9

UNIVERSITY AND WORK

CURRICULUM INQUIRY FROM AN ACTIVITY THEORY PERSPECTIVE

James Garraway

INTRODUCTION

Activity theory is fundamentally a theory of transforming and improving practice, whether in work organisation or in education (Roth 2004:7). Activity theory, particularly that based on Vygotsky's concept of mediated learning, has had an enormous influence on teaching and learning in general.

In activity theory terms, all human endeavour is goal-oriented; however, such endeavours are always beset with contradictions and difficulties, which often reside in complex systems of economic and power relations (Kaptelin & Miettinen 2005:2). The strength of the theory lies in recognising that contradictions are not givens but have historical and cultural roots and as such can be worked with, often providing the engine for change in organisations (Engestrom 1987). Activity theory approaches to analysing work and the curriculum are therefore particularly appropriate, as there is an intersection of two different sets of social practices.

The acquisition of knowledge at university, because of its more conceptual and general nature, can be of the form of learning central propositional knowledge – often in codified form. This may then be used to accrete or make coherent elements of knowledge drawn from the academic discipline or environment. On the other hand, much learning in practice involves learning about what works in a particular situation, which may not lend itself to codification. In addition, much learning is cultural and situated, occurring through participation in communities of practice (Eraut 2004, 2010). These differences between university and work knowledge and practice are likely to create tensions and contradictions in, for example, the design of career-focused curricula.

In terms of curriculum, activity theory has been used extensively in the literature to analyse the effects of information communications technology (ICT) interventions in the classroom (see, for example, Murphy & Rodriguez-Manzanares 2008 for an international perspective and Woods & Marsh 2007 and Hardman 2005 for a South

PART TWO • CHALLENGES IN RECONCEPTUALISING UNDERGRADUATE AND POSTGRADUATE EDUCATION

African perspective). Though research has been conducted on the use of activity theory to analyse the relationship between university and work in the curriculum (see, for example, Konkola, Tuomi-Gröhn, Lambert & Ludvigsen 2007; Pare & Le Maistre 2006; Virkunen, Makinen & Lintula 2010), its use is not extensive and it remains a somewhat novel approach to curriculum and work here and abroad.

Activity theory approaches to learning can be divided into three phases, beginning with Vygotsky and mediated learning as a largely individual process. This first phase is known as ‘first-generation activity theory’ (Engestrom 2001). The second phase, ‘second-generation activity theory’, expands Vygotsky’s concept of mediated learning to include the social relations and structures within which learning occurs into what is known as an activity system (Engestrom 1999). In the third phase, ‘third-generation activity theory’, the unit of study involves more than one activity system and the interactions between them (Engestrom 2001).

First-generation activity theory is related to the well-known curriculum design concept of constructive alignment (Biggs 2003) and explores how this concept itself can be related to work and the curriculum. Drawing on second-generation activity theory, suggestions are made in this chapter on how the system may be used as an analytic and developmental framework for work-integrated curriculum design. The last section reports on empirical research on curriculum and internships conducted from a third-generation activity theory perspective.

FIRST-GENERATION ACTIVITY THEORY IN WORK AND THE CURRICULUM

Vygotsky’s theory of learning describes learning as a movement from an initial less systematic, more localised understanding of a topic to one that is more systematic and abstract (Hedegaard 1998:119). In Vygotsky’s terminology, the student gains a more scientific understanding of the world, and this is the importance and focus of school learning. Furthermore, learning is not just an isolated individual act, but is mediated through cultural tools that could be symbolic (like language) and material (books and classrooms) and in general involves the actions of a more knowledgeable other (Hardman 2008:2). The difference between what students already know and can do unaided and what they can potentially know and do through tutelage and the use of mediating objects is known as the zone of proximal development (ZPD) (Hedegaard 1998:119).

The theory of learning can be represented by a triangle (see Figure 9.1) with mediating tools at the apex of the triangle and the ZPD lying between the subject/student and the object, the more scientific knowing to be worked on/understood.

FIGURE 9.1 Vygotsky's theory of learning (first-generation activity theory)

The implications of this theory of learning are that tools will be used differently in different circumstances, and that the way students work on the object will itself result in somewhat different knowledge constructs and outcomes. The Vygotskian framework provided the basis for what later was referred to as 'situated learning' (Pare & Le Maistre 2006) and 'social constructivist theories of learning', in which students actively construct meaning within a teacher-mediated framework towards more complex ways of knowing (Moll 2002:17). The currently widely used curriculum theory in higher education of constructive alignment is derived from social constructivist theories of learning (Biggs 2003).

Constructive alignment in curriculum was developed by Biggs as an antidote to emerging outcomes-based approaches to curriculum in Britain in the early 1980s (Biggs 2003). In these approaches, the important issue was that teaching, assessment and outcomes in the curriculum should be aligned such that it was very clear what students were supposed to know and how they were supposed to know it. For Biggs, the problem with this model was two-fold. Firstly, the type of outcomes being aimed for mattered, in particular in higher education. These, he reasoned, would need to be conceptual and systematically structured understandings of topics, as described in his well-known structure of observed learning outcomes. Secondly, reaching these outcomes would involve students in deep engagement with the topic and thus the construction of meaning. The role of the lecturer/tutor was then to move students from a relatively unstructured initial understanding towards a more conceptual understanding within a ZPD. Neither of these issues was overtly factored into an outcomes-based approach (Biggs 2003; Moll 2011). The similarities of Biggs' theorisations with Vygotsky's learning theory, in terms of scientific understanding and meditation through a more knowledgeable other, can be clearly seen.

Biggs was not just concerned with students knowing concepts, but also with their ability to use knowledge, which may also involve integration across different subjects (Biggs 2003). In addition, Biggs refers to problem-based learning (PBL) as an ideal illustration of a constructively aligned curriculum in that it involves deep understanding and application of knowledge to context through mediated learning. PBL can itself be a form of integrating work-like practices with the more theoretical curriculum (Charlin & Mann 1998). Though constructive alignment is focused on the in-house

PART TWO • CHALLENGES IN RECONCEPTUALISING UNDERGRADUATE AND POSTGRADUATE EDUCATION

university curriculum, it has also been suggested as a useful tool in the design of work-based learning curricula in internships, in which the issue of functioning knowledge is paramount (Walsh 2007).

Constructive alignment is still a dominant framework for curriculum design in higher education today, but has attracted some criticism. The first criticism concerns Biggs's (2003) focus on outcomes and his rather unfortunate statement that students will be trapped in a beneficial and challenging triad of teaching, assessment and outcomes. For some critics (for example, Jervis & Jervis 2005) this points to a strongly behaviourist pedagogic orientation that is at odds with constructivist ways of thinking in which students essentially make their own meaning, albeit within some form of set parameters. A second criticism more closely related to developments in activity theory is that constructive alignment is too limited in its focus on learning within a university course and does not take into account broader societal issues that may impact on the curriculum (see, for example, Boud 2007).

SECOND-GENERATION ACTIVITY THEORY IN WORK AND THE CURRICULUM

The simple triangle illustrating Vygotsky's theory of learning can be described as the first generation of activity theory, as it forms the basis for later developments (Engestrom 2001). The first development from Vygotsky's initial theory of culturally mediated, goal-oriented actions was to encompass different levels of complexity of action, broadly defined as individual and group goal-directed actions and larger-scale, more collective object-directed activities (Engestrom 2001:134). The difference between action and activity is that in the latter there is a division of labour with different groupings performing actions that together contribute to the overall activity (Engestrom 2008:203). The metaphor of the tribal hunt was used by Leontiev (1974) to illustrate the division of labour in activity versus action. The hunt is usually divided into two actions; those who beat the bush to chase the game away in a particular direction and those who wait to kill the fleeing animals. There is thus a division of labour that, when combined, constitutes the whole activity of hunting.

Further developments towards the development of second-generation activity theory involved an even greater integration of individual actions within a larger, more collective framework. In second-generation activity theory the focus is on the whole activity system or organisation. The individual subject still acts on the object and potentially changes it through the use of tools, but context is now writ large. Context in the form of a broader community with its rules and rituals and division of labour also serves to mediate and thus affect how the subject works on the object (Engestrom 1999). This second generation of activity theory (Engestrom 2001) can be conceptualised as shown in the expanded triangle in Figure 9.2.

FIGURE 9.2 Activity system triangle (second-generation activity theory, based on Engeström 1987)

The activity system as a whole is the object-oriented, collective and mediated activity. Though it may appear to be a static system, it is dynamic in that all elements of the system can interact with one another (Roth 2004), as is indicated by the lines between the elements of the system, but certain interactions may be prioritised. The object refers to what is of interest, what is being worked on or what provides the focal point for the whole activity system. The object is a particularly tricky concept to work with, firstly because it does not refer to object as in 'objective', but to the material object or 'problem space' that occupies the attention of the subject and community. Secondly, the object may be difficult to pin down; for example, what exactly do we mean by 'health care' in medical facilities (Engeström 2008) or indeed 'curriculum'? The objects themselves may require definition and different actors may define them differently.

In being worked on by the subject in interaction with other elements of the system, the object may be transformed into an outcome. The subject denotes who is primarily responsible for carrying out the activity and from whose perspective the system and the object of the system are being analysed (Murphy & Rodriguez-Manzanares 2008:44; Roth 2004:2).

The community refers to actors other than those in the subject who have an interest in working on the object to produce some form of desirable outcome (Mwanza & Engeström 2003). The community typically interacts with and has influence (constraining or supporting) over the subject through rules. These can encompass overt and codified rules concerning knowledge and behaviours within a system or organisation, as well as more tacit habitual practices. Rules mediate the interaction of the community with the subject(s). The division of labour, who does what in the system/organisation and what

PART TWO • CHALLENGES IN RECONCEPTUALISING UNDERGRADUATE AND POSTGRADUATE EDUCATION

particular influences they exert on one another, typically mediate between the community and the object (Engestrom 1999:31; Murphy & Rodriguez-Manzanares 2008:443).

Activity theory, as an approach to researching complex systems, can be used at different levels of analysis. The first level is one of analysing the system as a whole and thus gaining a sense of the nature of the different elements that make up the system. So, for example, one could do a detailed analysis of the rules operating within a system. On its own, this is a useful analytical exercise to carry out in any system. Other levels of analysis are concerned with where the contradictions in the activity system are sought and examined. Primary-level contradictions refer to contradictions within one element of the six elements of the activity system. Secondary-level contradictions occur between different elements of the activity system, for example between tools and division of labour. Tertiary- and quaternary-level contradictions refer to contradictions between the objects of current and more advanced or improved systems and between all the elements of two such systems (Engestrom 1987:34; Roth 2004:6).

ANALYSING VOCATIONAL CURRICULA USING SECOND-GENERATION ACTIVITY THEORY

At my university, lecturers are currently investigating the use of activity theory to better understand factors that impact on the design and implementation of the work-oriented or career-focused curriculum. We have started using the basic Engestrom-inspired second-generation activity theory and associated system. At present, the theory is being used as an analytical tool to describe the content of all the components and is still in its early stages of development. More empirical data need to be gathered using, for example, the questionnaire/checklist in Table 9.1 with a group of teaching and research staff. Even with the early manifestation of the system shown below, some primary and secondary contradictions are evident, and are briefly discussed in the following section on 'contradictions'. These and other contradictions have to be further explored once more empirical data have been gathered.

It must thus be pointed out that the contents of some elements of the activity system described here are peculiar to the career-focused curriculum project, and may not be found in Engestrom's original activity theory description.

Object: The career-focused curriculum is the problem space we are working with. This can be seen as consisting of subject knowledge integrated with elements of work knowledge, the various teaching and assessment methods related to these types of knowledge, as well as the outcomes we are attempting to achieve. In a typology of the career-focused curriculum, Engel-Hills, Garraway, Jacobs, Volbrecht and Winberg (2009) described different levels of curriculum, including courses and practical work oriented to career needs, problem- and project-based methods, and teaching and learning occurring during work placements. However, just what object we are dealing may differ in different universities.

Subjects: These include those lecturers tasked with the design and implementation of the curriculum. The experiences, skills and dispositions of the lecturers and their understanding of what is entailed in career-focused education are important factors here.

Tools or mediating artefacts: The tools lecturers could use to work on and develop the curriculum include more symbolic aspects such as theories of work and university integration, for example theories of transfer from university to work (Tuomi-Gröhn, Engestrom & Young 2003) or theories of different knowledge types in workplaces and in university courses (Bernstein 2000) and how the two may be integrated or recontextualised (Barnett 2006). More material aspects could include knowledge bases of courses and curriculum-mapping tools, as well as more general issues such as the availability of classroom and laboratory space.

Outcome: The outcome refers to the transformation of the object (courses and work knowledge and practices) through the actions of the subjects, using tools and the influences of the whole community. There would usually be a desirable outcome, for example a graduate with scientific knowledge related to work or one who is able to do work (Konkola *et al* 2007).

Community: The community of actors who also have an interest in developing the object of the career-focused curriculum include internal partners such as quality and planning practitioners, senior management and students, who are the eventual recipients of the curriculum. Included here would be academic developers, though these actors could also be seen as mediating artefacts in relating the subjects to the object. External partners with a common interest in the object include work advisory committees and individual work training professionals (for example work supervisors and clinical educators), professional bodies and national bodies such as the Council on Higher Education and the Department of Higher Education and Training.

The relationship of the community to the rest of the activity system is realised or mediated via rules and division of labour. In organisations, rules traditionally refer to overt rules and regulations and more tacit cultural norms, while division of labour refer to an often overt distribution as to who does what in a workplace, and what the power relations are between these different functions. Daniels (2005) draws on Bernstein's (2000) distinction between a structural and interactional focus in the curriculum. In general, the structural focus refers to the strength of boundaries and hence clear delineation, specialisation and 'classification' of one type of knowledge from another (Daniels 2005). The interactional focus, on the other hand, centres on the relative positions of control over the sequencing of the curriculum and who can say what in the pedagogical relationship between teachers and students (an aspect of framing, discussed further over the page under 'rules').

Division of labour: In division of labour, different courses can be separated from one another with different degrees of strength of boundary. This often relates to the

PART TWO • CHALLENGES IN RECONCEPTUALISING UNDERGRADUATE AND POSTGRADUATE EDUCATION

different degree of role specialisation of different lecturers. These parallel divisions would be likely to affect how well courses can be integrated in, for example, PBL tasks. The separation of different courses may also have a vertical dimension in that some courses may be given a greater weighting in the development of the career-focused curriculum than others.

There may be divisions between lecturers as to who teaches and who does research and what sort of research is done (hard science versus curriculum research, for instance).

In the career-focused curriculum there is also likely to be a division between practical laboratory courses, learning sessions in workplaces and the more procedural and conceptual knowledge taught in the classroom. Clearly, the relationships of parallelism and verticality and between practice and conceptual/procedural elements of courses will influence how the curriculum is to be structured.

Divisions may also refer to the relative influences that different members of the community have over the curriculum, as well as to power differences and different roles adopted between students who learn and lecturers who teach. However, in keeping with Daniels's (2005) approach, these are represented in the rules element of the activity system.

Rules: In pedagogy, rules can include those concerned with how the curriculum is structured and what counts as evidence of learning. There is also, as Daniels (2005) elucidates, the extent to which students can influence what can be said in the subjects and curriculum which, following Daniels's (2005) interpretation of Bernstein in activity theory, can be referred to as 'framing'.

The rules relevant to curriculum, however, go beyond what occurs in the classroom and must include other rules imposed on the work-integrated curriculum by the community. These would include rules of combination and credit rating, rules of assessment according to policies and rules related to the strategic objectives of the university. Professional bodies would also exert specific rules as to weightings of different forms of subject knowledge; for example the Engineering Council of South Africa requires a professional degree to have a minimum engineering science weighting of approximately 30% and an engineering design and synthesis weighting of 12% (ECSA 2009).

Curriculum researchers Mwanza and Engestrom (2003) have adapted the activity system components into a research interview questionnaire. In their research they were interested in harnessing advanced ITC (e.g. virtual reality, mobile technologies) as a source of innovative pedagogic practices in the college engineering curriculum. In order to do this it was first necessary to understand the nature of the whole teaching and learning activity, and how the different parts related to one another. They utilised a data-capture methodology in empirical research on different engineering classrooms called the 'eight-step model' to better understand the activity. Likewise, Hardman (2008) developed a checklist for the activity theory curriculum researcher to ensure that all elements of the activity system are noted (Hardman 2008). A similar process

can be used for inquiring into the curriculum and work, by combining elements of the eight-step model and the Hardman checklist into an adapted form of questionnaire/checklist, as outlined below in Table 9.1.

TABLE 9.1 Questionnaire/checklist for activity theory curriculum inquiry

Component of the activity system	Research questions to pose in analysing the curriculum and work
Object	<ul style="list-style-type: none"> What is understood by the career-focused curriculum as opposed to a more traditional curriculum?
Subject	<ul style="list-style-type: none"> What are the experiences and dispositions of lecturers towards the career-focused curriculum?
Outcome	<ul style="list-style-type: none"> What would be a desirable outcome for a career-focused curriculum?
Tools	<ul style="list-style-type: none"> What types of symbolic and material tools do the lecturers have at their disposal to work on the curriculum?
Community	<ul style="list-style-type: none"> Who are the internal actors and groups who share an interest in developing the career-focused curriculum? Who are the external professional bodies and other committees and individuals who share a common interest in developing this object?
Rules	<ul style="list-style-type: none"> What rules are imposed by internal and external groups on how the curriculum should be structured and enacted? What counts as evidence of learning? What level of interpretation by the students is permitted?
Division of labour	<ul style="list-style-type: none"> What is the nature of horizontal and vertical subject distinctions and the relative weighting given to theory and practice?

The questionnaire/checklist has only recently been used within the context of investigating the elements of the vocational or career-focused curriculum, and has not as yet been properly trialled and reported on.

CONTRADICTIONS AND DEVELOPMENTAL LEARNING IN SECOND-GENERATION ACTIVITY THEORY

The use of the activity theory as an analytic tool to describe a system (in this case that of the career-focused curriculum) can be further developed to pinpoint areas for further research. A common thrust in activity theory analyses is that there are always contradictions and difficulties that have arisen over time; there are always many different voices that have become embedded in the rules, division of labour, object and tools (Engestrom 2008:27; Engestrom & Miettinen 1999). These inherent contradictions provide the starting point for developmental learning in the system. In Engestrom's analysis of activity systems and learning, predominately in workplaces, all these historically developed contradictions have their origins in and are influenced by the fundamental contradiction of use and exchange value in capitalist activity (Engestrom 2008:205). However, as Blackler (1993) argues, writing from the work organisation perspective, the use of activity theory to analyse and identify inherent contradictions in activity systems can be performed without recourse to Marxist economic theory.

PART TWO • CHALLENGES IN RECONCEPTUALISING UNDERGRADUATE AND POSTGRADUATE EDUCATION

In the tools element of the activity system for the career-focused curriculum, designers may come from different theoretical perspectives that may be somewhat contradictory (primary-level contradictions). For example, a situated cognition approach to bringing the curriculum closer to work (Lave & Wenger 1991) may be viewed as ignoring a more social realist view of university and work knowledge as being substantially different and differently acquired (Guile & Young 2003:66). The surfacing of these differences may in turn lead to productive developments; the Daniels (2005) integration of Bernsteinian concepts of classification and framing with the more contextual approaches taken in activity theory, discussed earlier, is exactly such an example of productive development.

In the career-focused curriculum, a common contradiction may arise concerning objects and tools (secondary-level contradiction). For some lecturers the object of the curriculum may be primarily the knowledge and methods of the courses taught. For others, often also including work representatives, the object is functioning in workplaces and courses are tools to achieve this; there is an object-tool reversal in the activity system (Virkunnen *et al* 2010).

Or, within the rules and within the division of labour, students may be understood differently as passive recipients or as active learners (Murphy & Rodriguez-Manzanares 2008).

Contradictions between elements can be clearly seen in, for example, Hardman's (2005) analysis of the introduction of ICTs into the university classroom. Here, the tool of the ICT was at odds with the more didactic role of the lecturer, as students could to some extent work independently and pace their own work. There was tension between the tools and role (division of labour) of the lecturer and to some extent between the rules and the tools, as using ICTs may open space for increased student voice, perhaps in contradiction to that of the lecturer. Subsequent surfacing and examination of this tension introduced a process of change in the teaching and learning activity (Hardman 2005:390).

Contradictions between elements can also be traced to the activity system for the career-focused curriculum described earlier. For example, where the dominant culture of teaching (rules) is that students learn in a structured way through attending lectures, then implementing more student-controlled and student-centred learning (for example PBL) may be resisted by staff. PBL and project-based learning as examples of the object in a career-focused curriculum activity system are also likely to be hampered where the horizontal division of labour is one of strong classification between subjects. Through focusing on these tensions, much as was done by Hardman (2005), shifts and developments in the object and the activity system as a whole may occur.

Working through these sorts of contradictions and reorganising the activity system is a potentially long process involving interaction and reflection among participants. A method to work through contradictions is that of the 'change laboratory' described by Engestrom (2007). Here the activity theory analysis and the contradictions exposed through using it form a primary stimulus for change in the activity, which is worked

through using the experiences of practitioners and materials drawn from members of the community. Furthermore, sessions are filmed and elements of the films from one session are used as a stimulus for discussion in the next.

As more and more contradictions and difficulties emerge with current practice, participants, often with the further stimulus of the facilitator, may be able to break out of their 'iron cage' mentality (Engestrom 2007:382) and develop new objects for the activity. The new object is likely to be contradictory to the dominant practices embedded in the organisation (a tertiary- or even quaternary-level contradiction).

The method has been used in the development of a new Physiotherapy curriculum in Finland (Virkkunen *et al* 2010). Data were gathered from students and from practicing physiotherapists. The main contradictory issue that arose was that students were encouraged in the curriculum to focus on knowledge and techniques, but were not seeing categories of whole patients and the sorts of adaptations needed to treat such categories; for example, the category of older patients with all their associated health and lifestyle problems.

The research of Virkkunen *et al* (2010) in fact moved from the analysis of a single activity system to that of different, interacting systems. This is both another level of analysis, as contradictions between activity systems are examined, and another development in activity theory, referred to as 'third-generation activity theory' (Engestrom 2001).

THIRD-GENERATION ACTIVITY THEORY IN WORK AND THE CURRICULUM

Previously, in second-generation activity theory, work and learning were combined with the common object of the career-focused curriculum. Another way to analyse work and learning in the career-focused curriculum is to pull the system apart into two interacting systems that represent different voices, different perspectives from actors as well as different contexts; contradictions now arise between any or all elements of the two different systems.

Analyses involving such different activity systems fall under the concept of third-generation activity theory (Engestrom 2001:135). Work and the curriculum have been analysed in this way by McMillan (2009) in the context of the mainstream medical curriculum and service work in the community in South Africa, and by Konkola *et al* (2007) in the context of Physiotherapy internships in Finland and in Education and Social Work in Canada (Le Maistre & Pare 2004).

At the first level of analysis, the two activity systems can be shown to have quite different tools, objects, communities, division of labour and rules (Le Maistre & Pare 2004). However, the student as the subject in both systems, albeit with different roles, provides connectivity and the possibility for interaction between the two different activity systems.

Figure 9.3 below is a schema of two interacting activity systems of the university and work. When students are at work during their internships, they are required to deal with

PART TWO • CHALLENGES IN RECONCEPTUALISING UNDERGRADUATE AND POSTGRADUATE EDUCATION

work problems that are fundamentally different to the kinds of problems experienced in the university curriculum (Pare & Le Maistre 2006). The students have to refocus knowledge and methods learnt at the university, the object of university study, to the work problem, which constitutes the object of the work activity. In so doing, they transform both the object of study and the work problem into a mutually developed object (Konkola *et al* 2007).

FIGURE 9.3 Engeström's (2001) depiction of third-generation activity theory

Because we are dealing with different systems and often different objects, additional concepts such as boundary crossing and brokers from situated learning theory (Wenger 1998) and boundary objects from actor-network theory (Star & Griesemer 1989) need to be introduced (Engeström 2001:135).

Our own curriculum research focused on industrial internships for final-year Chemistry students (Garraway, Volbrecht, Wicht & Ximba 2011). Altogether 18 students doing their internships in nine different chemical industrial sites, ranging from industrial chemical to health product manufacturing and water purification, formed the focus of the study.

Our investigation involved the introduction of a task at work that would serve to connect the taught and practical curriculum at the university with work knowledge and practices. But more than this, the task needed to be of interest to and useful for both the workplace and the student. In this way the task could act as a boundary object (Star & Griesemer 1989), connecting work and university but also acting as a developmental node (Engeström 2001; Konkola *et al* 2007).

The research thus involved using activity theory as an intervention in order to improve practice (Roth 2004:7), as was described in the introduction. But it also provided a framework with which the researchers could analyse the curriculum as it is enacted in internships, in particular the relationship between university knowledge and work knowledge and practice.

Although we were all curriculum researchers, half our number was also Chemistry lecturers with responsibility for monitoring the students during their internships.

Students are required by the university to do an investigation of an issue at work and to submit the investigation as evidence of having 'applied' their university knowledge. Through interviews with work supervisors, the researchers were able to ensure that the investigation was something that really mattered at work and was substantial enough to stimulate the students to transfer knowledge from the university to the work context. In interviews with the students, their Chemistry lecturers encouraged them to think back to their university curriculum and select elements that were relevant to the industrial task. The university staff were thus acting as knowledge brokers (Wenger 1998) within the triangular relationship of work supervisors, the students and themselves as representatives of university knowledge (Konkola *et al* 2007).

In reporting on the investigation, the students were requested to reflect on what knowledge they had selected and transferred, what the gaps were between university and work knowledge and how they managed to bridge these gaps. This was submitted to the researchers in the form of a written, reflective report. The reflective report provided the main source of data for the researchers. In addition, the students were interviewed at work before they wrote the report and were asked to reflect on how the investigative project at work related to their learning at university; these were recorded and transcribed and provided additional data on how the students connected university and work knowledge and learning.

In writing about bridging the gap, the students were asked to reflect not only on what new knowledge was learnt, but also on how this knowledge was acquired in the workplace. Here, the researchers were attempting to tap into the context in which learning occurred at work, and the extent to which the students were becoming conscious of their engagement in a new and different community of practice (Wenger 1998).

In terms of gaps and knowledge development, as evidenced in the interviews and the written reflective reports, we found that the students' abilities differed. Some students could recognise the gap, but not how they might integrate and develop what they had learnt at university in terms of the new situation. For others there was not much of a gap at all, whereas for some students' extensive knowledge development was recorded.

The following example of reflection on connecting learning and knowledge between university and work is taken from a written reflective report submitted by an internship student working at a waste-water treatment plant. The context of the investigation was that the treatment plant staff had acquired a new mercury analysis instrument, but had experienced problems setting it up that remained unresolved. The task set for the student was to solve this problem and set up the instrument. The student was familiar with the general practice and procedures of chemical analysis of water, but not that involving mercury. In his reflective report he described how he had mobilised his knowledge of the chemistry of mercury learnt at university, combining it with general

PART TWO • CHALLENGES IN RECONCEPTUALISING UNDERGRADUATE AND POSTGRADUATE EDUCATION

practice, in order to solve the work problem and set up the instrument, thus developing his own knowledge and skills and contributing a new practice to the workplace.

In activity theory terms the mutually developed task acted as a boundary object (Engestrom 2001:136; Konkola *et al* 2007) because it was able to articulate the two worlds of the university and work. In so doing, it satisfied both the work problem and academic learning needs. Furthermore, through using the boundary object as a focus for development, both the student and the activity system as a whole were developed.

Within the written reflective report on his investigation, the student was also able to describe the approach he took to solving the problem. He described how he first followed the general procedure that all company employees follow of constructing a stage-by-stage flow chart of the process to help identify what the problem was and where it occurred. This he derived from his supervisor. Then he discussed the chart with other staff in the laboratory until the problem and possible solution became clearer. There are clear parallels here with the Vygotskian notion of the ZPD, where students are able to do more with the mediation of more experienced others than they can do unaided on their own. This way of practicing is different from typical university work, and involves both interaction and learning from supervisors and from other differently skilled individuals – what Pare and Le Maistre (2006:373) refer to as “distributed mentoring”. Developmental learning is thus not only about knowledge, but also involves engagement with the ways of doing in the workplace.

The empirical study illustrates how third-generation activity theory can be used as both a design tool for developmental learning and an analytical tool to understand learning and curriculum during internships.

SUMMING UP ACTIVITY THEORY IN UNIVERSITY AND WORK CURRICULUM RESEARCH

Table 9.2 sums up and illustrates the different ways in which activity theory has been used in curriculum research in higher education, as described in this chapter. It reiterates the different phases or generations of activity theory in research. Furthermore, it shows how second-generation activity theory may be used descriptively or to expose different levels of contradiction.

TABLE 9.2 Activity theory and curriculum research

Generation	Curriculum research and development focus	Examples of curriculum research
First-generation activity theory (Vygotsky)	Constructive alignment	Higher education curriculum design and analysis (Biggs 2003)
Second-generation activity theory (Engestrom)	Analytical framework for identifying components of an activity and the relative influences of the components on the activity as a whole	Analysis of the vocational curriculum and the role of ICT in engineering colleges (Mwanza & Engestrom 2003)
	Identification and exploration of contradictions within elements of the curriculum (primary-level contradictions)	Analysing the components of the vocational curriculum in universities (this chapter)
	Identification and exploration of contradictions between elements of the curriculum (secondary-level contradictions)	Introducing information technology into the university classroom (Hardman 2005)
	Exploration of new ways of working and the formation of new objects and activity that may be contradictory to previous objects (tertiary-level contradictions)	In change laboratories (Engestrom 2007)
Third-generation activity theory (Engestrom)	Comparing different activity systems and exposing contradictions as developmental nodes	In vocational university education and the workplace (Virkunnen <i>et al</i> 2010)
	Analysis and development of mutually formed objects between different activity systems involving issues of boundary and boundary crossing	In Chemistry internships (in this chapter) and in Physiotherapy internships where new practices emerge (Konkola <i>et al</i> 2007)

CONCLUSIONS

In traditional university curriculum practices, knowledge is typically developed from more simple to more complex forms and is organised conceptually via central guiding theories; this is what Bernstein referred to as vertical discourse (Bernstein 2000). In examining work and the curriculum, there will always be elements of vertical knowledge development. But there also needs to be cognisance of horizontal developments that involve movement between parallel activity contexts (work and university). These parallel contexts, or activity systems, entail some complementary but also “conflicting cognitive tools, rules and patterns of social action” (Tuomi-Gröhn *et al* 2003:3).

The limitations of first-generation activity and constructive alignment were that insufficient attention was paid to context and the dynamic nature of curriculum. Second- and third-generation theory with their focus on variation, multi-voicedness and constant opportunities for change (Engestrom 1999:20) within and between activity systems provide for a richer, less static framework for analysing work and the curriculum.

PART TWO • CHALLENGES IN RECONCEPTUALISING UNDERGRADUATE AND POSTGRADUATE EDUCATION

Activity theory with its focus on differences and contradictions within and between elements of an activity system in second-generation activity theory and between different activity systems in third-generation activity theory is thus an ideal tool for examining work and the curriculum.

REFERENCES

- Barnett M. 2006. Vocational knowledge and vocational pedagogy. In: M Young & J Gamble (eds). *Knowledge, curriculum and qualifications for South African further education*. Cape Town: HSRC Press. 143-157.
- Bernstein B. 2000. *Pedagogy, symbolic control and identity*. Lanham, MD: Rowman and Littlefield.
- Biggs J. 2003. *Teaching for quality learning*. Maidenhead: SRHE.
- Blackler F. 1993. Knowledge and the theory of organisations: Organisations as activity systems and reframing of management. *Journal of Management Studies*, 30(6):863-864.
- Boud D. & Falchikov N. 2007. Developing assessment for informing judgement. In: D Boud & N Falchikov (eds). *Rethinking Assessment in Higher Education*. London: Routledge. 181-197.
- Charlin B & Mann K. 1998. The many faces of problem-based learning. *Medical Teacher*, 20(4):320-331.
- Daniels H. 2010. Subject position and discourse in activity theory. In: D Frandji & P Vitale (eds). *Knowledge, Pedagogy and Society: International Perspectives on Basil Bernstein's Sociology of Education*. Chapter 4 (page numbers unavailable at time of going to press).
- ECSA (Engineering Council of South Africa). 2009. *Engineering Council of South Africa position paper: Implementing engineering qualifications under the HEQF*. [Retrieved 5 March 2010] <http://www.ecsa.co.za/documents/ECSA-HEQF-Pos-Paper-1.pdf>
- Engel-Hills P, Garraway J, Jacobs C, Volbrecht T & Winberg C. 2010. Working for a degree: Work-integrated learning in the higher education qualifications framework. In: R Townsend (ed). *Universities of technology: Deepening the debate* (Kagisano Working Paper Series No. 7). Pretoria: Council on Higher Education. 62-88.
- Engestrom Y. 1987. *Learning by expanding: An activity-orientated approach to developmental research*. Helsinki: Orienta Konsultit.
- Engestrom Y. 1999. Activity theory and individual and social transformation. In: Y Engestrom & P Miettinen (eds). *Perspectives on activity theory*. Cambridge: Cambridge University Press. 19-38.
- Engestrom Y. 2001. Expansive learning at work: Towards an activity theory reconceptualisation. *Journal of Education and Work*, 14(1):133-156.
- Engestrom Y. 2007. Putting Vygotsky to work: The change laboratory as an application of double stimulation. In: H Daniels, M Cole & J Wertsch (eds). *The Cambridge companion to Vygotsky*. Cambridge: Cambridge University Press. 363-382.
- Engestrom Y. 2008. *From teams to Knots: Activity theoretical studies of collaboration and learning at work*. Cambridge: Cambridge University Press.

- Engestrom Y & Miettinen P. 1999. *Perspectives on activity theory*. Cambridge: Cambridge University Press.
- Eraut M. 2004. The transfer of knowledge between settings. In: H Rainbird, A Fuller & A Munro (eds). *Workplace learning in context*. London: Routledge. 201-221.
- Eraut M. 2010. The balance between communities and personal agency. Paper presented at the conference on Enabling a More Complete Education: Encouraging, Recognizing and Valuing a Life-wide Learning in Higher Education, University of Surrey, Guildford, 13-14 April.
- Garraway J, Volbrecht T, Wicht M & Ximba B. 2011. Transfer of knowledge between university and work. *Teaching in Higher Education*, 16(5):529-540.
- Guile D & Young M. 2003. Transfer and transition in vocational education. In: T Tuomi-Gröhn & Y Engestrom (eds). *Between school and work: New perspectives on transfer and boundary crossing*. Amsterdam: Elsevier Press. 63-84.
- Hardman J. 2005. Activity theory as a potential framework for technology research in an unequal terrain. *South African Journal of Higher Education*, 19(2):378-392.
- Hardman J. 2008. Researching pedagogy: Activity theory approach. *Journal of Education*, 45:2-32.
- Hedegaard M. 1998. Situated learning and cognition: Theoretical learning and cognition. *Mind, Culture and Activity*, 5(2):114-116.
- Jervis LM & Jervis L. 2005. What is the constructivism in constructive alignment? *Bioscience Education*, 6 (Article 5). [Retrieved 12 May 2011] <http://www.bioscience.heacademy.ac.uk/journal/vol6/Beej-6-5.pdf>
- Kaptelin V & Miettinen R. 2005. Perspectives on the object of activity. *Mind, Culture and Activity*, 12(1):1-3.
- Konkola R, Tuomi-Gröhn T, Lambert P & Ludvigsen, S. 2007. Promoting learning and transfer between school and workplace. *Journal of Education and Work*, 20(3):211-228.
- Lave J & Wenger E. 1991. *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Le Maistre C & Pare A. 2004. Learning in two communities: The challenge for universities and workplaces. *Journal of Workplace Learning*, 16(1/2):44-52.
- Leontiev A. 1974. The problem of activity in psychology. *Soviet Psychology*, 13(2):4-33.
- McMillan J. 2009. Through an activity theory lens: Conceptualising service learning as 'boundary work'. *Gateways: International Journal of Community Research and Engagement*, 2:39-60.
- Moll I. 2002. Clarifying constructivism in a context of curriculum change. *Journal of Education*, 27:5-32.
- Moll I. 2011. Understanding learning, assessment and the quality of judgments. Unpublished research paper for SAQA. Pretoria.
- Murphy E & Rodriguez-Manzanares M. 2008. Using activity theory and its principle of contradiction to guide research into educational technology. *Australasian Journal of Educational Technology*, 24(92):442-457.

PART TWO • CHALLENGES IN RECONCEPTUALISING UNDERGRADUATE AND POSTGRADUATE EDUCATION

- Mwanza D & Engestrom Y. 2003. Pedagogical adeptness in the design of e-learning environments: Experiences from the Lab@future project. In: A Rosett (ed). *Proceedings of the E-learn 2003 International Conference on E-Learning in Corporate, Government, Healthcare and Higher Education*. Phoenix, USA: Centre for Research in Education and Educational Technology. 1344-1347.
- Pare A & Le Maistre C. 2006. Active learning in the workplace: Transforming individuals and institutions. *Journal of Education and Work*, 19(4):363-381.
- Roth W. 2004. Activity theory and education: An introduction. *Mind, Culture and Activity*, 11(1):1-8.
- Star S & Griesemer J. 1989. Institutional ecology, translations and boundary objectives. *Social Studies of Science*, 19(3):387-420.
- Tuomi-Gröhn T, Engestrom Y & Young M. 2003. From transfer to boundary to boundary crossing. In: T Tuomi-Gröhn & Y Engestrom (eds). *Between school and work: New perspectives on transfer and boundary crossing*. Amsterdam: Elsevier Press. 1-17.
- Virkunnen J, Makinen E & Lintula L. 2010. From diagnosis to clients: Constructing the object of collaborative development between physiotherapy educators and the workplace. In: H Daniels, A Edwards, Y Engestrom, T Gallagher & R Ludwigsen (eds). *Activity theory in practice*. London: Routledge. 9-24.
- Walsh A. 2007. An exploration of Biggs' constructive alignment in the context of work-based learning. *Assessment and Evaluation in Higher Education*, 32(1):79-87.
- Wenger E. 1998. *Communities of practice: Learning, meaning and identity*. Cambridge: Cambridge University Press.
- Woods W & Marsh C. 2007. Improving the efficiency of technologically disadvantaged students' use of computer technology. *African Journal of Research in SMT Education*, 11(2):25-38.