**Complexity Theory, Philosophy and Education**

**Symposium: BERA Philosophy of Education SIG**

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Symposium Abstract

Complexity theory offers an alternative to the simple causality and reductive accounts of change which dominate contemporary policy and practice. It does so by recognising that the interplay of dynamic elements results in the emergence of patterns and meanings that cannot be predicted by considering those elements in isolation. This symposium will show how complexity contests what it means to educate, and how it is related to existing philosophical traditions.

Paper 1 makes a case for complexity as a 'lens' which offers greater sensitivity to the particularities of different conditions and histories than normative approaches to education. Paper 2 disrupts the curriculum envisaged as 'organised simplicity' to imagine an open-ended, dynamic and emergent curriculum of 'organised complexity'. By connecting Deleuze’s 'flat ontology' to the complexity view of mind, matter and context as inseparable, Paper 3 challenges contemporary characterisation of learning. Paper 4 draws on Mead's 'philosophy of the present' to suggest approaches to assessment that take account of children's capabilities and needs here and now, instead of orienting children towards what they will need or should be able to do in the future. As such we invite the audience to engage with the relationship between complexity theory, philosophy and education.

**Paper 1: An Introduction - The Case for Complexity in Education**

*Melissa Hawkins & Jean Boulton*

Introduction

Although an admittedly bold statement to make, it could be argued that there are two distinct, and divergent, assumptions underlying the conceptualisation of educational organisations. One perspective is that educational organisations run like machines (Boulton et al., 2015), that they are best managed by defining and standardising roles, methods and ways of working, and that outcomes are both predictable and easily evaluated. Often this is translated into organisational forms which are hierarchical and facilitate a ‘command and control’ leadership’ style. Despite the recognition that organisational behaviour is not so simple, this perspective is evident in accepted practices of management, evaluation (James and Colebourne 2004, Hawkins and James, 2016) and policy (Ball et al., 2012). However, if the alternative, complexity perspective is taken, then we recognise that agents and organisations can adapt and self-organise, and that cause and effect are *non-linear*: properties emerge due to multiple and ultimately unpredictable interactions. It is this latter perspective that we wish to discuss further in this symposium. This paper will outline complexity theory, before it is developed in relation curriculum, learning and assessment in the papers which follow.

Complexity thinking

Theories that embrace the complex, interdependent, dynamic nature of human and natural systems have existed since time immemorial (Boulton et al., 2015) although current thinking on complexity has been steadily developing from around the beginning of the twentieth century. However, there isn’t an overarching meta-theory of complexity, and claims made of a particular ‘complexity theory’ or ‘complexity science’ (Hardman, 2015), rest upon specific simplifying assumptions (Boulton et al, 2015). For the sake of consistency, the singular use of the word theory will be used in this symposium, but we are particularly interested in how complexity thinking has formed alliances with existing philosophical discourses as it has been brought to bear on education. What can be said is that complexity theorists seem to share an anti-positivist perspective that the world is not easily measured (or at least that outcomes are not easily attributable to inputs), nor is it deterministic (Prigogine and Stengers, 1985). Boulton et al (2015) summarise this ontological stance as: complex systems are systemic, path dependent, sensitive to context, have characteristics that are emergent and demonstrate patterns of change which are episodic (sometimes ‘locking in’ and hard to change, sometimes ‘tipping’ into new regimes).

Complex systems

The well-known saying ‘the whole is greater, or other than, the sum of its parts’ can be used to help consider the nature of complex systems (Holland, 2014), and how a holistic approach should be taken when trying to understand them. The philosopher Paul Cilliers, who wrote extensively on complexity, made the useful distinction in remarking that a complicated system can be understood simply by analysing its constituent parts, whereas a complex system cannot, due to interaction between both the parts and the external environment (Cilliers, 1998). Although complexity theorists are somewhat disparate in their ontological and epistemological stance, most acknowledge that *emergence* is what distinguishes a complex system from a simple, chaotic or complicated system, and this is a key focus in considering education through the lens of complexity.

Emergence signifies that new features have appeared in the system which were not present in the previous regime and could not have been predicted. Emergence is unpredictable due to non-linear dynamic interaction and to the role of variation between agents and contexts, but is not random (Scheffer, 2009). What emerges is shaped by the interplay between existing patterns/structures/norms and events or variations (Goldspink and Kay, 2003, Eoyang, 2006, Goldstein, 1999, Stacey and Mowles, 2015). The consequences of emergence are that you cannot understand the whole by looking at parts, that the past is not a good predictor of the future, and that the context and history of organisations plays a significant role in shaping their characteristics (Harcourt-Heath, 2013, Eoyang, 2006, Boulton, 2012) .

The case for complexity in considering education

Complexity theory has been applied in a variety of academic fields: mathematics (Wiener,
1961) biology, (Von Bertalanffy, 1972) computer science (Mitchell, 1996),
business and management (Stacey and Mowles, 2015), sociology (Byrne and
Callaghan, 2014, Castellani and Hafferty, 2009) economics (Hayek, 1989) and
public policy (Mason, 2016, Geyer and Cairney, 2015, Gerrits, 2015, Room,
2011). Whilst a complexity perspective remains marginal in educational
research (Harcourt-Heath, 2013), there are notable works to be found (Weick,
1976, Orton and Weick, 1990, Bates, 2016, Morrison, 2002, Osberg et al., 2008,
Osberg and Biesta, 2010, Davis and Sumara, 2009), as well as the work by
convenors of this symposium.

Morin (1992) considers complexity to be a paradigmatic shift in how we see the social
world and Blaikie (2007) refers to the ‘complexity turn’ in social enquiry. If educational organisations are difficult to measure, control, predict, analyse and compare due to non-linear cause and effect, self-organisation, the number of heterogeneous interacting agents and the importance of context, variation and historicity, then this brings into question many aspects of contemporary research, policy and practice in education. However, complexity theory does not itself establish a new normative view (Mitleton-Kelly, 2003, Weick, 1976, Gell-Mann, 1994, Gell-Mann, 1995). Rather than focusing on what works or ought to work and imagining this can be universal, complexity theory focuses on understanding the nature of educational organisations and providing conditions for adaptation and response to the particularities of different conditions and histories (Whitty, 2016, Weick,1976).

The papers which follow will flesh out the case for complexity as a new ‘lens’ through which to approach research, policy and practice in education. Through considering in turn curriculum, learning and assessment in light of complexity theory, each paper will develop implications for education, but will also explore how this relates to existing thinking in the philosophy of education.

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**Paper 2: Curriculum and Complexity: A Different Imaginary**

*Phil Wood & Jo Trowsdale*

*‘The systems view is the emerging contemporary view of organized complexity, one step beyond the Newtonian view of organized simplicity, and two steps beyond the classical world view of divinely ordered or imaginatively envisaged complexity*.’ (Lazlo, 1972 in Doll, 2008: 198)

The traditional view of curriculum is one first devised by Ramus in the 16th century. This view of curriculum as organised content, still popular amongst much of the educational establishment naturally leads to disciplinary categorisation, and can become hierarchical, static and knowledge-driven. Such curricula can be attractive as they have a clear structure, and allow for a level of complexity reduction (Biesta, 2010), a way of moderating the messy complexity of reality to allow for easier manipulation for educative purposes. This perspective on curriculum is analogous to a ‘Newtonian view’ of organized simplicity. This worldview can become linked to the transferring of knowledge from the curriculum document and the teacher to the student, the relative success of this process being measured by the degree to which knowledge can be retrieved and correctly represented by the student.

Lazlo’s observation of a systems perspective helps us create a different curriculum imaginary, one of organized complexity. Whilst traditional reductive views of curriculum lead to a ‘vertical’, simplistic view of the curriculum and associated pedagogy, complexity theory offers a different frame of reference for understanding these relationships. Here we consider three characteristics of such an alternative view, the value these might have and exemplify them through a STEAM project: *The Imagineerium*, located across primary school and an arts and engineering maker-space.

Firstly, both knowledge and curricula can be identified as open systems. This means any area of knowledge is part of larger networks, linked laterally as well as vertically. Consequently, we need to think as much in terms of the interactions and interconnections within and across disciplines as much as considering the ‘quanta’ of knowledge within disciplines. This openness leads to an understanding of knowledge as networked, interactive, shifting and emergent. It also emphasises the need to consciously link knowledge to other elements of learning such as skills, concepts, behaviours and application. The Imagineerium allows learning to be situated in and motivated by a purpose, role and context rather than by a discipline - in this case by imagining, designing and making a model of a kinetic performance vehicle or structure. Learning the skills of negotiation and collaboration to develop an idea, to persist in finding a solution to a challenging problem interweaves with learning scientific principles, testing materials, mathematical formula and developing know-how of particular art-making and engineering practices. Here the hybrid ‘imagineer’ role emphasises the networked and interactive nature of disciplines involved in the core making task and the emergence of its artefacts.

Next, the openness of curriculum indicates the importance of emergent processes. Osberg and Biesta (2008) see this as a process centring on the subjectivity of the student, occurring through interaction with the curriculum. In The Imagineerium, children’s personal interests and ideas underpin, motivate and shape the process, illustrating how the curriculum becomes a process allied to both pedagogy and content which evolve through enactment as opposed to being a series of predetermined events. Davis and Sumara (2006) provide a useful framework for the fostering and enactment of emergence in educational contexts, through, internal diversity and internal redundancy, neighbour interactions and distributed control, and randomness and coherence. By holding these factors in tension, for example, by inviting children to draw upon eclectic, ‘found’ objects in The Imagineerium space as part of a process of designing and making, draws simultaneously on randomness and coherence. As they collaborate, new ideas and processes appear, fed by / growing and diversifying from the stimulus which might be considered thereby an ‘enabling constraint’. Some ideas become recognised by the group as effective, attractive and to be pursued, others (through negotiation or collective ‘gut’ feeling) naturally fall away as less effective for the agreed purpose (like a material that won’t flex enough to create the desired feeling). So whilst possible, or desirable to some, the collective process causes some lines of enquiry to become redundant until a coherence is apparent and a design and model emerges. In this way learning is dynamic, emergent and ‘in the making’. It is also affected by elements of serendipity: the particular resources apparent and which appeal to the children at the time, the particular commissions in which professionals are engaged and which shape the approaches, thinking, talking and likewise the particular experiences, contexts and family influences upon the children. So learning is affected by the neighbourhood interactions of the worlds and interests of each child and adult. Significantly the imaginative frame of The Imagineerium in which children are invited and positioned as commissioned ‘imagineers’ disrupts the traditional school-based adult-child relationship.

Finally, curriculum can only be understood in terms of its interpenetrative (Byrne and Callaghan, 2014) relationships with the other complex adaptive systems of teaching, learning and assessment, as will be explored in the next two papers. As a consequence, any detailed consideration of curriculum cannot be developed in isolation from these other processes, otherwise there will be incomplete and reductive understandings of the issues and practices involved. Pedagogy then becomes a process understood through the interaction of these elements and the ways in which they emerge within different educative contexts. In the case of The Imagineerium, assessment becomes embedded within the emerging design, building and testing of solutions, whilst teaching is multi-faceted, at some points more direct and explanatory, elsewhere supportive, questioning and probing. But each of these features emerges through the process itself rather than being predetermined.

Complexity offers a theoretical basis for understanding and developing curriculum perspectives which differ markedly from traditional viewpoints, particularly emphasising holistic and interactive processes which embrace many more facets than merely a list of knowledge to be transmitted. It reconceptualises curriculum as an interactive, emergent process with political, cultural as well as educative elements which create different, contextually driven symbiotic relationships through the wider process of pedagogic practice.

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**Paper 3: Complexity and the Characterisation of Learning**

*Mark Hardman & Anna Wilson*

The last paper considered learning as emergent from the interplay of curriculum, teaching, the worlds which students bring with them and the serendipity of broader context. This paper will further that argument in showing that complexity provides not only a critique of simplistic, ‘linear’ accounts of learning, but also a challenge to the dualism which underpins how learning is characterised.

Classroom practice in England and Wales is undergoing a painful struggle to shake off the influence of the National Strategies (DfES 2003), which ran from 1997 until 2011. The strategies exemplify a ‘linear’ formulation in which the progression of a child through predetermined levels became the focus of education, rather than learning (Ofsted 2010, DfE 2011). Such a formulation still underpins approaches to curriculum design (as we heard in the last paper) and also assessment (to be explored in the next), but in the classroom, characterisations such as Bloom’s taxonomy (1956), or SOLO (Biggs & Collis, 1982) are presented as hierarchies: from remembering, through understanding, applying, and analysing, towards finally being able to evaluate (and, for the select few, create). Such a formulation flies in the face of experience around how learning occurs

Complexity is a frame which recognises the messiness, unpredictability and joy of classroom practice in a way which ‘linear’ models of learning do not. However, we here wish to develop the even bolder argument that complexity also challenges the inherent dualism within contemporary education. Educational discourse is still dominated by social constructivism, which is commensurate with the view of learning as the development of predetermined levels of knowledge and skills. Under this view individual minds are inducted into what curricula term “conceptual understanding” (DfE 2014); it is the status of this understanding itself which we contest in this paper.

Ryle (2009 [1949], p.5) argued against “the dogma of the Ghost in the Machine” in relation to dualist accounts of mind, questioning where the distinction between mind and matter should be made. Complexity theory allows us to take this further by seeing that in dynamic, non-linear interactions, which are sensitive to the minutiae of context, it is impossible to sustain a distinction between matter and a supernatural mind with which that matter is interacting. Whilst neuroscience is too young to be trustworthy, the study of brains as complex systems is bringing into questioning how mind can be distinct from body (Cilliers 1998, Freeman 1999, 2000, Edelman, Tononi 2000). Furthermore, cognitive science suggests that mind cannot be seen as independent from the detail of the contexts in which we learn. For example, body positioning and unconscious actions (e.g. face touching), as well as our prior relationships influence how receptive we are to others (van Baaren, Janssem et al. 2009, Tognoli, Kelso 2015); whether we watch a teacher demonstrating a science experiment or do it ourselves influences how we perceive the results (Jackson, Meltzoff et al. 2006). Studies of this kind link mind, matter and context, but taken with the theoretical frame of complexity theory we might question whether we can see learning as an isolated (and measurable) property of an individual at all.

Yet one can easily point to our ability to communicate and empathise, as well as pass standardised tests. How then can we square the unique and unpredictable dynamics of learning within complex systems with the recognition of shared, social understanding? The theories and models which emanate from the scientific study of complexity are not themselves enough to answer this question and here, as with other questions posed by complexity, we must draw on existing philosophical discourses. The next paper draws upon the work of George Herbert Mead to consider assessment through the complexity lens. Here we shall draw on a different discourse, namely the work of Gilles Deleuze.

Deleuze proposed a ‘flat ontology’, in which heterogeneous elements can be seen to interact without any claim of ontological hierarchy (Deleuze 2004 [1968], Deleuze, Guattari 2004 [1980]). Taken in relation to a classroom, this allows us to recognise that people, music, textbooks, conversations, ideas, videos and anything else we could name, all interact within a material “hodgepodge” (Deleuze 2007). Deleuze (2004 [1968]) also proposed that understanding emerges from the “difference and repetition” of experience. We learn not through access to some other realm of ideal understanding, but because there are repeated patterns in the world, manifest in unique circumstances. We learn from, respond to and manipulate repeated yet unique patterns of behaviour, symbolic language, expression and thought.

The ‘difference and repetition’ of classroom events denotes that each lesson is unique, even if the planning, resources and decorations on the walls are identical. Whereas constructivism recognises the uniqueness of learners, it still characterises learning as moving them towards *a priori*, ideal understanding. In the frame of complexity, the teacher is no longer a gatekeeper to a realm of knowledge that exists independently of specific contexts. They are engaged in unique contexts in which the repeated patterns of shared understanding are contested and dynamic.

Furthermore, by removing supernatural ideas from the picture, we see that we learn *from* contexts rather than just acquiring knowledge *in* contexts. As Biesta’s (2007, p.10) points out: “The means we use in education are not neutral with respect to the ends we wish to achieve.” People learn from the way things are done and the values implicit in those ways. If we take Deleuze’s flat ontology seriously, the very notion of individuals (and learning) as separable from context becomes untenable; learning is an emergent phenomenon, involving people, things and all that might normally be bracketed as ‘context’.

A complexity theory informed by a Deleuzian materialism thus provides a frame for challenging simplistic, linear formulations of learning but also provides the basis for a drastically different characterisation of learning. Drawing upon anti-dualist metaphysics learning is seen as unique, contextual, dynamic and emergent. It thus allows us to recognise the gloriously messy and ethical nature of education, in a way that is missed by the dominant view of education today.

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**Paper 4: Assessment Policy, ‘*Readiness for School*’ and a Complexity View of Time**

*Agnieszka Bates*

*Children only get one chance at education and every child deserves the opportunity to*

*reach their full potential… childhood is short, and when it comes to a child’s education, there’s no time to waste.* (Nicky Morgan, DfE 2016: 4)

This paper draws on G.H. Mead’s (2001) ‘philosophy of the present’ to consider more holistic approaches to assessment policies in relation to children’s readiness for school. Readiness for school has traditionally been defined in terms of children’s developmental skills and abilities such as social, emotional and motor development, language, cognition and learning skills (Kagan et al. 1995; Rogoff 2003). The conceptualisations of readiness for school currently promoted by the United Nations Children’s Fund (UNICEF 2012:6) focus more broadly on a ‘good start in life’ predicated on nurturing, safe environments that enable children to ‘be physically healthy, emotionally secure, socially competent and able to learn’. Conceptually, the focus has thus shifted from cognitive, emotional and social abilities that enable a smooth transition to school to caring environments that enhance a holistic development of children. However, a reductive focus on ‘outcomes for children’ assessed through Standard Assessment Tests (SATs) in reading, writing and mathematics prevails in English policymaking (DfE 2010, 2016).

Although Nicky Morgan’s assertion above hints at the irreversibility of time, assessment policies for primary education remain tied up to five-year electoral cycles and often rely on reversing the previous government’s policies. A sense of ‘urgency’ in reforming education typically results in introducing ‘tougher’ assessment tests to tackle ‘underperformance’ (DfE 2016). One constant in the policy ‘pendulum swings’ (Barker 2010) has been a continued reductive focus of assessment on children’s SATs results. Within this paradigm, policymakers and teachers tend to see ‘children-as-data’ rather than individuals possessed of unique capabilities and needs (Bates 2016). Readiness for school is underpinned here by an assumption that the ultimate purpose of schooling, as illustrated by Morgan’s statement above, is for children to ‘reach their full potential’ - at some time in the future - within a view of time as linear, future-oriented and not to be wasted. This paper takes up a complexity view of time as non-linear, irreversible and emergent in the present (Mead 2002) to consider how children’s readiness for school is bound up with schools’ readiness - the degree to which schools are ready to respond to children’s needs and capabilities here and now, in more caring ways than those engendered by the ‘children-as-data’ approach.

The present as the locus for realising one’s ‘full potential’

Although not directly addressing readiness for school, Mead’s ‘philosophy of the present’ supports more holistic approaches to assessment in two ways. First, even though time is irrevocable in the ‘carrying on of [past] relations’ (Mead 2002: 16), it is in the present that possibilities emerge to discontinue the past and shape the future in novel ways. In the present as ‘the locus of reality’, a child may gain (or lose) a myriad of chances at education, depending on her teacher’s readiness to engage with teaching as a dynamic process of constantly producing and readjusting a course of action within a situation (Joas 1997) rather than acting to a pre-determined outcome. Schools’ readiness to respond to children’s needs and capabilities in the present may thus be more effective in shaping their development than orienting children towards what they will need or should be able to do in the future. This is, however, based on seeing beyond the linear view of children’s progress through school, with its milestones of getting ready for school, transition from primary to secondary education and preparing ‘for adult life’ (DfE 2016: 8). Linear time is a neutral, independent variable (Prigogine 1996) utilised to measure the extent to which schools ‘stretch’ children to ‘reach their full potential’ (DfE 2016: 10). For Mead (1956: 332), however, the notion of time as a ‘mere passage’, ‘divided into equal portions of itself’, is an illusion and example of an ‘unwarranted use of abstraction’. To more readily respond to the ‘real’ children here and now, we need to reconsider educational purposes.

‘Taking on the role of the other’ as the social purpose of education

A second important contribution of Mead’s ‘philosophy of the present’ is his concept of ‘sociality’ - the ‘social nature of the present’ resulting from the inherent relatedness of social processes (1956: 339). ‘Sociality’ relies on continual readjustment necessary for incorporating the emergent event into ongoing experience nested in multiple systems (Doan 1956; Natanson 1953). For young children, the school presents an entirely new social world with a unique system of meaning which may be exciting, anxiety-provoking and at times meaningless. The most immediate and ongoing need upon entering the world of school as a new ‘sociality’, is to learn to ‘take on the role of the other’, to be able to apprehend what many others may think and feel in response to one’s actions (Mead 2002: 190). For Mead, realising one’s ‘full potential’ is about accessing higher levels of conscious experience at which the individual is able to apprehend the plurality of attitudes and meanings in the social sphere that extends beyond one’s immediate social environment. This process is not located at some time in the future, but in the present, in the presence of others. Mead’s philosophy of the self thus offers a social purpose to education that transcends the reductive focus on SATs results. It also suggests alternative approaches to assessment which would allow children to tell their own stories, for it is by hearing such stories that adults can apprehend children’s thoughts and feelings in more holistic ways.

Conclusion

Childhood is indeed short in the timescale of human life but, to ‘take time seriously’ (Mead 2002: 184), we may need to dwell longer in the present as if there were time to waste. It is in the present that the reductive approaches to the curriculum, learning and assessment discussed in this symposium can be merely replicated, or imagined differently, changed.

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