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Vocational Education and Training Institutions' Collaboration with the World of Work from the Perspectives of Actor Networks and Ecosystems of Learning

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Abstract: Vocational and professional education institutions, as well as higher education institutions, are more and more expected to collaborate with the world of work and each other. At the same time, the boundaries of organisations have become somewhat blurred. Employers may be subcontractors for a larger firm or subdivisions of an enterprise (organisation) may serve their headquarters through digital connections on the other side of the globe. As a result, the forms and cultures of organisations that educational institutions are expected to collaborate with have become rather complex and difficult to figure out. In order to better understand the complexities of the collaborative practices that educational institutions are dealing with, this study explores, in particular, two approaches that theorise transformed organisations: actor–network theory (ANT) and discussions on ecosystems of learning (EL). The authors investigated what characteristics of the ‘collaborative contract’ in educational institutions’ collaborations with the world of work these two approaches are able to address. The analysis is based on a selected literature overview of research incorporating the ANT or EL concepts. Empiric examples are drawn from a study on two developmental collaborative networks of Finnish universities of applied sciences, eAMK and Toteemi.

Keywords: Collaboration, VET, work, organisation, ecosystem, actor–network

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1 Introduction

This study is part of research conducted by members of the Work, Education and Learning team at the Finnish Institute for Educational Research (FIER) for the two large Finnish developmental networks of UAS (universities of applied sciences) named eAMK and Toteemi. Both of these developmental projects are funded by the Finnish Ministry of Education and Culture's special funding programme for the development of higher education. Despite some similarities, these two developmental projects have somewhat different foci and combinations of partners. While the eAMK project focuses on developing the shared digital education provision of Finnish UAS, the Toteemi project's emphasis is on developing work-based learning and its accreditation for studies at UAS. In both of the projects, the UAS' collaboration with the world of work is central and the increased utilisation of digital solutions both enables and demands the reformation of existing practices.

The eAMK project's aim is that the developed digital provision of education will enable students to choose studies across institutional boundaries within the UAS network. Also, work-based learning and conducting studies while at work should become easier through flexible educational provision all year round. The new, wider and more flexible provision of studies should enable shorter study times, more flexible specialisation, further education, individualised education routes, and enhanced employability. The eAMK project is coordinated by the JAMK University of Applied Sciences and involves a consortium of 23 UAS, The Rectors' Conference of Finnish Universities of Applied Sciences (ARENE) and FIER (eAMK, 2018).

The Toteemi project's primary goal is to improve UAS students' employability and to enhance structures that promote collaborations between UAS and the world of work. Eventually, these activities will enhance students' learning and renew both working life and education. In particular, assessment and accreditation of prior learning are targeted via, for example, alumni networks. The accreditation of prior and present work-based learning continues the developmental work conducted in earlier networks of UAS with partly similar goals, such as that of the preceding project, Verkkovirtaan (Kotila, Mäki, Vanhanen-Nuutinen, Moisio, Pettersson, & Aura, 2016). The Toteemi project is coordinated by the Haaga-Helia University of Applied Sciences and involves 15 other UAS (Toteemi, 2018).

In general, the Finnish Ministry of Education and Culture's funding for these projects reflects the increasing policy interest in promoting better networks between higher education (HE) institutions and the world of work. HE institutions are seen as part of the innovation system and as serving the development of the well-being of citizens and economic growth in the nation state (Schienstock & Hämäläinen, 2001; Hautamäki & Kuusi, 2005; Hautamäki, 2006). UAS are expected to serve innovation system's need for sharing the latest knowledge, enabling its implementation and creating new innovations, and also to improve students' employability. The increased interest in HE graduates' employability is an outcome of the expansion of the HE system and reflects international trends in HE (Schomburg & Teichler, 2011). On the whole, there has been a shift toward a stronger emphasis on efficiency, output management and international reform initiatives in Nordic HE policies over the last few decades. This has involved the introduction of steering mechanisms and has increased the competitiveness of academics (Pinheiro et al., 2014; Berggren and Cliffordson, 2012). The shift in policies has, to some extent, replaced the earlier emphasis on social equality in educational policies (Telhaug et al., 2006; Ahonen, 2002).

While the societal interest in developing educational institutions' relations with the world of work has increased, there is also a demand to better understand what is going on in these relations. Accordingly, several approaches have been developed to deepen the understanding of particular aspects of these collaborative networks. For example, the model of integrative pedagogy (Tynjälä & Gijbels, 2012) has been developed to guide pedagogy toward combining theory and work-based learning, and to enhance learning within the collaborative constellations of educational institutions and enterprises. Second, the connective model (Guile & Griffiths, 2001) suggests how practices between educational institutions and the working world could be coordinated on the basis of particular underpinned theoretical starting points. Third, models of learning organisation portray how new knowledge and modes of action are ideally adopted in a learning organisation (e.g., Nonaka, Toyama, & Konno, 2000). Fourth, discussions on boundary crossing describe how the interaction and understanding of agents evolves by crossing the boundaries of organisations and through the recognition of shared 'boundary objects' (Akkerman & Bakker, 2011). Fifth, research based on cultural-historical activity theory (CHAT) has analysed how boundary objects are defined and molded in collaborative work as 'knots', where a collection of partners work together to reform or create a new service or product (Engeström, 2000; cf., Bishop et al., 2009).

In contrast to the studies mentioned above, our present study explored two research perspectives that have focused on the networks that actors create within and across the boundaries of organisations, namely the actor–network theory (ANT) and discussions regarding ecosystems of learning (EL). In the actor–network approach, the relations between education and the world of work are understood in terms of network-building between human and non-human actors. This approach has produced a respectable body of research literature and has established itself as a scientific approach. The discussion on the term 'learning ecosystem' is relatively new, and ecosystem has been used in many ways within different contexts. A consensus on the meaning of the term is lacking. Therefore, one of the purposes of our research presented here is to contribute clarification to this discussion. Our method for achieving a clearer understanding was twofold. Firstly, we scanned the literature by using some strategic keywords and reviewed some of the best known theories involving the ecosystem concept. Secondly, we asked the participants of the eAMK and Toteemi projects about their understandings regarding the origin and meaning of the concept of 'ecosystems of learning'. The results of this latter data collection, we report later. In the following section, we first briefly present the two approaches (ANT and EL) and thereafter discuss the findings from our overview of the literature.

2 Actor–network theory (ANT): From ANT to post-ANT, and their lessons for methodology and ontology

The actor–network theory (ANT) was first developed as a response to developments in the sociology of science in the 1970s and 80s (Muniesa, 2015). This theoretical approach emerged at the Centre de Sociologie de l'Innovation (CSI), which studied the social determinants of innovation processes. Its emergence was part of the general post-structuralist movement and a reaction to the French tradition of the epistemology of science and the British tradition of scientific knowledge. The ANT school of thought criticised the French tradition, which presumed scientific facts to be constructed. That

French tradition was seen to neglect the concrete operations that are needed for obtaining scientific facts; operations such as experimenting, measuring, calculating, writing and communicating. The British tradition's emphasis on social interests and collective representations as definers of scientific truths and falsehoods was also criticised from the ANT perspective, but from a different angle. From the ANT perspective, there was a need to study scientific controversies, empiric operations and the material conditions of scientific work. This standpoint of ANT was seen as a step back toward realism and positivism from the British tradition's perspective (Muniesa, 2015).

The central problems that have been addressed from the ANT perspective include agency, 'translation' and how collective realities are constructed (Muniesa, 2015). In the following section, the ANT's approach to these three phenomena are characterised briefly. First, the view on agency from the ANT perspective demands paying attention to the conjunction of all kinds of agencies and avoiding simplistic divisions such as human versus non-human, intentional versus unintentional, or nature versus culture. The classic example for this is Louis Pasteur's microbiology laboratory (Latour, 1988). Also, from the ANT perspective, agency's sovereignty and interest-oriented as well as socially conditioned actions were questioned. The duality between agents and their social dependencies was questioned, for example, in studies on drug addiction and by shifting attention from 'moving' to 'being moved'. Studies utilising the ANT approach have described societies', nations' and states' compilation with the notion of 'generalised agency' (Muniesa, 2015).

Second, 'translation' refers to how problem statements as such transform the relations between issues at stake and one another. This is what defines the actor-network complex as non-dualistic: it consists of actors who act as a network, spring from that network and form a network of actions (Muniesa, 2015).

Third, concerning the constitution of collective worlds, the ANT perspective has underlined the importance of empiric studies on semiotic processes that constitute the collective worlds and that are aimed at understanding how collective realities are formed and reformed through material semiotic processes. The ANT approach has insisted on taking into account how metrics, methods, techniques and devices used constitute the entities they refer to in particular ways. The examples Muniesa (2015) gives for this include population and enterprises.

Before the mid-1990s, ANT studies' conceptions of societies via the notion of 'generalised agency' was criticised, for example, for not providing apt tools for restricting the entities (actor-networks) that are studied, for presupposing a Machiavellist human actor while downplaying intentions in human actions, and for not being able to describe and analyse non-human actors and their role concerning certain activities in a satisfactory way (Miettinen, 1998). The ANT approach's neglect of the forces that underpin networks has been criticised for missing the meaning that human agency has for networks, while giving priority to 'actor-networks' in analyses. The ANT approach's focus on networks has thus, according to some critics, led to not recognising important forces which move agencies, such as: consciousness, directedness, concern, understanding, will, and decision making (Brown & Capdevila, 1999). The paradoxical ethos around the ANT approach is also prevalent in its relation to the study of culture: it has impacted studies on culture, but—from the ANT perspective—the notion of culture is neither explained nor explanatory or an object of study as such (Farías & Mützel, 2015).

However, the ANT approach has also yielded studies on culture, including on descriptive sociology more generally, and has made a methodological commitment to describe activities in detail and use descriptions as an analytical strategy. Such descriptions, as part of the analytic strategy, define how actors create contexts for their

own actions and how some events lead to other events. Using descriptions as part of the analytical strategy makes it possible for contexts and causal explanations to be questioned. From this particular ANT perspective, cultural products, such as art or fashion, cannot be explained as a result of the culture of a certain social class or nation but make it possible to describe and analyse how cultures of a certain social class or nation are constructed through such products, in practice (Entwistle & Slater, 2013; Farias & Mutzel, 2015).

More recently, the methodological approach originated from the ANT perspective, and it has been used to describe network-building between human and non-human actors, such as in a study on the project accountability of a renovation project analysed in stages including problematisation, interessement, enrolment and mobilisation (Burga & Rezania, 2017). These are stages described from this ANT perspective in the now classic study conducted by Callon (1984). Also, in the context of studying a brain-machine network, Ahn (2016) has suggested that it is important to consider what the dash is for in the term ‘actor–network relation’ and what ontological implications it has for defining an ‘actor network’ and what detectable influence the actor and network have on one another. On the basis of the study’s findings, Ahn (2016) claims that an ‘actor–network’ comes into being when separate entities exchange influence over one another for a long period of time while being jointly enrolled in one system (actor–network) of heterogenous but mutually sustaining elements (Ahn, 2016).

In contrast to the ANT approach and in relation to its criticism, it has been suggested from the perspective of the cultural-historical activity theory that the basic object to be analysed should be a local, compound, historical activity system that produces concrete objects (Miettinen, 1998) instead of being an unlimited actor–network. One such ‘activity system’ may include human beings and their subsystems (communities of practice), the organising of work, symbolic tools, objects of work, and the outcomes themselves. Activity systems may also coordinate and form other networks of activity systems (Miettinen, 1998).

In later studies based on the cultural-historical activity theory, collaborative (knowledge) work of contractors who solve problems through various stages in their activity system has been called ‘knotworking’. These ‘knots’ were understood as temporary clusters of disparate partners, who would come together to focus on a common objective. The common objects that they would create together could be products or services depending on the field of production (e.g., Engeström, 2000). This conceptualisation of knotworking has been criticised for its failure to recognise both the history of individuals as goal-setting, biographic individuals and the history of systems as contexts in which the knotworking takes place (Bishop et al., 2009).

3 From ecologies of practice toward ecosystems of learning

The conceptual models and frameworks describing ‘ecosystems’, such as ecosystems of learning and ecologies of learning, are of particular interest from the Finnish perspective. While it was first used in research to portray the new collaborative arrangements across educational institutions’ and work organisations’ boundaries (Neuvonen-Rauhala, 2011; Tynjälä, 2013; Niemi, 2016), the conceptual term ‘ecosystem’ has become a kind of fashionable word used by Finnish ministries during the last few years. The term has appeared in several policy papers and plans for the future across several ministries (see, e.g., Oksanen & Hautamäki, 2015). Recently, it has been used, for example, in a speech by

the Finnish Minister of Education and Culture (Ms. Sanni Grahn-Laasonen) announcing the recipients of major funding for research from the Academy of Finland. She stated that “high-quality research and development environments and competence ecosystems support research and learning as well as business and society, and tempt experts in Finland to serve both enterprises: HE institutions and research institutes” (Opetus- ja kulttuuriministeriö, 2018). Due to the policy whirl around the concept, there is, from a research perspective, an increased demand to understand where the concept comes from and what characteristics of its phenomenon related to encounters between education and work it helps to explain. Its usage refers to activity across traditional organisational and institutional boundaries, but from a research perspective it is also important to investigate specifically what characteristics it enables to be referred to and understood in regard to the organisation and reorganisation of tasks shared between institutional players in the worlds of education and work. However, a complete understanding of the term is lacking, and there do not appear to exist any unambiguous definitions of the concept. Due to the lack of a common understanding regarding this key concept, one party might imagine the term ‘ecosystem’ to mean something completely different from what another party uses the term to represent.

One of the best-known applications of the concept of ‘ecosystems of learning’ is the one introduced by Urie Bronfenbrenner. He formulated the Ecological Systems Theory to explain how a child grows and develops through interacting with his or her environment. In his theory, Bronfenbrenner stressed the importance of multiple environments, also known as ecological systems, in the attempt to understand the human development. A child is simultaneously enmeshed in different ecosystems. The whole system is formed through nested systems, ranging from the most intimate systems, which Bronfenbrenner called ‘microsystems’ (such as family, the nearest nurses of the daycare, et cetera), and moving outward to larger systems that he referred to as ‘mesosystems’ (kindergarten, school, et cetera) and ‘exosystems’ (school district, et cetera), and further out to the most expansive system he called ‘macrosystems’ (society and culture). Later on, he added the concept of ‘cronosystems’, which refers to the transitions and shifts during one’s life span, also involving the socio-historical contexts that influence the formation of a person. Each of these nested systems interacts with and influences the others in every aspect of the child’s life (Bronfenbrenner, 1979; Härkönen, 2008).

Although Bronfenbrenner’s Ecological Systems Theory is widely known among education scientists, in the contemporary discussion about ecosystems of learning, in Finland, there does not appear to be any mention of that theory. Instead, the most common interpretation is that the ‘ecosystem’ concept has been adopted in contemporary discussions in the field of education via research on economics and business. In economics, the concept of ecosystems has been used widely in regard to business-to-business networks. In research on business, there have been discussions about the similarities between biological evolution and economic development for more than a century (Hodgson, 1998). One of the milestones of this debate is considered to be James F. Moore’s article written over two decades ago, *Predators and Prey* (1993), where he introduced the concept of ‘business ecosystems’.

In his article, Moore (1993) suggests that companies should not be viewed as members of a single industry but rather as part of a business ecosystem that reaches across a variety of industries. In a business ecosystem, companies act like species in nature: sometimes they cooperate out of mutual interest, while at other times they may be in fierce competition with each other. The business ecosystem can be understood as a realm of continuous competition and struggle for success as well as survival, as in nature’s evolution. In order to succeed in this struggle, companies develop new products, satisfy

customer needs, and, as another developmental step in their evolutionary process, eventually incorporate the next generation of innovations. As in nature, some species rise to the top of the pyramid. Moore uses the American company Apple Inc. (current name) as an example of a leader of an ecosystem, in this case crossing at least four major industries—personal computers, consumer electronics, information, and communications—and thus provides products and services to a large number of customers in various market segments (Moore 1993, 75–76).

When applied to education, the educational institutions, networks and actors are understood as a parallel system to the business ecosystem, or sometimes as a subsystem of it. These systems interact and communicate in many ways and there are different kinds of ‘energy flows’ between these systems. In economical terms, we would understand education as an economic investment, which, in turn, provides added value by producing a capable workforce for the ecosystem of production and economy, as well as adopting and spreading the latest scientific knowledge and methods. This way, there is an interchange of resources between these ecosystems, which are actually interdependent on one another if not in symbiosis. Ecosystems of education can also be studied within a framework of ‘ecologies of practice’ (Kemmis & Heikkinen, 2012).

This approach of ecologies of practice describes ecological relationships that social practices form with one another by applying ecological principles, introduced by Fritjof Capra (2004, 2005; see also Kemmis, Wilkinson, Edwards-Groves, & Hardy, 2009; Kemmis, Edwards-Groves, Wilkinson, & Hardy, 2012). Capra has listed eight principles of ecology considered applicable for understanding the relations of social activities, namely: networks, nested systems, interdependence, diversity, cycles, flows, development, and dynamic balance. Kemmis and Heikkinen (2012) have added a further principle to these, which may organise social activities. This ninth principle is that of ecological niches. The characterisations of these organisational principles are presented in Table 1, as follows.

The nine characterisations of the relations of social activities can be understood as idealisations (theorisation) of how social activities may be organised with respect to one another. These characterisations have been used in our data collection (as one substudy) for the eAMK project (e.g., in Tampere, 22 January 2018), where teachers were given the task to discuss what kinds of characteristics of social activity they find important or relevant when organising intraorganisational and interorganisational cooperation between UAS and the world of work, regionally. The characterisations enabled teachers to capture those features of the collaborative relationships which they were concerned about. Since the framework is quite complicated, it was, however, difficult to get their discussion organised and focused, also due to the time limit given for the teachers to discuss these characteristics of ecosystems. Teachers’ discussions revealed the complexities, multi-layeredness, and interconnectedness of social activity systems where teachers are embedded.

Table 1. Ecological Principles (adopted from Kemmis & Heikkinen 2012, 164–165)

Ecological principles	If practices are living things and ecologies of practice are living systems, then...
Networks	Practices derive their essential properties and their existence from their relationships with other practices.
Nested systems	Different levels and networks of practice are nested within one another.
Niches	In ecology, a niche is the relational position or function of an organism in an ecosystem of plants and animals. The ecological niche describes how an organism or population responds to the distribution of resources and competitors and how it in turn alters those same factors. Likewise, there are ‘niches for practices’ within other practices.
Interdependence	Practices are dependent on one another in an ecology of practices as are multiple ecologies of practice.
Diversity	An ecology of practices includes many different practices with overlapping ecological functions that can partially replace one another.
Cycles	Some (particular) kinds of matter (or in education – practice architectures, activities, orders or arrangements) cycle through practices or ecologies of practice – for example, as in a food chain.
Flows	Energy flows through an ecology of practice and the practices within it, being transformed from one kind of energy to another (in the way that solar energy is converted into chemical energy by photosynthesis) and eventually being dissipated.
Development	Practices and ecologies of practice develop through stages.
Dynamic balance	An ecology of practices regulates itself through processes of self-organisation, and (up to the breaking point) maintains its continuity in relation to internal and outside pressures.

4 Methods: Literature overview of ANT and EL

An initial literature search with the help of the University of Jyväskylä library’s search engine was conducted (20 April 2018) regarding international e-materials published in relation to the terms ‘actor–network theory’ and ‘ecosystems of learning’. It revealed some major differences between the two approaches (see Appendices, Tables 1 and 2). While the extent of the publications published in relation to each of these terms is overwhelming, the disciplines where these concepts have emerged differ substantially, as described earlier. Even though any one single university’s access to e-materials is limited, having a look at these literature searches helps to get a picture of the general profile of the publications related to these themes.

The origins of the discussion on ANT lie in the field of social sciences. The majority of articles published in relation to the ‘actor–network theory’ are related to disciplines such as social sciences, sociology, education, economics, business, sociology, and history (>5,000 publications). In contrast, ‘ecosystems’ have been studied firstly and mostly in relation to ecology, biology, general agriculture, environmental sciences, and climate change (>70,000 publications). These findings show how the usage of the ‘ecosystem’ concept as a metaphor has moved from these fields to other fields of study like education

and business (see also Niemi, 2016). In Finland, the term ‘ecosystem’ has spread across ministries in particular since the former idea of ‘innovation systems’, where HE institutions were seen to be vital, has become redefined as ‘innovation ecosystems’ (Schienstock & Hämäläinen, 2001; Oksanen & Hautamäki, 2015).

At the same time, the amount of studies conducted using these approaches with respect to ‘education and learning’ or ‘education, learning and teaching’ is far more limited. In relation to the ‘actor–network theory’, the search engine found less than 2,000 articles in combination with ‘education and learning’, and less than 350 articles with respect to ‘education, learning and teaching’. The findings related to ‘ecosystems’ were more frequent when ‘education and learning’ were considered (around 1,900), but quite rare when ‘teaching’ was added as a term (<40). When the terms ‘work’ or ‘working life’ were added to the subjects in the search, the number of studies became even more limited. Combining the terms ‘ecosystems’ with ‘education’ or ‘learning’ and ‘work’ resulted in 10 and 5 articles respectively, and combining them with the term ‘actor–network theory’ resulted in 5 and 7 articles respectively. As researchers know, the search engines and their algorithms do not necessarily work ideally from the perspective of specific research projects, due to certain algorithmic biases. This seems to also have been the case this time. Not all of the articles found were relevant to this study’s interests. Consequently, the initial searches were reconsidered for the needs of the overview conducted for this paper (e.g., restricting the search to ‘work’ being mentioned in the abstracts instead of as subjects). This resulted in a few more studies coming up that had used cultural-historical activity theory (Engeström 2000) or were related to teacher education or elementary education. Still, the search provided only a limited number of results and we selected the most relevant examples as presented in the following tables (see Tables 2 and 3).

In the following section, we present an initial literature search of studies that utilised the ANT and EL approaches. It is a useful way to get a better view of and explore what characteristics of ‘collaborative contracts’ in educational institutions’ more or less digitalised collaborations with the world of work and one another the two approaches enable or might enable to address. The limitations and bias resulting from access to published studies via the University of Jyväskylä’s library and its search engine algorithms (yielding mostly results related to disciplinary fields not relevant to the needs of educational research) should be taken into account in related future studies. The following overview has to be considered as being quite basic, rather as a preliminary starting point for further and more detailed studies than a complete list.

5 Results and preliminary analysis

The selected overview of research that was found to be relevant to our study from the perspectives of ANT and EL on networks organised for collaboration between UAS and with the working world to promote all-year-round education provision with the help of digitalisation and the accreditation of work-related and work-based learning is presented in Tables 2 and 3 below. The results show that while there is quite a lot of research related to ANT and ecosystems as such (see Appendices, Tables 1 and 2), the educational institutions’ networking and collaboration with the world of work appears to still be an under-studied and under-theorised area. This is our experience also from earlier studies. A limitation of our study is that it utilised the narrow scope of two specific approaches, ANT and EL. Research on education–work collaborations from other perspectives is more numerous but not overwhelming, which is why we think that the multi-level nature of the

collaborative arrangements between educational institutions and the world of work deserves more attention.

The comparison of the themes of research articles conducted from the two perspectives suggests two major outcomes with respect to what could be learned for future research trying to capture the key phenomena of teaching and learning in a networked context across boundaries of institutions. Studies conducted from the ANT perspective rely on a more unified school of epistemological and ontological thought (see Table 2) than do those related to EL. Also, they place emphasis on trials to see how actors, while acting in their networks, construct and create the context for their actions in a processual but not necessarily linear manner. The non-human actors are considered parts of the ‘network’ and have an influence on human actors and their network-building as well as their actions’ outcomes when they exchange influence over a long period and eventually become enrolled as a system.

Table 2. Studies addressing actor networks or practice theory and the formation of ‘collaborative networks’ between educational institutions and work

Author:	Focus of the study and what is explored:
Mlitwa (2007)	The paper explores a possible “framework for the analysis of objective (goal)-directed <i>applications of technology in a teaching and learning environment</i> and implications thereof”.
Bagarukayo et al. (2016)	“1) How Facebook affords students to transfer knowledge acquired in the lecture room to the workroom, and 2) the usefulness of Activity Theory (AT) as a lens to analyse how students interact on Facebook to develop knowledge application skills.”
Reich & Hager (2014)	The article aims “to problematise and clarify the concept of practice to reconceptualise professional learning”.
Broad (2013)	“How vocational teachers in English Further Education (FE) colleges maintain and develop their subject and occupational expertise.”
Fenwick & Edwards (2014)	“How approaches to knowledge in HE might benefit from network sensibility to gain a better understanding of how social dynamics bring forth actions, subjectivities and ideas.”
Wilkinson & Kemmis (2015) ¹	This “study examines how practices of leading relate to other educational practices.”
Wilkinson et al. (2010) ¹	Investigated “educational leadership as a site of practice, utilising the notion of ‘practice architectures’”.

Note. ¹ These studies relate to the ‘ecologies of practice’ approach and came up whilst searching for ANT studies – this search result being another peculiar example of this particular search engine’s algorithmic logic

In the research where the notion of ‘ecosystems’ is used, the concept of the ecosystem is rather a descriptive marker of the cultural change, where the place of learning is not merely the school anymore but the whole question of organising learning environments has to deal with the notion of ‘anyplace learning’ (see Table 3). Anyplace learning refers here to how technological applications, such as smartphones and 4G mobile networks, allow information devices to be used in any place, including at school, home or work and even while travelling. Technological devices, such as digital platforms, reform the organisation of work and also create new forms of business, such as the ‘platform economy’. It, the ‘ecosystem’ concept, has become the common denominator of studies that explore the more or less digitalised combining of learning environments. Internationally, studies referring to ‘ecosystems’ have tried to understand how teaching and learning practices are reformed in collaborative networks utilising digital tools and/or deriving experience from work-based learning. The theoretical approaches used in relation to ‘ecosystems’ do not form a unified school of thought, at least not yet. But the quest for understanding the complexities of the networked organisation of learning environments is common among the studies.

Table 3. Examples of studies referring to ‘ecosystems’ in the context of ‘collaborative networks’ between educational institutions and work

Author:	Themes or problems investigated in the study:
Walsh & Powell (2018)	This study examined “how students, full-time and part-time, may be supported in developing their ‘intrapreneurial’ skills and capabilities, as well as being introduced to more typical ‘entrepreneurial’ activities”.
Purg (2011)	This study investigated whether assessment methods, such as open wiki (online text and media collaboration), and closed multiple-choice tests can assure addressing the learner both as an information processor and a social entity, when combined.
Cerezo et al. (2016)	This study examined students’ interactions with Learning Management Systems (LMS), asking: “Can students adapt to the demands of the current learning environments? Does their ability to adapt have any effect on their achievement? Going further, can we adapt those online environments to the students’ characteristics?”
Folkstead, Smith, & Moritz (2009)	Aimed “to understand the phenomenon of the multimedia fishbowl” (see p. 62).
Ladyshevsky (2016)	Explored the <i>virtual university professor</i> role and experience of an actual professor of a university’s business faculty working remotely, in a foreign country.
Gibson & Tavlaridis (2018)	Investigated students’ perceptions of individualised and social perspectives of work-based learning.

6 Discussion and conclusions

The major benefit of this overview of ANT and EL research is a deeper understanding of the complexities of the relationship between educational institutions and workplaces in post-modern times of digitalised ‘anyplace learning’. A lack of knowledge in this regard—due to the limited number of studies conducted with respect to the combining of education, work and digitalisation as well as their multi-level, networked organisation from the perspective of ANT and EL—is prevalent, even though these concepts have been used to a greater to study other subjects.

Our conclusion with respect to studies conducted utilising the ANT approach is that this approach could be used to inform methodological strategies for studying collaborative networks between UAS and the working world by showing how collaboration is formed via various stages (e.g., problematisation, intersement, enrolment and mobilisation), such as by creating descriptions of how the collaboration evolves and asking participants to comment on them in order to see how the actors co-create the contexts for (students’, work-life representatives’ and their own) learning by adopting (digital) tools to help in the collaboration (see, e.g., Burga & Rezania, 2017). Yet, the stages suggested by the ANT approach are best also compared with the dialogical learning mechanisms suggested by Akkerman and Bakker (2011, 151) in their overview of mechanisms and processes characteristic of boundary crossing. This could be helpful because the boundaries of system-level and person-level networking should be made more clear. The need to be more specific in the study of networks in order to understand them and their actors better has been recognised from the perspective of the cultural-historical activity theory and even its critics (Engeström, 2000; Bishop et al., 2009).

When it comes to ‘ecosystems of learning’, it is particularly important to apply the concept critically and carefully in order to try to avoid that it is merely used as a fashionable all-purpose key, so to speak, suggesting that all digitalisation is good for learning. While the ‘ecosystem’ concept has become a marker for stepping through the chronological gate to a new age of ‘anyplace learning’, it should not be understood as a suggestion for downplaying the importance of traditional school-related activities (such as curriculum planning and the communities of action that partake in it for the purpose of choosing reliable, evidence-based knowledge and pedagogical methods for curricula). Rather, it should be taken as a suggestion for a thorough investigation of what is compounded in teaching and learning when digital tools and platforms are used across the boundaries of school and work.

In the following table (Table 4), we suggest another framework worth giving attention for the analysis of learning environments in which collaborative relationships of educational institutions and workplaces are embedded that utilise new technological media such as smartphones, distant learning tools, videos, and webinars. It is based on the framework presented by Akaka and Vargo (2015) to enable multi-level analyses of service contexts. Their framework moves the analysis of service encounters from that of seeing and understanding them as isolated encounters to that of viewing them as being nested in ‘ecosystems’. Our framework is an analogical translation and adjustment of their framework made for the context of services, adapting it to our context of learning environments. Two of their table’s columns have been adopted almost verbatim: the first one on the left and the last one on the right. However, our adaptations to these columns are that: in the first column on the right, ‘service’ is replaced with ‘learning’, and to the last column on the right we have added “the application of knowledge and skills for the benefit of oneself and others” as a conceptualisation of learning. The columns Learning encounter

and Learning space have been translated to fit our purposes and adjusted to contextualise learning.

We find this explanation by analogy particularly apt, because education is at times understood as a ‘service’ in present society. Also, in Finland, every now and then, it has been interpreted by the administration and parents that educational institutions provide ‘educational services’. From a research point of view, this has been found to be problematic since education is not easily defined and is restricted as being like a deliverable package, formed rather through the interaction of experienced experts and the learners they supervise (see also Koris & Nokelainen, 2015). Furthermore, it is not merely a relationship between one expert teacher and a learner (‘customer’) but rather embedded in wider networks of expertise also involving the student's peers and requiring mutual confidence in order to certify learning that is valid for a wider audience, and it enables mutual recognition and the building of trust in society. Furthermore, it is a problematic consideration to think the ‘client’ of education could be or is only one person (‘learner’) at a time; in reality, the education ‘clientele’ includes the wider society, employers and teachers in further education institutions via, for example, the security and guarantees they gain through assessment, certificates, cohesion and safety in society. However, these educational institutional settings are constantly renegotiated in society and are objects for policy discussions.

Table 4. The extended context of learning in the collaborative ecosystems of education and work (cf., Akaka & Vargo, 2015, 458; adjusted from their ‘extended context of service’ to our ‘extended context of learning’)

Components of context	Learning encounter	Learning space	Learning ecosystems
Conceptualisation of learning	Educational offerings that involve direct interaction between learner and expert (teacher, mentor, workplace supervisor)	Self-directed learning, expert-led and supervised learning, distant learning	Application of knowledge and skills for the benefit of oneself and others
Focal relationship(s)	Expert/Teacher–Learner dyad, Peer-Group–Learner relations	Context–Learner (educational context: school, workplace, virtual, combinatory); Learner–Learner	Networks of multiple actors
Parameters of learning	Peripheral and core educational interaction	Constructed physical space	Socio-historic structures; intersecting and overlapping institutions
Learning experience	Offerings for learning (knowledge, skills, methods), relationship, mutual recognition, assessment, opportunities for reflection	Expansive horizontal and vertical learning, social connection	Phenomenological value determination

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Appendices

Table 1. Publications on the topic of actor–network theory (University of Jyväskylä Library, international e-materials)

	Actor–network theory (in any of all fields, i.e. title, author, subject, abstract)	Actor–network theory (all fields) AND subject: education, AND subject: learning	Actor–network theory (all fields) AND subject: education, AND subject: learning, AND subject: teaching
Format			
E-article	72,400	490	115
Dissertation	63,825	1,228	178
Book	18,442	123	28
Conference proceeding	4,710	37	5
Review	4,594	1	1
Subjects			
Social sciences	43,361	324	
Sociology	15,696		
Education	14,625	1,658	280
Economics	11,144		
Business	7,758		
Sociology and Social history engineering	5,479		
Anthropology	3,854		
Learning	3,737	527	
Higher education		362	138
Educational		292	
Technology		275	
Adult education			
Teaching			220
Curricula			108
Higher education			62
Teaching methods			53

Table 2. Publications on the topic of ecosystems of learning (University of Jyväskylä Library, international e-materials)

	Ecosystems (in any of all fields, i.e. title, author, subject, abstract)	Ecosystems (in any of all fields) AND subject: education, AND subject: learning	Ecosystems (subject), AND subject: education, AND subject: learning, AND subject: teaching
Format			
E-article	819,470	948	29
Dissertation	91,286	713	
Book	44,043	92	
Conference proceeding	50,460	141	5
Review article	23,012	11	
Subjects			
Ecosystems	241,777		61
Ecology	170,989		
Biology	108,130		
General	87,765		
Agriculture	78,212		
Environmental Sciences	73,956		
Climate change	70,516		
Ecosystem and Ecology studies	69,010		
Education		1,528	42
Learning		952	49
Science education		520	31
Students		421	
Environmental education		412	
Ecosystems		375	
Teaching		281	50
Educational Technology		272	14
*AND subject:			
Teaching methods			*6