navigate this transition well researchers and educators need to understand the importance of correspondence between (a) pedagogy, places and people; and (b) theory, design and practice (Carvalho & Yeoman, 2019). A deeper appreciation for these connections will ensure learners are less likely to experience a mismatch or dissonance between design intentions and unfolding learning activity.

In what follows, we lay out a theoretical backdrop for exploring the intricate interplay between physical design (material and digital) and learning activity in the context of design for learning, through four main themes. First, the paper offers a deep dive into sociomaterialist theories that connect mind, body and materials, and elaborates on the nature of relations between humans and things. The notion of 'learning entanglement' allows us to explore human-thing relations in terms of enabling dependence and constraining dependency, and to articulate how these groups of humans and things come together to influence situated learning activity. Second, the paper argues that a networked learning perspective helps us break down the complexity of learning situations, conceptualized as assemblages of multiple elements emmeshed in learning activity. Thirdly, the paper introduces analytical lenses that help to frame the complex nature of design for learning, paying particular attention to the performativity of materials, or on how they invite, exclude and/or regulate different forms of participation (Fenwick, 2015). In embracing performativity, one is contesting "the excessive power granted to language to determine what is real" (Barad, 2003, p. 802) – performativity allows us to shift the focus towards practices, doings, and actions. The materiality of learning is then seen as critically shaped through materials, in ways that not only

acknowledge the artefacts themselves, but positions materiality as distributed, an inherent part of social and physical processes, where materials invite, incite, exclude and regulate different forms of participation (Fenwick, 2015; Fenwick & Edwards, 2013; Sørensen, 2009). We claim that these analytical lenses help bring the physical situatedness of learning to the fore without losing sight of the epistemic and social situatedness of learning. Finally, whilst we speak of parts, our intention is to foreground the 'learning-whole' emerging in and through action –or the learning-whole in action. Drawing on the work of Ingold (2011; 2012) we put forward a view of learning that involves increasing correspondence between people's ability to read subtle cues in their enviros, and their ability to adjust their actions without markedly disrupting the flow of their learning. We argue that this sensitivity to materials within a holistic perspective leads us to a particular view of design for learning that takes the physical, social and epistemic nature of learning into account, foregrounding part-whole relations at different levels of granularity and bringing awareness of how changes in one aspect of the learning environment is (or is not) expressed or reflected in another.

2 ECOLOGICAL APPROACHES AND SOCIO-MATERIALITY IN LEARNING

A growing number of scholars have turned to socio-materialism, to more deeply understand relations between social and material elements, and culture and technology. These sets of relations are understood as enmeshed in the carrying out of everyday practices. Socio-materialism explores how things and humans act on one another and, within this very act, how they mutually transform the characteristics and activity of the other (Fenwick, 2015; Fenwick & Edwards, 2011; Sørensen, 2009). Ecological approaches to learning (such as cognitive ecology, distributed and embodied cognition) argue that people do not think with their brains alone. These theories emphasize the importance of linking learning activity to sensory and motor processes and pay careful attention to how these processes are intimately connected to bodily interactions with the environment. It is claimed that it is through interactions with tools that thinking processes evolve, and that experiences with materials and tools often suggest particular goals that are likely to change the way we think and perceive the world.

Cognitive ecology suggests that we study cognitive processes in context, focusing on understanding connections between human perception and the properties of the world to be perceived. In order to understand action and behaviours, one must consider the motor systems *as well as* their interactions with the world, much like a biological phenomenon where everything is inter-connected (Hutchins, 2010). This calls for systemic assumptions about how people come to know, and it is a call for cognitive phenomena to be seen not as individualized or isolated but as emerging from distributed processes. Hutchins (2014) notes that in taking a distributed perspective we are choosing a particular way of looking at the world, we are selecting 'scales of investigation such that wholes are seen as emergent from interactions among their parts' (Hutchins, 2014, p. 36). Drawing on similar ways of looking at the world, embodied cognition theorizes connections between bodies, minds

and technologies (Clark, 2011; Kirsh, 2013), speaking of minds as extended beyond bodies, in ways that include tools, symbols, and artefacts that mediate one's interactions in the world (Clark, 2011).

In situated cognition, a systemic character is also present, with authentic practices seen as influenced by a range of social and activity systems, which might constrain and/or guide behaviour (Wilson & Meyers, 2000). In essence, situative perspectives ask that we look beyond individual behaviour and cognition, to recognize the role of the social, cultural and physical structures which also often influence learning. People's perceptions, actions, and learning are then seen as part of their participation in self-organizing systems, which comprise many singular organisms (Lemke, 1997); and hence meaning-making, or meaningful activity, is not confined to one's organism or brain. In this view, people embody their past, as the environment surrounding us also embodies its own past. Thus, our interactions and experiences not only rely on our memory but on our culture, physical structures, history and affect as well, and all of this indirectly shapes what we do.

Essentially, these ecological perspectives foreground concepts and beliefs about the world we live in, which influence our perceptual-action experiences with objects, artefacts and the things around us. And it is through these tool-mediated experiences that our understanding of the world evolves, resulting in activity that is situated in the ways people interact with and through tools (Kirsh, 2013). Such a view of learning reinforces the idea that cognition is not only influenced by our own behaviour or by what we do, but importantly, it is also affected by our perceptual system, constantly searching for alignment between our actions and the predictions we make about the environment around us (Markauskaite & Goodyear, 2017).

In theorizing connections between humans and materials in learning, we also draw on concepts from archaeology including the theory of entanglement. Entanglement allows us to dig deeper into the role of materials and human-thing dependences (Hodder, 2012, 2013) going beyond connections and relationality alone, to reveal how humans become entangled in dynamic webs of relations with things. As Hodder (2012) explains, humans become reliant on tools and this affects how they organise themselves and adapt to changes in the environment. People rely on things to develop personal goals, but this results in demands that involve maintenance and care for those things in order that those things may be relied upon. Hodder describes this as 'sticky entrapment' a reference to how humans are caught up and carried along in the lives and temporalities of things.

Entanglement embodies the concepts of 'dependence' and 'dependency' between humans and things (Hodder, 2012, 2013). Individual's reliance on materials, thoughts or things, is expressed through the idea of 'dependence', which is characterised as a productive and enabling relationship. This is about the use of things to 'enable an action' (Hodder, 2012), for example, to use a smartphone to communicate with someone, or to use a bag to carry goods. Constraints between humans and things are expressed through the concept of 'dependency', which is used to describe situations where people may be overly reliant on things. It describes situations that are somehow limiting, in relation to people's ability to evolve as individuals or as members of society. For example, when someone chooses only

to holiday in places with reliable mobile data, or when one cannot shop if they do not have a carry bag with them.

These analytical concepts have been widely applied in archaeological research, with Hodder (2016) exploring the notions of 'entrapment' and 'path dependency' to unveil the origins of farming and settled life in the Middle East in the Çatalhöyük site. These concepts help to reveal new explanations, many of which seemed counter-intuitive or surprising at first. This was the case when Hodder (2016) looked at social and ritual entanglement, between hunting and farming practices in the Çatalhöyük site and found that the take-up of farming was deeply enmeshed in efforts to support hunting activity, which occupied a core place in the social and ritual life of that society. Our own recent research has explored the notion of 'learning entanglement' within formal and informal learning contexts, offering detailed analyses of moments of interaction between teachers and students extracted as vignettes, or by discussing visual representations of 'tanglegrams' used to break down the complexity and layout part-whole relations within networks of learning (Carvalho, 2018; Carvalho & Yeoman, 2019; Yeoman, 2015, 2017).

In mapping the dependences of a learning network or using 'tanglegrams' to graphically represent these relationships, educational designers and researchers are invited to abstract the complexity of a learning network. These visualizations offer snapshots of its functionality, going beyond how a piece of technology enables a certain desirable behaviour, to highlight a range of other elements that are implicated in the doing of everyday teaching and learning practice. The notion of learning entanglement allows us to conceptualize the physical (including the material and digital) as fluid, where things in themselves embody flows of matter and energy. In so doing, it helps us depart from static notions of networks, resist deterministic explanations (Oliver, 2011, 2013), and embrace relational accounts of heterogeneous elements using concepts capable of supporting their analysis in-context (Carvalho & Yeoman, 2019).

In what follows, we explore ideas from networked learning that underpin our research –ideas that allow us to conceptualize the multi-layered assemblage of elements in learning.

3 MULTI-LAYERED ASSEMBLAGES OF ARTEFACTS, TOOLS, IDEAS AND PEOPLE

Innovative learning environments (ILEs) (OECD, 2015) emphasize strengths-based teaching and learning, in ways that ground activity on principles of flexibility, agency, ubiquity, and connectedness (ERO, 2018; TKI, 2019). ILEs do not only refer to flexible furnishings and materials, or the inviting contours of a learning space, but have a much broader character –one that embraces the social and pedagogical contexts in which learning activity unfolds. As such, the notion of ILEs aligns well with place-based spaces for networked learning (Carvalho, Goodyear, & de Laat, 2017) as both, in essence, foreground learning activity through multiple dimensions of learning, which is seen as a socially, epistemically and physically situated activity.

Networked learning first emerged in the 90s, as a way to describe the growing use of technologies for learning in higher education. It mostly referred to practices that combined ideas from critical theory with an active social role and placed a special emphasis on the individual agency of learners and teachers (Hodgson, McConnell, & Dirckinck-Holmfeld, 2012; Jandrić & Boras, 2015; Jones, 2015). As noted by Hodgson et al. (2012) even in its earliest beginnings networked learning alluded to a socio-material dimension, as illustrated by the role of the word 'technology' in its most widely used definition: networked learning involves "learning in which ICT is used to promote connections: between one learner and other learners; between learners and tutors; between a learning community and its learning resources" (Goodyear et al, 2004, p. 3). Since then, multiple possible meanings and interpretations evolved, in connection to the notion of 'networks'. As Dohn (2018) explains, networks may sometimes refer to geographically distributed people coming together through interconnected technologies. It may also imply communication mediated by the Internet or be associated with networked machines as agents. Networks may also indicate activities in hybrid spaces, or spaces that mix the physical and the virtual. Or they may describe a personal network of like-minded people, reflecting one's dependence on others for everyday activities. Dohn (2018) argues that in spite of the many perspectives one may take, overall, the notion of 'networks' always foregrounds connections.

In embracing connections, openness and fluidity, networked learning is concerned with the development of a learning culture in formal or informal settings and is no longer seen as limited to learning activity in higher education (Hodgson et al., 2012). As Internet access and mobile technologies become more pervasive, the perceptions of where and how networked learning is happening have also changed (Ryberg & Sinclair, 2016). The notion of place-based spaces for networked learning acknowledges this hybrid nature, where a 'physical' learning space is likely to involve a range of interconnected technologies and the use of these 'technologies' for learning must account for their physical sites of use. Indeed, people's interactions with the digital are not disembodied experiences, they involve co-presence in multiple spaces (Bayne et al., 2020; Fawns, Aitken, & Jones, 2019; Gourlay & Oliver, 2018; Jandrić et al., 2018).

Overall, networked learning implies valuing specific ways of learning, which involve supporting each other and building shared understandings of a particular phenomenon. Those who ascribe to a networked learning stance, emphasize that (i) cooperation and collaboration are crucial in the learning process; (ii) there is high value in group and community work; (iii) discussion and dialogue are key; (iv) self-determination is inherent to productive learning activity; (v) not only is there value in 'difference' but the 'valuing of difference' plays a significant role in the learning process; (vi) trust and relationships are reflected through weak and strong ties; (vii) reflexivity is at the core of networked processes; and (ix) technology is used to connect and mediate learning activity (Hodgson & McConnell, 2019).

In taking a networked learning perspective to frame the design and analysis of teaching and learning practices, we make a commitment to these principles. Talking about place-based spaces for networked learning foregrounds an understanding of learning activity, as part of networks of multiple actors, engaged in particular ways of knowing, grounded in

a range of digital and material elements. Such a stance allows us to account for a multi-layered assemblage of artefacts, tools, places, ideas and people, which together influence the overall quality of a learning environment and the ensuing experiences of learners. In our research, these ideas have been expressed through the Activity-Centred Analysis and Design (ACAD) framework (Goodyear & Carvalho, 2014; Goodyear, Carvalho, & Yeoman, 2021) and ACAD wireframe (Yeoman, 2015) as analytical tools to support educational designers and researchers in conceptualizing connections between people, tools, and tasks at the micro, meso and macro levels of design.

4 TOOLS FOR ANALYTICAL THINKING

The Activity-Centred Analysis and Design (ACAD) framework conceptualizes learning activity as an emergent phenomenon, as something that cannot be entirely predicted in advance (Goodyear & Carvalho, 2014). What people actually do, their thoughts and feelings, are seen as something that emerges at learntime. Nevertheless, this learning activity does not happen in a vacuum, it is influenced by a number of design choices made in advance. The work of educators often involves making a range of decisions on behalf of learners. For example, educators decide what learners will do and the selection, sequencing and pacing of the information of a particular learning task. Educators often choose the tools and resources that will be available to their learners –will students work with pen and paper, or will they use a particular app on a tablet? How will the furniture be arranged in the learning space? Decisions might also have a more social nature, as educators consider whether learners will engage in a collaborative group and follow scripted roles, or whether they will work in pairs or as individuals. All these choices involving tasks, tools, and social arrangements become variously enrolled in activity at learntime –when learners exercise their agency in reshaping and co-configuring what has been proposed. Learntime is conceptualised as the time when learning activity unfolds, the time when learners interact with the designed components of what has been proposed, and with others.

As such, the ACAD framework acknowledges four structural dimensions (Figure 1); three are open to alteration through design and are termed the set design, the epistemic design and the social design. Set design accounts for the material and digital tools and resources, including furnishings and spatial arrangements. Epistemic design refers to tasks, or what is proposed for learners to do, including the ways of structuring knowledge and knowing. Social design is about the social organisation of learners, through divisions of labour, roles, and the make-up of groups, pairs or individual arrangements for learning. A fourth dimension of ACAD is not designable, it accounts for emergent co-configuration or co-creation activity, or what happens at learntime.

Being able to distinguish between designable components and emergent activity is crucial, as it is what allows educational designers and researchers to begin the search for relations between 'form' and 'behaviour' –that is, to look for how what has been designed in advance may relate to what emerges at learntime.

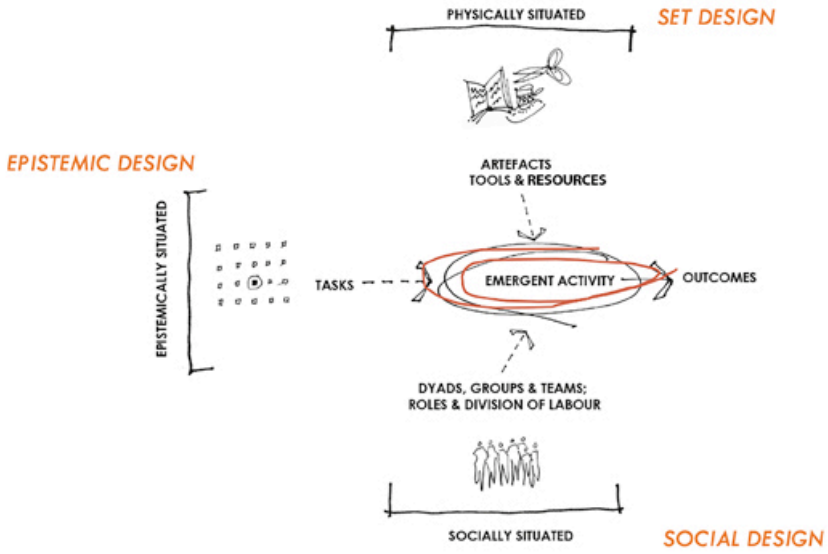

Figure 1 ACAD Framework

The ACAD wireframe (Yeoman, 2015) builds on the ACAD framework (Goodyear & Carvalho, 2014), on Goodyear's earlier work on a pedagogical framework (1999) and pattern languages (Alexander et al., 1977) to offer a single view of the dimensions of design (set, epistemic and social) at different levels of granularity (micro, meso, and macro). In offering this single-view outline, the ACAD wireframe (Figure 2) invites educational designers and researchers to (i) formulate a statement about what is valued in learning and (ii) detail key designable elements in a series of blank frames before noting the degree to which each supports their statement of values. As a result, the ACAD wireframe supports designers and researchers to trace part-whole relations within the context of their values.

Architects and designers often use wireframes as shareable representations, which can be annotated and revised as design ideas evolve. Similarly, the ACAD wireframe can act as a mediating artefact or boundary object, allowing educational designers and researchers to see the essence of their designs as they discuss and share their views with others. The grid format makes it easy to identify the three dimensions of design (set, epistemic and social) and establish degrees of correspondence across and within various scale levels (micro, meso and macro). This single view of the core components of any learning ecology (Figure 2) helps educational designers and researchers break down the complexity of their designs, visualize part-whole relationships and, in tracing degrees of correspondence between dimensions of design (left to right) and scale levels (top to bottom), it supports the identification of potential areas for further research or redesign.

As such, the ACAD framework and wireframe become representational tools for thinking about the 'what', 'where' and 'how' people learn, with important practical and theoretical

	SET DESIGN	EPISTEMIC DESIGN	SOCIAL DESIGN
High level philosophy	Learning is...	Learning is...	Learning is...
Macro The global Level I patterns	Buildings and technology	Stakeholder intentions	Organisational forms
Meso The structure Level II patterns	Allocation and use of space	Curriculum	Community
Micro The details Level III patterns	Artefacts, tools and texts.	Selection, sequence and pace	Roles and divisions of labour

Figure 2 ACAD Wireframe

implications. At a practical level, they offer visual aids in a single frame, making it possible to navigate between one element of one dimension, without losing sight of the learning whole. The ACAD framework is now a well-established analytical tool that has been widely used to analyse educational designs and support educational design work. Research drawing on the ACAD framework includes qualitative analysis of cases studies (Carvalho & Freeman, 2018; Goodyear & Carvalho, 2014; Yeoman, 2017), applied research investigating practical design work in action (Martinez-Maldonado, Kay, Shum, & Yacef, 2019; Shum, Echeverria, & Martinez-Maldonado, 2019), and quantitative research investigating learning networks in higher education (Czaplinski, 2020). The framework and wireframe have also been used in several practical workshops where mixed groups of educators and designers have gathered to discuss the development of new learning spaces, refine or create new educational designs, or to exchange ideas about how to bring their epistemological views into their design practice (Goodyear, Carvalho, Yeoman, Castañeda, & Adell, 2020; Yeoman & Carvalho, 2019). At a theoretical level, the ACAD framework and wireframe can be seen as translation devices (Bernstein, 2000) supporting educational designers to operationalise conceptual ideas.

Of particular note here is the materiality of the ACAD framework and wireframe –in the ACAD Toolkit– in which abstract concepts are purposefully laid out or embodied within a physical object that accommodates annotation, re-writing, and the revision of these conceptual ideas. One could argue that this sets the scene for the emergence of cognitive activity in the form of a distributed processes (Hutchins, 2010), in which tools do more than help individuals to think. Rather the Toolkit itself acts as a thinking tool extending one's mind (Clark, 2011). Representational tools of this nature are particularly relevant for heterogeneous teams of educational designers that often include educators working alongside space planners, architects or others –where the tool acts as a boundary object helping to ground conversations within a shared understanding of learning and design.

In the next section, we turn to learning activity as expressed in and through the learning-whole, noting the role of materials and perception in learning.

5 MATERIALS AND THE LEARNING-WHOLE IN ACTION

As discussed, in any learning situation there are a range of elements at play, which influence the emergent activity of learners. These elements may be abstracted through the three dimensions of design (set, epistemic and social), and at learntime, this assemblage is likely to influence what learners do, think and feel. Importantly, networked learning activity may emerge through participation in diverse social contexts, through learner's engagement in a range of tasks, through their conversations, and their reflections (Hodgson & McConnell, 2019; Hodgson et al., 2012; Jones, 2015). These processes may take part whilst people are at schools, universities, libraries, museums, cafes, workplaces, ILEs, or as part of everyday life. Learning is not really restricted to what happens when teachers and students are together in allocated spaces and set times for education (Gourlay & Oliver, 2018). Indeed, learning often involves a range of activities, such as reading and writing; searching, finding, selecting topics and texts; reflecting on experiences; developing knowledge artefacts; communicating ideas and so on –overall, learning in a networked world is rarely homogenous. At schools or elsewhere, learners often switch between periods of individual reflection and collaborative group work, with times for using technology individually or alongside peers, with moments to attentively watch a presentation, and many other varied activities in between. At each of these times, a mix of digital and material tools, ideas and people are often in play.

Through these learning interactions learners often produce physical and conceptual artefacts, which may take a range of forms. These may include written texts, tools, images, digital stories or concept maps. Students may use particular methods, contribute to shared endeavours, link the newly created to the pre-existing, or create many other different forms of reification (Wenger, 2010). Each of these digital or material productions embody and reflect people's shared experiences and often help to organise their participation in a particular social context. As such, meaningful learning often requires both participation *and* reification, which are intimately interconnected. In turn, participation and reification require dynamic negotiation and renegotiation of meaning. These created artefacts reflect the context of one's participation; as participation alone, without the production of knowledge artefacts, may result in loss or be too ephemeral (Wenger, 2010).

As such, not only does the materiality of one's knowledge creation (e.g. digital story or text production) play an important role in grounding one's learning activity, but the materials themselves act as cues to action all around us. Ingold (2012) suggests that matter should not be seen as inanimate raw material, awaiting animation through making. Instead, material things are emmeshed in processes of flow and transformation; materials are in movement. In this view, being in the world involves action, and each action is determined by its place in an unfolding sequence in which each new action is a measured response to the last (Ingold, 2011).

Taken together these ideas foreground relations between materials, knowledge creation and learning, which involve learning to couple perception and action –or to act knowledgably in evolving contexts. This way of looking at knowledge and learning shifts the focus from what is to be known, to a more relational view of the learning process that includes how one comes to know, and one's ability to attend to unfolding situations –or to under-

stand the performativity of things; to notice how these things, together with other things, are constantly inviting, excluding and regulating different forms of participation (Fenwick, 2015) at schools, universities, libraries, museums, workplaces, cafes, ILEs and so on.

6 CONCLUSION

This paper delves into socio-materialist perspectives to assert that materials are neither neutral nor inert; they have properties that influence the quality of our interactions. This has implications for how we learn and how we design for learning. Having an awareness of the relations between designed forms, materials and human activity allows us to theorize the physicality of our enviros and their influence on the teaching and learning that takes place, foregrounding how things and spaces help or hinder particular forms of participation (Fenwick, 2015; Woolner, 2010). In formal and informal educational settings, we are seeing a shift towards environments that value principles of flexibility, agency, ubiquity and connectedness in learning. Design for learning needs to be grounded on what we value in learning and on theoretical understandings of how people come to know, which in turn, should be coherently reflected at different scale levels in the networked assemblage of elements –the tools, tasks, and social arrangements at the micro, meso and macro levels.

Our research embodies these values of flexibility, agency, ubiquity and connectedness, at its core. Our recent work involves the development of practical analytical and conversational tools –or tools to think with and through. These tangible materials embody conceptual ideas and are materials that extend minds outwards (Clark, 2011). Our aim is to facilitate conversations about theory, design and practice in ways that support educational designers to manage the complexity entailed in designing for learning, and to reach shared understandings of how to solve the problems they are faced with. In this regard, the ACAD Toolkit includes a cards-based method to support design for learning (Yeoman & Carvalho, 2019) that has been translated for use in Spanish contexts (Goodyear et al., 2020; Yeoman, Carvalho, Castañeda, & Adell, 2020), which extends the reach of our research outwards to support a wider range of educators. In distilling these ideas into tangible tools, we reflect our theoretical grounding in socio-materialism and networked learning, always searching for distinctive multi-layered elements of specific learning situations, ably supported by the materiality of the toolkit.

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