

How do ecological perspectives help understand schools as sites for teacher learning?

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Abstract

Schools are sites of teachers' professional learning for both new entrants and experienced practitioners. In this paper, schools are conceptualised as complex, multidimensional ecologies that are constituted by the relations that exist between school leaders, teachers, mentors and all members of the school community. As relational environments, the conditions affecting professional learning – both formal and informal – are constantly dynamic, with multiple and simultaneous interactions taking place between these stakeholders. Interactions are also multi-layered - between the school system, individuals, classrooms, the community and the policy environment. School leaders are a major influence on these dynamics and affect how schools act as sites of professional formation, mediating external policy as well as affecting micro-dynamics within individual school systems. The challenge of realising professional learning within these relational contexts can be viewed as a 'wicked problem', a feature of complex systems that resists simplified solutions. In conceptualising a complex ecology at work, we illuminate the relational dynamics with a focus, for all stakeholders within schools, including leaders, on the need to recognise and value the importance of 'emergence' in professional learning. This means embracing inevitable uncertainty as a feature of schools as complex systems.

Key words: complexity; ecologies, professional learning, relations, school leaders

Introduction

This paper draws on ecological perspectives to examine the relational nature of schools as professional learning environments. We examine schools as 'systems' in which teachers learn; in conceptualising schools from an ecological perspective, the relations among all stakeholders are brought into focus. This is to respond to the persistent challenge in realising professional learning for teachers in schools. Pedder and Opfer (2013, p. 540) argue that research into professional development 'has yielded disappointing results'. Part of the problem they attribute to 'simplistic conceptualisations of teachers' professional learning that fail to consider how learning is embedded in personal and professional lives and working conditions'. We suggest that an ecological conceptualisation offers deepened understandings of the conditions that constitute schools as sites of professional formation. From this perspective, reconfigured relations among key stakeholders in school communities - including leaders - are needed in order to realise the potential of such environments as sites of professional learning, both formal and informal. The challenge of reconfiguring the relations among stakeholders in schools is not to be underestimated. Despite considerable research into teacher leadership (e.g. Mujis and Harris, 2003, York-Barr and Duke, 2004, Harris, 2015) and the potentials of professional learning communities (Stoll *et al.* 2006, Stoll, 2010), the realisation of altered learning relations among members of school communities remains elusive. Similarly, participatory and inquiry-focused professional learning at a national scale has

remained hard to embed in many education systems (Bowe and Gore, 2017), depending as it does on the capacities of schools to collectively question existing norms and work with the unsettling consequences of changing the ways people think and act (Kemmis, 2006). This includes in New Zealand and Wales where we have conducted studies into the induction and mentoring of new teachers in school communities, which inform the conceptual work in this paper. In many ways, these challenges indicate a ‘wicked issue’ (Bore and Wright, 2009) that characterises complex ecologies, by which core problems remain in constant focus and are subject to serial ‘solutions’, both theoretical and practical, but typically remain unsolved. Lillejord *et al* (2018, p. 294) suggest that this is because

‘contradictory intentions, for instance, formative *and* summative ambitions, are embedded in the problem. Wicked problems are ambivalent, resist resolution and cannot be ‘solved’ in the sense that they disappear. Merton (1976) has shown that ambivalence is central to modern societies, and warns of unintended consequences when solving problems in ambiguous contexts.’

This paper reflects schools as such ‘ambiguous contexts’. The emotional work of teachers within relational environments is acknowledged, alongside analysis of those environments as complex systems in which teachers learn. Contrasting theoretical positions in relation to knowledge-making processes are thus considered. These are not considered to be contradictory, but rather suggest that each can contribute to deepening understanding of an issue that defies any singular theoretical position or solution. Ecological perspectives help to locate such concerns about the learning of teachers – and their leaders - as individuals within an understanding of schools as complex environments, which are dynamic and require their members to constantly negotiate the shifting contexts, both personal and resource-based, in which they operate.

Complex ecologies

The ‘ecological shift’ in educational theory is well-established (Clift and Brady, 2005, Bore and Wright, 2009, Valencia *et al.*, 2009, Ell *et al.*, 2019). As argued by Valencia *et al.* (2009, p. 304), teacher learning can be illuminated by an ‘ecological, systems-based approach to studying the complexities and interrelations of individuals, institutions, programs, and ideas in context’. As such, members of school communities are viewed as operating within multiple sets of relationships, settings and demands that are frequently competing and that affect ‘their actions and stances’ (*ibid.* p. 305). This goes beyond the ‘various dyadic relationships’ (*ibid.* p. 306) that are so often the focus of professional learning (for example, mentor-mentee relationships) and places them in the wider ecology of the school. Ell *et al.* (2019, p. 1) argue that, crucially, ‘complexity theory is also a theory of learning and change’. Schools as complex systems learn and grow, and new states have an historical relationship with previous ones (Cilliers, 1998, Davis and Sumara, 2006) – they emerge. ‘The concept of emergence puts the emphasis on the system as a learning entity, rather than individuals within the system’ (Ell *et al.* 2019, p. 6). Individuals are both changed by being part of the system and also help constitute the changes within the system. Thus ‘emergence’ is a core characteristic of schools as complex systems and means accepting ongoing dynamics and processes of change as inevitable.

We have previously argued for the relevance of ecological concepts of schools as complex environments for professional learning (Milton *et al.*, 2020), focusing on three complementary theoretical perspectives – ‘at systems level through complexity theory; at the level of individual interactions with environment via ecological theory; and...through theories of communities - professional, learning and practice-oriented’. At systems level, complexity theory is able to illuminate the multiple and dynamic sets of relations among stakeholders within a school; it proposes the inevitability of uncertainty as a constant feature. This is brought about by the

multivarious connections among people and resources and the constant state of contingency in which people operate, brought about by the options available to them. Essentially, schools are argued to be 'complex adaptive systems', by which they 'exhibit dynamic interaction of agents in a system which simultaneously react to and create their environment' (Bovaird, 2017, n.p.). Thus the school as an environment is in a continuous process of co-construction by its members as 'agents', in interaction with the changing resources and policies which have bearing on them.

From an ecological perspective, the importance of capacity for adaptation is core to professional learning environments. In order to 'evolve', adaptive knowledge needs to be fostered (Langdon, 2017) and the conditions for knowledge-exchange need to be optimised among members of a school. This means resisting replicating existing 'solutions' or behaviours (Rosas, 2015) and creating conditions in which teachers' individual characteristics and belief systems are acknowledged as crucial to how they interact with factors within the environment. Adaptive experts are constantly tuning their practice in response to new interactions and contexts (Timperley, 2011). At the same time, the values and norms of the school community, both overt and covert, have significant influence on the capacity for growing adaptive expertise (Nyman, 2014). Thus school cultures and ecologies are in continuous interaction with each other, each shaping the other. Further afield, Godfrey and Brown (2018) draw attention to the wider ecological dimensions in which schools operate, by which the capacity for beliefs and actions to evolve is influenced by external stakeholders such as local authorities or universities and the impacts they have on resources and potential for change. Langdon *et al.* (2012) and the European Commission (2015) have further identified how national, regional and local education policymaking are influential factors affecting the learning capacities of schools.

Alongside these analyses, theories of community draw attention to how 'practices, beliefs and values are constructed within the environment - how school cultures are constituted and enacted' (Milton *et al.*, 2020, p.4). Langdon (2017, p. 1) argues that school communities are 'individual, multifaceted and relational', involving members in multiple interactions between individuals and across sectors of the wider community and policy environment. Thus ecological perspectives of schools as complex systems posit that it is only possible to enhance teachers' professional learning by understanding that it is located in the complex relational learning communities of schools. As relational environments, the conditions affecting professional learning are constantly dynamic, with multiple and simultaneous interactions taking place between stakeholders; 'they are thus comprised of interactions that are *non-linear* (between mentor, teacher, other teachers etc.) and *multi-layered* (interactions between the school system, individuals, classrooms, the community and the policy environment)' (Langdon *et al.*, 2019, p. 252). Taylor (2020) suggests continuous professional learning and development is itself a 'complex process' which emerges unpredictably and can be shaped by a myriad of factors – past, present and even future in relation to intent. Taylor contends that the 'contexts for professional growth are shaped by relationships, leadership, capacity and ethos, nested within external conditions of policy, culture, society and values' (p. 3). These perspectives recognise the likely futility of leadership directives towards pre-determined goals (Fidan and Balci, 2017, p. 11) - however enlightened - because the conditions that constitute schools as complex systems do not support teachers to learn through such strategies.

Theories of teacher leadership (Mujis and Harris, 2003, Frost, 2012) and leadership for learning (MacBeath, 2007) have proposed conditions for professional learning that are relational, agentive and premised on developing the self-directing capacities of teachers; collaboration has been advanced as a foundation for effective professional learning (Cordingley, 2005) and Poekert (2012) has identified principles that characterise the impacts of such approaches, including

‘focusing on learning for everyone at the school; creating and sustaining conditions that favour learning; engaging in explicit, transparent, inquiry-based dialogue; sharing leadership to allow everyone to influence school operations; and maintaining internal and external accountability to examine how results match up with the school’s goals and principles’
(Poekert, 2012, p. 176).

Despite the identification of these characteristics, there is a vast underestimation of what it takes to change teachers’ and leaders’ concepts of professional learning (e.g. Pedder and Opfer, 2013, OECD 2018). In the UK, there has been a persistent challenge in developing genuinely collaborative professional learning cultures within schools *at scale*, in which teachers are agentive and in which collaborative learning involves all stakeholders, including leaders (Opfer and Pedder, 2010, OECD, 2018, Milton *et al.*, 2020). We suggest that greater attention to *emergence* as an explicit feature of learning in complex systems helps to illuminate these challenges and can inform priorities and values that support leaders in developing their schools as learning entities.

The challenges of working with complexity

Attention to the school as a learning entity is what concerns us here. For Valencia *et al.* (2009), professional learning opportunities are lost because of insufficient attention to how the ‘array of people with varied histories, understandings, beliefs, and perspectives on instruction and curriculum interact’ (p. 304). This array includes university partners but extends to all levels of the education system – to the motivations and interest of policy-makers, local authorities, school leaders and school communities. Leaders engage with multiple, performative and conflicting agendas, some of which militate against forms of learning that encourage deep reflection and change – for leaders and teachers. Brady (1999) summarised these as ‘conflicts of interest’. Lofthouse and Leat (2013), draw on the work of Engeström *et al.* (1995) to argue that leaders and teachers belong to different activity systems – leading to inevitable tensions in the perspectives and priorities that affect these stakeholders. Valencia *et al.* (2009) and Lofthouse and Leat (2013) root their claims in studies of professional learning involving student teachers on school placements and peer-coaching initiatives within schools. Their research suggests that these examples reflect the ways in which individuals are interacting within the entire activity system of the school (Valencia, 2009, p. 306), which according to Engeström *et al.* (1995) is comprised of the ‘visions, expectations, cultural histories, past experiences, tools, and settings constructed and negotiated among all those involved’. Such perspectives draw attention to complexity as the frame of reference for understanding professional learning. Attention to individual factors or policy foci alone will not suffice and instances of professional learning cannot be attributed to singular or even groups of factors – it is the totality of the environment that needs to be understood. This inevitably brings considerable challenges for policy-making at school, local and national levels, which has historically focused on component parts that enable auditing of cause and effect, and that lend themselves to logic models that seek to isolate the effectiveness of particular factors in professional learning. As argued by Bredeson (2000, p. 386), professional learning that is not precisely evidenced and explicitly linked to enhancements in school improvement can ‘become the victim of capricious budget cutting or, worse, be relegated to the scrap heap of educational fads and ephemeral educational elixirs’. In some systems, the growth in randomised control trials and the search for positivist evidence of ‘effective’ teaching (Goldacre, 2013, Coe *et al.*, 2014) is indicative of the neglect of ecological perspectives as they are necessarily resistant to testing of singular strategies and pre-ordained outcomes measured against constant factors. The ‘rolling out’ of initiatives – including the top-down establishment of professional learning communities - that promote decontextualised solutions is symptomatic of a *simplification* of something that is essentially, complex – ‘complex things are wholes and exist as a unity of relationships and structures that cannot be meaningfully separated for analysis’ (Ell *et al.*, 2019).

The ‘nuanced dance’

Instead, it is important to work with complexity. We need to learn to interact productively within the potentials of ‘emergence’, embracing contingency as a resource for learning. It calls for all members of a school community to take part in what Langdon has called a ‘nuanced dance’ (2017, p. 14) that allows them to be continuously responsive in interacting with the policies, resources and colleagues that together constitute the ecology of the school. In a study of mentor learning to support early career teachers in New Zealand, Langdon found that a focus on professional learning for all those involved is hard to achieve, due to the multivarious demands on individuals and the persistence of linear, hierarchical concepts of what is to be learned and who can learn:

‘adapting new conceptual understandings of themselves as mentor learners, engaged in inquiry to transform their *own* mentoring practice, was problematic. The difficulty was simultaneously attending to mentee, student and their *own* learning.’

(Langdon, 2017, p. 12)

The ‘dance’ is difficult, dependent on all members’ alertness to the learning possibilities and openness to acting upon them. It does not work through linear relationships between the elements involved, such as policies, strategies, peers, leaders and personal factors such as prior experience or qualifications. The nuanced dimensions of the dance are captured in Netolicky’s (2016) research into professional learning:

‘The researcher’s, teachers’, and leaders’ stories reflect fluid and nonlinear growth with a multiplicity of intersecting, sometimes contradictory, influences...Professional growth can be continuous, ongoing, and adaptable. Small, unexpected, epiphanic moments can be [sic] transformational of teachers and leaders. Data from this study expose impactful moments, relationships, conversations, and life events that have the potency to shift core beliefs, shape senses of self, and alter learning trajectories, in nonlinear, viral, and synaptic ways. Small things, not necessarily called “professional learning” or “professional development,” can be catalysts for deep and lasting personal learning and individual change.’

(Netolicky, 2016, p. 279)

The futility of thinking in terms of ‘linear, process-product thinking’ (Ell *et al.*, 2019, p. 1) means accepting teacher professional learning as a ‘wicked problem’. ‘Wicked problems’ (Rittel and Webber, 1973) are highly complex social phenomena, nested in multiple contexts that are subject to continuous change, a complexity theory concept adapted from its origins in systems and design planning (Bore and Wright, 2009; Lillejord *et al.*, 2018). Wicked problems result from intense challenges generated by the inter-relationships between components in a social landscape. They acknowledge that individuals have agentic capacities but these are always tightly linked to their complex environments. Lillejord *et al.* (2018, p. 294-5) suggest that ‘Efforts to solve one aspect of a wicked problem often breed new problems. The greater the disagreement between stakeholders, the more wicked the problem’. Components are never fixed, are in transition and can be unpredictable and unique. Examples in professional learning are ‘how can schools best support student teachers whilst on teaching placement?’ and ‘how can teachers be ‘masters’ of their practice at a national scale?’. Often in contexts like these, ‘goals are ambiguous or contradictory, the expected outcome is broad and vaguely defined ... and various actors have their personal interpretations of how this outcome may be achieved’ (*ibid.*). Wicked problems confound attempts at complete resolution – as soon as a solution to a ‘problem’ is available, the changing relations among its many components render it unsolved and newly-constituted versions of the same challenge emerge. Essentially, the productive focus with wicked problems is on *continuous re-solving*

of the challenges rather than achieving permanent solutions. It is therefore process-oriented and the fundamental aim of engaging with them is to *learn* rather than achieve a settled state. This can be in stark contrast to the processes dominant with the public sector which frequently inhibit expansive thinking, because they privilege ‘hierarchical organisation and control, focused on input monitoring and process compliance’ (*ibid.*). A shift to a process orientation means that all stakeholders in schools - including head teachers - need to re-prioritise, paying attention to their own learning. The focus moves to a process orientation that privileges perceptions and responses to situations rather than prescribing and directing solutions and strategies. This makes policy-making at the level of individual strategies, resources or entitlements fairly powerless to achieve much on its own. Policy design that supports the entire ecosystem is needed – in effect, multiple and connected policies linked to resources that can bring about reconfigured relations among key stakeholders. This is far from a ‘scattergun’ approach. It is about recognising the interaction between policies, together with their impact on stakeholders’ perceptions of how they learn and the ways in which their professional growth is recognised. Investing in collaborative ways of learning that seek to question the way things are done, do not promise quick results and are premised on provisional thinking and inquiry, makes significant demands on teachers and leaders. It is important to understand and value this in the context of ‘emotional capital’:

‘Emotional capital is a tripartite concept composed of emotion-based knowledge, management skills, and capacities to feel that links self-processes and resources to group membership and social location.’

(Cottingham, 2016, p. 452)

Attention is needed to develop leaders’ capacities to enable teachers and themselves to recognise and embrace the feelings of disorientation and uncertainty that accompany a process orientation towards professional growth. Deliberate strategies are needed to support open dialogue and close working (Poekert, 2012) in recognition that this is emotional work and to use these feelings effectively within the school community. Emotional capital is an essential element of relational environments (Greer and Daly, 2020) and support is needed to grow it, by learning about how to plan for productive dialogue, developing safe spaces for speculative and risky talk, and building trusting relationships in which all levels of a school community can exchange their reflections on the feelings generated by the change process.

It is evident that school culture that fosters a process orientation towards professional learning, for new entrants and experienced practitioners, is inextricably linked to school leadership. Taylor (2020) contends that the professional learning of staff is mediated by leaders and can be ‘experienced as supportive, empowering or criticising’ (p. 9). This reflects Kose’s (2009, p. 642) suggestion that ‘transformative cultural leaders’ are focused on nurturing shared practices, behaviours and values which are built on trust and a collective responsibility for all learners – pupils and staff; encouraging risk-taking and collaboration and a persistent focus on learner-oriented practice and reflection to meet social justice aims. The idea that ‘learning is central to the energies and efforts of everyone in the school’ (Bredeson, 2000, p. 393) demands that leaders demonstrate an authentic commitment to professional learning and recognise that they can and do shape the perceptions of teachers through their own active engagement and the ways in which they model beliefs and values (Kose, 2009). This is in addition to leaders enabling environments that promote and value experimentation, risk-taking and innovation and that facilitate change that emerges from teachers’ own ideas, feelings and practices. This needs to be delicately balanced against the impact exerted by leaders’ identity, position and power which can position them as ‘gatekeepers or governors’ rather than enablers who promote ‘independence and professional autonomy’ (Bredeson, 2000, p. 395).

Leadership and complexity

Recognition by leaders of the ‘complexity of classroom life – especially the multidimensionality, simultaneity, immediacy, unpredictability, publicness and historical embeddedness of the demands made on teachers in classroom lessons’ (Pedder and Opfer, 2013 p. 542) together with its reality, is core to their role as enablers of professional learning in schools. This recognition informs and underpins the ways in which leaders can foster cultures of professional learning that evolve within the dynamics of the school, and which are capable of learning from conditions of continual change. As a core characteristic of complexity theory, *emergence* (Ell *et al.*, 2019) suggests that professional learning can be perceived as a state of being that is constantly changing, and that new practices and understandings are linked to their previous forms. Emergence does not necessarily bring about desirable transformations however; from an ecological perspective, new states ‘of being’ for teachers may take varied and unexpected forms. They cannot be pre-determined, cannot be readily measured (and are always changing anyway) and are intricately interwoven with the behaviours of others – that is all stakeholders including colleagues, students and external influencers such as policy-makers, exam boards, parents/carers and educational researchers. Leaders can carefully orchestrate and influence these inter-dependent behaviours, supporting opportunities for collaborative reflection on practice, where teachers work together to construct meaning and develop goals which are flexible and responsive to need (Frost, 2012) - thus enabling teachers to shape and lead their own learning. Such a stance builds upon the inter-relationship between professional learning and teacher leadership (Poekert, 2012) and calls for the adoption of an inquiry-oriented approach to developing practice (Guskey, 2002). It also resists hierarchical conceptualisations of school relationships (Langdon and Ward, 2015, Daly and Milton, 2017) and the imposition of technicist solutions to complex, contextual challenges. The nature and form of learning within complex systems cannot be ordained, it evolves, but new states of professional being within this ecology can be influenced by the values and conceptions held by leaders together with their capacity to model learning in these ways. Leaders can perceive complexity as an asset, valuing opportunities for provisional thinking (including their own), risk-taking and critical enquiry that can help all stakeholders to contribute to and benefit from the collective knowledge of the community.

It cannot be underestimated however, how hard it is for school leaders to navigate the competing priorities and accountability agendas that characterise complex systems (Connolly *et al.*, 2018). The possibility of leaders becoming ‘creators of tension’ in their schools was proposed by Bredeson (2000, p. 394) to ‘help people inside and outside of the school unfreeze current values, expectations, structures and processes so new ways of thinking about teaching, learning, and schooling can be considered’. However, this vision, based on working with the school as a complex system, requires resistance to the ‘managerial drift’ (Lillejord and Børte, 2020, p. 276) that has long affected the multi-layered interactions that permeate the relations among stakeholders. A consequence of managerial drift, with far reaching consequences for school ecologies, is the persistent and uncompromising focus on engaging with complexity as management and administration rather than complexity as the relational conditions in a school that impact on learning and pedagogical practice. This is further compounded by the wider ecologies within which schools are situated, as interactions can be dominated and skewed by the demands of external accountability measures and technorational solutions to common educational challenges (Connolly *et al.*, 2018, Ball, 2012).

The struggle of schools to become learning organisations is long-standing. In 1998, Young suggested this was because of the failure of schools to recognise the social conditions of learning. Numerous studies have identified the prevalence of hierarchical concepts of professional learning and simplified understandings of the roles of each stakeholder that prevent ‘learning for everyone’ (Poekert, 2012, p. 176), particularly around the development of new teachers. Research within schools employing early career teachers indicates the challenges of establishing collaborative,

inclusive professional learning environments in which all stakeholders can benefit from mutual endeavour and the collective knowledge and experience of colleagues (Hobson and Malderez, 2013, Langdon *et al.*, 2014, Langdon *et al.*, 2019, Milton *et al.*, 2020). From leaders' perspectives, Sunde and Ulvik (2014) suggest a 'lack of awareness' of the experiences and needs of newly-qualified teachers in their schools. Leaders have been found to have 'exceptionally positive views' (Langdon *et al.*, 2014, p. 99) of their schools as learning environments, that are not shared by staff members; from new teachers' perspectives, an imperative to be silent about the challenges they face means that opportunities are lost to learn from the collective experience within schools (Hobson and McIntyre, 2013, O'Grady *et al.*, 2018). Across schools of varying socio-economic status and geographical location, and when accounting for gender, age, qualifications and initial teacher education experience, school leaders, mentors and other staff members can have widely varying perceptions regarding the learning conditions within their institutions that support professional learning in relation to induction and mentoring (Langdon *et al.*, 2019).

Reconfiguring relations

Despite this, there are many examples of schools that have succeeded in reconfiguring the relational environment and thereby changed the school as a system in which teachers and leaders learn. Timperley *et al.* (2007, p. xxvii) cite 'active school leadership' as one of the conditions for effective professional learning, with a key feature being leaders who 'focused on developing a learning culture within the school and were learners along with the teachers'. In Netolicky's (2016) study of teachers and leaders in professional learning contexts, learning took place in life, school and work, and was generated both in and out of educational settings and balanced between that which was mandated and that which was self-directed. Leaders alongside teachers viewed professional learning as 'life-wide' (p. 275) as well as life-long. This centres on a harmonisation of values. Leaders have particular responsibilities to recognise the 'values dimension' of these processes (Pedder and Opfer, 2013, p. 544), so that tensions between stakeholders' core professional values and the current practices within a system become a focus for collective review. Within a complex system, it is possible for teachers to 'discuss problems, strategies and solutions...change in teaching practice then becomes an ongoing, collective rather than an individual responsibility' (*ibid.* p. 542). Collective responsibility made possible by growing emotional capital is the necessary backdrop to the risk-taking that is endemic in altered relations. Netolicky (2016) reported the impacts of inquiry as 'dandelion seeds on the breeze' (*ibid.* p. 279), in a metaphor that captured the impossibility of control and desirability of knowledge-generation as an outcome of multiple, contingent interactions among stakeholders within and beyond the school. Altered power relations are key to this. In inviting such extensive change, Poekert (2012) identified the need for leaders' own development to help them to 'rethink their own roles and develop their capacity to support and maintain teacher leadership' (p. 179). Drawing on Birkby *et al.*, (2006), he identified constituent elements that can support such re-thinking in practical ways, including time for teachers and leaders to work together. Fundamental to this were closer and more open working relationships and collegial ways of working, necessary to break down hierarchical relations.

Where relations are reconfigured, leaders become learners alongside teachers, mentors and all members of the community. School leaders need to nurture and cultivate a school environment and ethos where professional learning is perceived as a shared responsibility by whole school communities. It has been framed in many studies as the space in which reflection and a questioning stance towards practice is legitimised and which fosters critical dialogue and a 'collaborative, collective approach to problem solving and decision making' (Killeavy, 2006, p. 170). Killeavy argues that this is a far-reaching reconceptualisation of learning relations that extends to school leaders and newly-qualified teachers, who should engage with mutual inquiry-oriented professional learning. This would be a radical change in many schools and although far from the norm, such aspirations are

vital. In England, the Early Career Framework (DfE, 2019) a recent major policy initiative in professional development, does not currently promise altered relations among leaders and new teachers. Mentoring is projected as a largely 'private' responsibility, delegated to a specific individual, following an external programme. It continues to reflect the simplification of relations that tend to permeate the conditions for learning in schools more widely. Yet as Shanks *et al.* (2020) contend 'When the school community understands the needs of early career teachers and how they are working with their mentors, they will be far more willing to collaborate and support these new teachers' (p. 11). Stronger collective responsibility is possible through diversifying roles as learners and embracing the uncertainties that go with that.

Conclusion

Understanding the need to grow a school's professional capital by enabling all stakeholders to share and develop collective knowledge and expertise is well-established (Lingard *et al.*, 2003, Hargreaves and Fullan, 2012). This requires an ecological understanding of schools, that places the emphasis on what it is possible to shape within the school as a system, rather than within individual teachers or by implementing specific policies. It means accepting continual re-solving of problems as a desirable professional state, rather than a fixation on finding solutions that cannot endure because of the continuous evolution of components that cannot be made static in a complex system. However, in many settings the 'collective learning resource that is constituted by all members of a school fcommunity appears to be underutilized' (Langdon *et al.*, 2019, p. 262); embracing complexity is far from the norm. The wicked problems that characterise complex systems are, inevitably, recurring, but therein lies the opportunity for increasing the focus on the relational environments that constitute schools and an expectation that all stakeholders can engage in the 'nuanced dance' that these relations demand. School ecologies are interacting with wider systems, in a constant state of shift that can stifle and constrict the possibility of reconfigured relations. However, numerous studies have demonstrated that such reconfigurations among leaders, new and experienced teachers and mentors can be achieved. To become normalised within school cultures, there needs to be wider acceptance by policy-makers, leaders and teachers that, for everyone, professional learning is predicated on an intricate web of interrelationships and dependencies. These are between members of school communities but also affected by wider ecologies (such as higher education, digital environments and pupils' future employment contexts) that constantly provoke adaptation and the re-tuning of practice by teachers. At systems-level, schools operate in relation to local and national policy environments that influence the activities among individuals, the resources that can be utilised and the scope of choices that can be made. To understand schools as sites of teacher learning therefore, perspectives drawn from complexity theory, ecological theory and theories of community can together provide a comprehensive account of the relational nature of schools. Complexity is unavoidable. Given the right conditions, it can induce continuous, revelatory, collaborative learning, within reconfigured relations that are essential to schools as learning entities.

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