HIGHER EDUCATION AND THE WORLD OF WORK

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ABSTRACT

Although South African universities do invest in integration, for example in problem-based learning approaches and experiential learning, the outcome is often less successful than was expected; the two domains do not easily map onto one another. Why does it seem to be so difficult to successfully integrate ways of doing and thinking in workplaces with those of the university? The answer lies, in part, in the observation that knowledge in the workplace serves a different purpose from knowledge in the university, and that the two types of knowledge are, broadly, structured differently. Given this essential difference the chapter proposes that it need not be seen as an impediment to further developments, but rather, drawing on activity theory, it should be seen as a resource which can, under certain conditions, promote knowledge development. It is argued that the modern university needs to create these conditions, if it is to more properly recognise the importance of knowledge from outside of itself. Using evidence from research in South African universities, the author proposes that the university needs to develop 'boundary-crossing structures' and boundary-crossing expertise in order to better facilitate integration.

INTRODUCTION

The concept of different social groups separated by boundaries derives from work done by Wenger (1998) and Star and Griesemer (1989). The concepts of difference and boundary are nowhere more apparent than in South African society today. Notwithstanding the democratic elections of 1994, issues of race, culture and language, for example, still act as significant boundary markers in our society. The continued presence and often further development of these boundaries serves to

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make social integration difficult. Boundary is also apparent where new students with their own histories of learning are confronted with academic knowledge fields derived from quite different histories. Such difference and the resultant boundary create a very real barrier to student learning (Steinberg and Slonimsky 2004). What is less apparent, however, is that boundaries also exist between the institutions of Work²⁴ and the university. Such boundaries make both the insertion of Work knowledge into the academic curriculum and the transfer of academic knowledge to Work more complex than our policy makers originally imagined.

In 1994, Gibbons, Limoges, Nowotny, Schwartzman, Scott, and Trow coined the now familiar terms 'Mode 2' and 'Mode 2 society'. These terms were again used in 2001 by Nowotny, Scott and Gibbons in an attempt to describe a move from a more regulated society of separate entities, a Mode 1 society, to one in which boundaries were continually being crossed and new knowledge, Mode 2 knowledge, was being produced in the context of application (Gibbons *et al.* 1994; Nowotny *et al.* 2001). Gibbons *et al.* (1994:3) explain the differences between these terms in the following way:

In Mode 1 problems are set and solved in a context governed by the largely academic interests of a specific community. By contrast, Mode 2 knowledge is carried out in the context of application. Mode 1 is disciplinary while Mode 2 is transdisciplinary ... Mode 1 is hierarchical and tends to preserve its form, while Mode 2 is more heterarchical and transient ... Mode 2 is more socially accountable and reflexive. It includes a wider, more temporary and heterogeneous set of practitioners, collaborating on a problem defined in a specific and localized context.

The work of these authors signalled an emergent and significant global trend away from the separation of university and Work. More than ever universities were being pressurised to be responsive to the needs of society. In South Africa, higher education policy has been strongly influenced by Mode 2 debates (Kraak 1999) and by other responsive developments in Europe, for example the Dearing Report (Dearing 1997).

Support for the perceived need to cross boundaries between Work and the academy can be recognised in the early National Commission on Higher Education (NCHE) position paper. This paper suggested that university knowledge should be judged by its usefulness, embrace cross-disciplinarity and generally be more open to societal

²⁴ 'Work' is capitalised throughout where it refers to the workplace to distinguish it from more commonplace usage of the word.

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influences (NHCE 1996:49). This trend was further developed in the Higher Education Act of 1997 in which meeting global economic trends, in part through programme development, was promoted. Although the Act gave equal measure to both economic responsiveness and political redress, subsequent government directives indicated a shift towards a foregrounding of economic factors, such as the development of generic Work skills in academic curricula, creating academic/Work or society partnerships and efficiency (Cloete and Maassen 2002; Boughey 2002).

Despite much critique of boundary crossing (see Ensor 2002; Muller 2000) it is an existing, if not yet dominant, paradigm in higher education in South Africa. The question must then be raised: If we are to transfer knowledge between the academic curriculum and Work (and vice versa) then how is it to be done? The simple answer might be merely to transfer elements from Work and integrate them into an academic curriculum, as has occurred in the more vocationally oriented university fields such as engineering and health. But, as Bernstein (2000) and Michael Barnett (2006) convincingly argue, Work knowledge, even in the vocational fields, has become substantially recontextualised as academic subject knowledge; vocational subject knowledge and the vocations they originally derived from are quite separate entities. Even where there are attempts to orient subject knowledge more closely to Work, as, for example, in problem-based learning (PBL), there is no guarantee of effective transfer; tensions between the structure of subject knowledge and the structure of the problem persist.

In attempting to answer the question of how Work knowledge may be successfully transferred and integrated into the university, Gibbons (2005) proposes that the nature of the university should move beyond developing academic mastery towards a greater focus on boundary-crossing expertise. While looking at Work and higher education responsiveness more generally, the main thrust of the chapter is to develop Gibbons's argument further by examining the nature of the Work/academic boundary and how best it might be crossed.

UNIVERSITY RESPONSIVENESS TO WORK

Universities respond to calls to be more responsive to Work in different ways. They could ignore the call entirely and carry on with what they have always done in transmitting large amounts of disciplinary knowledge and, hopefully, at the same time developing a critical, thinking individual. The typical university BA and BSc would embody this approach. The hope then would be that students would be able to apply what they have

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learnt at the university to new situations in the workplace. As Eraut (2004) reminds us, this is not a simple process, and may be more of a challenging proposition for students than acquiring the disciplinary knowledge in the first place, and doing so without the benefit of texts and expert guidance. The nature and problem of such 'natural' transfer is well summed up by Layton, Jenkins, Macgill and Davey (1993:58-59):

The problems which people construct from their experiences do not easily map on to existing scientific and pedagogical organisations of knowledge. What is needed in solving a technological problem may have to be drawn from diverse areas of academic science at different levels of abstraction then synthesised into an effective instrumentality for the task at hand.

[...]

Solving technological problems means building back into the situation all the complexities of real life, reversing the process of reductionism by recontextualising knowledge.

It would seem therefore that higher educators have a responsibility at least to help the students in some way in this transfer. A dominant approach in Europe and particularly the UK, and which is also evident in South African policy, is the development of key skills alongside disciplinary knowledge acquisition. The skills, such as recognising and solving problems, working productively in groups, thinking systematically and reflecting on and managing one's own learning can then be transferred from university to Work situations (In South Africa the key skills are known as the critical cross-field outcomes). Another weaker version of the skills approach is that of subject integration in programmes as suggested in South African policy and taken up in many of the traditional universities (Moore 2003; Ensor 2001). The ability to integrate knowledge may be seen as a precursor to the idea of subject selection in the face of a real-life problem as put forward by Layton *et al.* (1993).

Integrated key skills learning can be included as an example of 'learning for Work' using the useful rubric of learning 'for, at and through Work' first proposed by Seagraves and Boyd (1996). The differences between these types of learning are illustrated in Table 11.1.

CHAPTER 11 • HIGHER EDUCATION AND THE WORLD OF WORK**TABLE 11.1** Learning for, at and through Work

Type	Explanation	Example
Learning for Work	The university curriculum includes structured components which prepare students for thinking and doing at Work (e.g. key skills approaches)	Personal development plans, problem-based learning, integration and project work
Learning at Work	Work includes structured and assessed opportunities for learning	Experiential learning components, Work-based learning
Learning through Work	Unstructured and tacit learning occurs through engagement with the Work community (e.g. situated learning approaches)	Work teams and critical circles in which workers work cooperatively on problems and engage in some sort of reflection on learning.

The problems with the key skills approach is that the skills still need to be transferred and mobilised to different situations from those in which they were originally learnt. As the possible situations students may encounter at Work are highly variable, there is no clear approach to what sorts of skills matter. Critics of the key skills approach, such as Ron Barnett (2004), claim that such skills, though important, would need to be overarched by a super skill or disposition to working with uncertainty, as Work is becoming increasingly changeable and flexible, though how this is to be accomplished is not made clear.

Key skills teaching can be packaged in different ways. One method that solves to some extent the generic nature of the key skills is to embed them in scenarios drawn from the workplace. The use of case studies, simulations, problem-based and project-based learning are all attempts to bring the real Work world into the university curriculum, and are successful to differing degrees. Such initiatives attempt to make students draw on and integrate relevant subject fragments as described earlier by Layton *et al.* (1993). One issue with all these approaches is the degree to which Work knowledge is absorbed and changed to meet the needs of the academy, and the degree to which the scenarios are offset from the dominant academic practices. Two examples illustrate these points. In PBL at one South African medical school, the dominance of the problem as the organising principle for teaching and learning events was undermined by the need of faculty to teach certain topics which they felt were under-represented in the problem situations. The result was a less immediate and less real Work problem. In another example from the University of Leeds in the UK (Kneale 2003), students were exposed to real-life problem scenarios which had already occurred and been solved in the workplace (the academic field was environmental and geographical sciences,

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EGS, and the related workplaces were local government). Students worked in groups for an afternoon on specific questions which needed to be answered from the cases. In working to solve the problems, students were using and presumably further developing many of the key skills mentioned earlier. However, the impact of the cases on the mainstream curriculum was small and the cases occurred largely as separate events. The addition of components to an already existent curriculum, rather than integration, may be said to be a typical response to the need to include elements of Work practice in the curriculum.

The point I wish to make is that PBL or the use of real scenarios in EGS can be improved, but that this is difficult to do within the ambit of university knowledge bases and practices.

A different approach to relating universities to workplaces in the universities of technology and in some of the more traditional university fields is the idea of experiential learning. Here, the student enters Work for extended periods of time at some point in the degree to gain Work experience, and in so doing to transfer university knowledge to the Work situation. This sort of approach fits in with the category of learning at or through Work, depending on the degree of structured learning occurring. The problem here is that Work and academic learning are almost entirely separated from one another, occurring at different sites and at different times. There is an expectation that transfer occurs, but this is not necessarily overtly promoted and may be expected to again occur 'naturally'. In research conducted at my university on chemistry experiential students we found that they spoke of analytic methods they had done or seen at the university which they were now doing 'for real'. They were less able, however, to relate their Work practice to particular theory and ways of doing in chemistry acquired at the university. We concluded that students were predominantly only able to transfer procedural knowledge and skills rather than higher level theoretical knowledge (cf. Garraway and Volbrecht 2007).

The final example of Work-based degrees is the opposite of the pure university courses such as the BSc. Here the workplace is the curriculum and each workplace and individual studying in it generates a unique curriculum (Boud 2001). The role of the university is to ensure that certain key principles of university education remain intact, but the involvement of traditional university disciplines is minimised if not entirely absent. The relationship between the knowledge and practices of those at the university and those in the workplace shifts strongly in favour of those in the workplace. This is an example of learning at Work, as the workplace now becomes a learning focus.

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The different trends in developing relationships between knowledge at Work and in the academy can be summed up in Table 11.2.

TABLE 11.2 A typology of trends in knowledge at Work and in the academy

Type of relationship between Work and academic knowledge and practices	Learning at, through or for Work	Problems
Traditional university courses with no overt relationship	For Work	No overt relationship and it is unclear what transfer, if any, occurs
Key skills in the curriculum or elsewhere	For Work	Skills may remain attached to the scenario through which they are learnt – problem of transfer
Work scenarios in the curriculum	Learning for Work	Academic needs predominate or scenarios remain separated from academic Work
Work or experiential periods in the curriculum	Learning at or through Work	Physical and spatial separation of university and Work and again no overt relationship
Work-based degrees	Learning at Work	No necessary overt relationship between academic disciplines and Work learning and experiences

The typology does not cover all possible approaches to relating academic and Work practices, but it should be possible to position most approaches on it.

The discussion so far has attempted to describe approaches through which Work and academic knowledge may be integrated. Whether these approaches concern interventions such as PBL in the curriculum or Work practice, they all have some benefits as well as limitations in integrating Work and academic knowledge. The limitations, it is argued, concern less than ideal integration in which Work and academic knowledge remain mostly separate.

Throughout the text thus far there has been the theme of separation or boundary between ways of knowing and doing at Work and in the academy in one way or another. The following section explores this separation further.

Differences between Work and academic knowledge

A key difference between Work and academic knowledge is difference in purpose to which the knowledge is to be put. At Work, knowledge is essentially used to enhance the productivity, innovativeness and skills base of the firm whereas in the academy it is concerned with the mastery of disciplines and their (possible) application in the world.

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Eraut (2004) explores this difference in purpose as it manifests itself within the nature of knowledge.

He typifies workplace knowledge as being largely context-bound, acquired through interaction with similar contexts and adaptive to prevailing conditions which may include the following: the degree of collaboration/supervision; time constraints and their conditions of performance; the culture of the workplace; and unpredictable situations to which the worker must adapt. Most Work knowledge is not codified and there is little time for critical reflection and analysis.

On the other hand, professional academic knowledge tends, to consist of codified academic knowledge in the form of academic subjects (like sciences), academic professional fields (like medicine or engineering) and some elements of the occupation itself, as described earlier by Barnett (2006). According to Eraut (2004), the relative prominence of these components is usually weighted in favour of the academic as this is the 'culture' that staff work in. Knowledge is developed and circulates predominantly through interactions with other field specialists and research. The more occupational aspects are often interpreted through seminars, simulations and on-site experience.

VERTICAL AND HORIZONTAL DISCOURSES

Following Bernstein (2000; 1999), vertical discourses have broadly accepted guiding theories and are systematic in that there are interlocking concepts. They operate in a context-independent arena (and so across contexts) at a high level of abstraction; they are furthermore highly coherent and explicit. All vertical discourses are theoretical, abstract in nature and internally coherent. What sets them apart from one another is their different internal logic and structure (for example, between different subject knowledges) and, overall, their abstract nature and internal coherency sets them apart from typically everyday knowledge in society or at Work. Within vertical discourses there are also two main types of knowledge structure, hierarchical and horizontal. The former is hierarchically organised as in the sciences and the latter consists of a number of parallel, competing and equivalent specialised languages, modes of enquiry and rules for the realisation of texts (Bernstein 1999:159), as in arts and social science subjects. There is, too, a further sub-division of horizontal knowledge structures into those with weak and those with strong grammars. Horizontal structures such as linguistics and psychology would be classified as having strong grammars whereas fields such as cultural studies, sociology and education would be seen as having weak grammars. The difference would be that fields with strong grammars

would be immediately recognisable as such whereas within weakly 'grammared' fields a student may be uncertain as to what counts as valid knowledge. Within strongly grammared fields the internal rules for legitimate enquiry and realisation of texts would be explicit whereas within weakly grammared fields rules may be more tacit and thus more dependent on tacit and contextual acquisition. Bernstein (1999:165) further suggests that such weakly grammared fields have much in common with horizontal discourse, the discourse of everyday Work and society. Gamble (2002) illustrates the nature of such weakly grammared fields through the description of cabinet-making craft apprenticeships. Though occurring at Work and largely tacit in nature, there is still a holistic, integrated system of meaning into which individual events in crafts may be positioned and explained, thus enabling their classification as a form of vertical discourse.

Vertical discourses tend to be insulated to differing degrees from other forms of knowledge, whether everyday knowledge or other vertical discourses. There are furthermore, explicit rules (pedagogic recontextualising principles) for the transformation of knowledge from one to another vertical discourse. Vertical discourses are typically acquired through access to the organising principles of the discourse which in turn can be operationalised to explain different events.

Horizontal discourse, on the other hand, is likely to be "oral, tacit, local, specific to particular contexts, multi-layered and contradictory across but not within contexts" (Bernstein 1999:157). This is the dominant discourse of the workplace. Central to this discourse is its segmented nature; it is differently realised according to the different activities and specialisations it is embedded in. Learning in the workplace has a strong component of explicit exchange of situated narratives which are potentially inexhaustible, each new experience generating another narrative. Such segmented acquisition of horizontal discourse is also likely to involve trial and error experimentation, exploration and tolerance of dead ends (Brown and Duguid 1996). Learning in the academy is different as lecturers deal in predominantly sequential, codified, abstract and theory-driven knowledge, or vertical discourse, which students are expected to acquire in their interactions with academics.

Horizontal discourses, being often tacit, context-bound and flexibly applied, do not insert well into vertical discourse ways of doing which are more cross-contextual and abstract. Similarly, vertical discourse sits uncomfortably with horizontal discourse knowledge.

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Young's (2005) interpretation of Bernstein's concept of vertical and horizontal discourse is that these are ideal-type analytical categories rather than knowledge types that occur empirically. Vertical and horizontal discourse may thus occur in different proportions in all types of knowledge. For example, Breier (2003:83) argues that in labour law teaching practices vertical discourse is not the preserve of the disciplinary lecturer, but is produced, too, by trade union workers during interactions with the lecturer. Furthermore, everyday practices (horizontal discourse) emerge in the discourse of law within formal lecture delivery mode. There is, she asserts, a "complex relationship" between vertical and horizontal discourse in pedagogic discourse. Labour law is more of an in-between hybrid of the two.

PROBLEMS OF KNOWLEDGE TRANSFER BETWEEN THE UNIVERSITY AND WORK

According to Bernstein (1999), vertical discourse cannot generate horizontal style discourse and vice versa. For Eraut (2004) the transfer of knowledge from the academy to the workplace involves substantive work, an issue which is seldom realised by lecturers. The two types of knowledge, from Work and from the academy, seem to be doomed to a state of almost perpetual separation; crossing boundaries between them. Effecting some form of hybridisation is always going to be difficult to accomplish.

Scholars such as Young (2003), Bernstein (2000) and Muller (2000) have critiqued notions of hybridity as assuming that all boundaries are permeable and thus anything can be put with anything else. This suggests that disciplinary knowledge based on ways of thinking that have been developed over the past 150 years or so can be simply broken up and reformed at will. Furthermore, hybrid approaches are defended by 'hybridisers' (such as, for example, Gibbons *et al.* 1994) through their being something inevitable and unavoidable, tied up with changing modern economies and the crossing of previously "hard" boundaries (Muller 2000:57).

Broadly, one can position these authors as predominantly concerned with boundary maintenance. Those who support boundaries between different discourses across disciplines and between disciplinary and social knowledge as a given are most likely to adhere to a broadly structuralist paradigm where structures are seen as anterior to, and to some extent determining of, social action (Carter and New 2004).

When, in contrast, all disciplinary knowledge can and should be integrated and hybridised with social knowledge, authors may well take the epistemological position that all knowledges are relative and of equal value. In this version it should be possible to substitute social phenomena within disciplines with no ill-effect on either the social

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or the disciplinary world. Here, structural constraints and enabling factors are muted or absent (Muller 2000) and authors favouring this approach would tend towards a more constructivist paradigm.

For Muller (2000) the hybridisation of school knowledge with everyday knowledge is driven by self-styled (though ultimately deluded) 'progressive' educational thinkers. Here, the assumption is that more universal access to schooled knowledge is facilitated through the erosion of boundaries between school and everyday knowledge. Boundaries are seen as an impediment to learning. Muller (2000) demonstrates that hybridising mathematical and everyday knowledge serves to prevent learners from acquiring the overall logic of school mathematics and hence becoming mathematical thinkers. Some learners, usually from lower socio-economic backgrounds, are thus deprived access to 'full' mathematics.

The duality of 'maintainers versus hybridisers' or 'structuralists versus constructivists' does not, however, hold in practice; some maintainers also support hybridisation of more academic and local knowledge, though only under certain conditions. For example, Muller (2000) argues for the possibility of hybridisation of mathematics and the social world using the work of Walkerdine (1998). Here mathematical and everyday knowledge are "prised apart from their set of relations of signification" (Muller 2000:69) and rearticulated through a succession of recontextualising events. In addition, Muller and Subotzky (2001:177), in discussing community outreach at universities, conclude that university subjects and practical community issues should only be brought together where it is "operationally and epistemologically appropriate". The point raised by Muller and his co-author is not that disciplinary/social knowledge hybridisations are bad, but that they should be systematically performed within the confines of what knowledge is appropriate to hybridise at an appropriate level of disciplinary expertise, and with recognition of boundary. Without boundary there can be no meaningful knowledge development or conditions for hybridity (Muller 2000:76).

The argument thus far is that differences between Work and academic knowledge, whether these be concerned with purpose, context or knowledge structures, make the transfer and hybridisation of knowledge difficult. Activity theory, it is proposed, through acknowledging boundary and theorising boundary crossing, provides us with tools to better understand and promote knowledge transfer and hybridisation.

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Activity systems theory understands human activity as being object-oriented, i.e. there is some focal point towards which the activity is directed. For example, the lecturers of an academic department have students as their teaching and learning object and their hoped-for outcome would be learning. In order to achieve this objective, outcome tools such as lectures, texts and so on are used. The top half of the diagram in Figure 11.1 represents this triadic structure. The problem with this well-known representation of a teaching and learning system is that the complex social web, which acts on lecturers, tools and students, is not recognised. Engeström (1999) thus extends the basic triangle to include the influences on teaching and learning of the division of labour (and power) in the department, the overt and tacit rules of the department and the broader community within which the departmental lecturers operate.

FIGURE 11.1 Proposed activity system of an academic department
(After Trowler and Knight 2000)

The activity triangle is used as a heuristic to expose contradictions among its various components. The contradictions then act as a first stimulation for actors to examine how difficulties may be overcome, and further tools are brought into play as additional stimulations.

The description of workplaces as activity systems has been extensively studied by Engeström and his associates (Engeström 2001; 1999) in the fields of health and

engineering in order to understand their internal dynamics and possibilities for change, as well as to study differences and interactions between like systems.

Activity systems, boundary-crossing and hybrid developments

Activity theorists working within the ambit of so-called third generation activity theory (Engeström 2001; Konkola, Tuomi-Grohn, Lambert and Ludvigsen 2007) are currently exploring the ideas of boundary-crossing between different activity systems. The following example illustrates important activity theory concepts concerned with boundary-crossing between different activity systems. These are the importance of hybrid forums, visibility of difference and disruption in opening up developmental hybrid spaces in which hybrid objects may be produced.

DISRUPTION AND HYBRIDITY

Gutierrez, Baquedano-Lopez and Tejeda (1999) analysed a classroom situation where the different social worlds of teachers and pupils interact within a 'third space' which extends the knowledge of both worlds. The authors then propose the development of an inter-language which bridges between these two worlds, but does more than this.

The authors show how the interaction of social groupings, each with its opposing social characteristics and epistemologies, creates disruptions and the possibility for hybrid transformations. Their example focuses on the school, on a particular attempt to teach the subject of reproduction to junior school children. Their methodology is first to examine the different discourses used by teachers and children, and then to look at how the teacher incorporates the children's discourse to create a hybrid language which talks to both the 'rude' world of the children and the official requirements of the curriculum. The authors identify two activity systems, that of the teacher, school and official schooled knowledge, and that of the 'rude' lived experiences of the children, each with its own language of description for reproduction. The two systems disrupt one another. Between them lies a third space in which a bridging, hybrid object in the form of a hybrid language develops that is understandable and operative for both systems (see Table 11.3). The hybrid language practices in the third space mediated the ways students and teacher interacted with one another and mediated student learning and intellectual development. The third space can be depicted with samples of language from both activity systems and resultant hybrid language practices inscribed (Gutierrez *et al.* 1999:297).

PART THREE • TEACHING, LEARNING AND THE CURRICULUM**TABLE 11.3** Hybrid language in the third space

Teacher talk	Third space (hybrid space)	Student talk
The chest	"In some families the chest is affectionately known as chi-chis."	Chi-chis

The examples of interacting activity systems above can now be used to explain how new knowledge forms may arise. Outputs presented from each system (which result from the action of the system on its objects) come into contact with one another and there are similarities, differences and gaps between them. Where there are differences they may serve to challenge and disrupt the previously held knowledge of the other. The processes of disruption are that knowledge is questioned, analysed and potentially remodelled in a way which satisfies both activity systems. A new zone of potential knowledge development can be opened up between the two activity systems such that "potentially shared or jointly constructed objects" may arise and be identified (Engeström 2001:136).

Work responsiveness involves interaction between Work and academic representatives. We are now in a position to describe an academic department as an activity system whose outputs (e.g. knowledge and procedures) interact with those of another activity system from Work. In between the two systems there is a zone of potential development. This zone arises, because differences raised between the two systems disrupt one another, and these disruptions can be mediated by boundary- crossing work. The interactive structure is shown in Figure 11.2.

FIGURE 11.2 Interactions between two activity systems

Under certain conditions the zone of potential development can become, a productive in-between space or third space. Third spaces, as is argued by activity theorists, are the result of boundary work and can also be developed further by such work.

THIRD SPACE DEVELOPMENT BETWEEN UNIVERSITY AND WORK KNOWLEDGE

Project work

An example from the Finnish Polytechnic (Miettinen and Peisa 2002) involves third-year students in a technology and a business department working cooperatively with one another in partnership with a truck cab industrial firm. Even though some of the students are training as engineers, the focus of the students is on how the truck cab business is run. The purpose here is to engage students in more real Work scenarios rather than in often clearly (to the students) contrived simulations. The task involves learners in moving from simulation with no consequences to consequential, creative, exploratory work in the zone of development beyond that actually practised by both the firm and the institution. In so doing both workplace and academic theoretical knowledge is developed.

Students are divided into four groups within the institution, each group representing the different functions of the truck cab firm (production, finance, logistics and accounting). Each group is asked to step outside the institution and do in-depth research and analysis of one function of the firm. This involves limited experiential work, observations in the firm, interviews with the firm's members and reading up on the firm so that they really come to know that part of the firm. The hybrid forum thus involves students, academic tutors and Work representatives. Once they really know how one of the functions of the firm works, they are asked to identify dilemmas or issues which arose.

The next step for students is to ask the question: "If this is what the firm is currently doing, and this is the issue that is arising, how can they extend their current practices to deal with it?" In identifying the issue and in suggesting ways in which it may be dealt with, learners are asked to mobilise what they have learnt in the institution in new and innovative ways – new, because they have never seen these problems before, and innovative, because they have to bring their academic and Work knowledge to the problem all at once in order to come up with a creative solution.

The solutions the groups come up with are not simply theoretical. The students are required to write these up and present them persuasively to the company; they have to say why they think the company could benefit from such changes. Evidence as to whether or not their ideas are good comes from the type and level of critique coming from the company, thus there is again the involvement of the Work hybrid forum representatives. A new object emerges in the third space – a Work problem about which solutions are sought through mobilising academic knowledge.

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The project involves another level of knowledge development. The academic curriculum is interrogated from the point of view of the students' Work experiences: students with their tutors are asked to identify gaps and areas to be mutually developed. This is a mirror process of the one in the workplace in which academic knowledge is now transformed.

The nature of the project is that new knowledge to deal with a Work issue is mutually constructed from both Work and academic components. Furthermore there is an impact on the academic curriculum as it is re-examined in the light of workplace learning.

Differences between Work and the curriculum are highlighted in hybrid forums consisting of lecturers, students and workers. The tension created by the necessary differences opens up a 'third space' in which a new, hybrid object, the solution to a Work issue, arises and develops through the collaborative actions of the actors.

These processes performed by the participants constitute 'boundary work'. Boundary work enables the transfer of knowledge across boundary and its successful hybridisation.

As already pointed out with reference to a South African medical school, hybridisations between Work and more traditional academic knowledge are not always without conflict. In this problem-based learning example the contents of subjects such as pathology and anatomy were forwarded by academic staff as necessary for student learning, even though not all the content elements were necessary to solve the problem situation being studied. The tendency was for these elements now to be included through restructuring the problem, or for content to continue being taught in traditional format alongside the problem-based approach to ensure no elements were left out. Even though the courses operated within a broadly integrated PBL structure, disciplinary knowledge structure still exerted a strong influence.

Advisory committees

The second example concerns advisory committees in South African universities of technology. Advisory committees consist of an assortment of field-relevant Work representatives and the academic staff of a department. They are thus hybrid forums. They meet once or twice a year. The role of the committee is to decide upon curriculum issues so that the academic courses are more closely aligned to what Work wants,

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and to changes which are occurring in industry. There is no fixed way in which the committees operate and they may have different protocols.

These committees are heterogeneous, purposeful curriculum design meetings and fulfilled the following criteria: they involved interaction between Work and academic representatives in some sort of formal, purposeful manner; they involved negotiation of procedures and knowledge; and they were concerned with developing some aspect of the curriculum.

In the advisory committee I observed differences in the kind of knowledge which was highlighted as 'relevant' for students, and interactions involving the force with which different propositions were presented. Unlike in the previous example, I could examine the actual actions of actors in raising differences and attempting to cross boundaries between the activity systems of Work and the institution. In an examination of over 22 such meetings I found that most contained elements of boundary crossing, but these were mostly not developed. In most cases it was possible to identify distinct developmental phases that were either successful or unsuccessful. Table 11.4 shows an edited version of an excerpt from a more successful meeting.

TABLE 11.4 Edited transcript of interactions between Work and academic representatives

Representative	Statement
Work	The students do not know the difference between minerals and rocks. You need to include geology.
Academic	A good idea. We should also think of the other specialisations we need ... should this go into the current diploma or is there too much already?
Work	A talk from industry then?
Academic	It must be formal and assessed
Academic	But the curriculum is already very full ...
Work	What about a new geology module and modules in the other specialisations?
Academic	We should think of integrating knowledge rather than adding on extra modules.
Academic	We could replan the whole course to do this.
Work	Remember to have integrated assessments when you do this (not just across subjects).
Work	The new integrated curriculum should relate to what the training boards are doing.
Academic	It is not just geology, but also communications and maths which should be integrated.

What is interesting here is how the academics are willing to mediate between the needs of industry (the need for a geology component) and the requirements of the academic

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curriculum (the fact that it is already quite full, and that components must be assessed). Here, the academics are acting as knowledge brokers (Wenger 1998:10).

In terms of boundary work performed by participants, this excerpt can be analysed as:

Participants raise differences → differences disrupt and create a new third space for discussion → actors work on boundary-crossing processes between Work and the academic world → a new hybrid object forms (integrated curriculum) → it is developmental as it can undergo further change through collaborative work.

Other meetings were more conflictual in nature with representatives taking opposing positions which became further cemented during the course of the meetings. In one meeting the issue of a sandwich workplace training year (experiential year) was raised. Industry representatives wanted the experiential year rather to occur after two full years of academic training, after which, they believed, students would be more trainable and useful in the workplace. The academics, on the other hand, stated that the experiential year provided a platform for later learning in the second, fully academic year. Industry accepted this argument and offered shorter periods of Work exposure for students after the first academic year. However, the academics rejected this proposal insisting that the full sandwich year was essential for student development. Despite being dependent on industry for ‘hosting’ students in their experiential year, the academic logic dominated that from the workplace.

The chemistry meeting was successful, because a mutually developed, in-between hybrid object emerged (or at least began to emerge). Likewise, the Miettinen and Peisa (2002) project was successful because of a similar development. Successful integration, or at least the potential for success, can be understood in terms of the productivity of interactions between Work and academic knowledge.

Productivity

As pointed out earlier, knowledge transfer involves both movement from one world to another and change in this knowledge. Where knowledge transfer has successful outcomes it can be referred to as productive. The concept of productivity derives, firstly, from Wenger’s understanding that new meaning is a product of interaction between existent (and often fixed) meanings generated within separate communities of practice (Wenger 1998:54), Secondly, productivity has its origins within the activity theorists’ understanding and promotion of the development of “potentially shared or jointly

constructed objects” in the interstices between different activity systems (Engeström 2001:136).

Productivity relies, firstly, on boundary recognition and hence the existence of some degree of difference between different knowledge forms. Boundary recognition involves making difference which may have previously been implicit explicit. It is not, however, necessarily a barrier to further development; boundary, rather is a pre-requisite for hybrid developments. When two different communities interact, their differences become a resource and there is the possibility that previous contextual constraints fall away or are muted as a new, intermediate space develops. On its own the space will not necessarily result in interactions which may be productive. There need to be actions by actors to cross these boundaries.

Productivity is now measured as the extent to which new, collaborative knowledge formations arise within this intermediate space through the collaborative actions of the actors involved. Being productive is therefore more than just communication across differences. It involves the production of new knowledge with elements of both higher education and Work which has value in both of these contexts.

The concept of productivity can be further elucidated with reference to another activity theorist, Van Oers (1998), and his generative conception of ‘recontextualisation’. Van Oers describes depthful integration and development of one form of knowledge within another as vertical recontextualisation and contrasts this with horizontal contextualisation in which, for example, Work and academic discourses do not undergo mutual development. In horizontal recontextualisation the workplace activity would be relatively un-problematically inserted into the curriculum. For example, learners may perform mathematical calculations of real situations within engineering classes. The workplace here serves to connect different strands of mathematics to one another in order to solve a problem, or to specify particular aspects of mathematics and exclude others. Horizontal recontextualisation can be recognised in the earlier description of experiential learning in chemistry. Recontextualisation only becomes vertical when the process opens up new avenues of thinking or new ways of doing things and becomes more generative, often applying theoretical subject knowledge in new ways to do this, as was illustrated in the Finnish engineering project (Miettinen and Peisa 2002).

CONCLUSIONS

Boundary crossing between Work and academic knowledge within the academic curriculum is a world-wide phenomenon which is further forwarded in South African

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higher education policy. The problem raised in this chapter is that there is an expectation from policy makers that boundary crossing and subsequent knowledge transfer and integration is an uncomplicated process which should occur naturally. On the contrary, this chapter has argued that Work and academic knowledge are in general differently structured, have different purposes and differ in practice. If this is the case then there needs to be a theory as to how the two may be successfully integrated.

In third generation activity theory, structural and other differences between interacting activity systems are seen as a resource for future development of new knowledge, rather than as an impediment which needs to be 'eroded'. As was earlier argued, it is the very existence of boundary that sets up the conditions for hybrid developments. The process of development typically begins with the setting up of hybrid forums and the raising of differences, followed by mutual disruption and the emergence of new hybrid objects. The concept of productivity develops activity theory further in order to better understand the formation of mutually developed, Work/academic hybrid knowledge constructs, and the stages described can be recognised in the two idealised examples of curriculum development discussed.

However, 'productive' interactions in new curriculum formation as described in this chapter may generally be a somewhat rare occurrence. As indicated earlier, Work and academic communities may take on conflicting positions which are difficult to bridge. As I have argued elsewhere (Garraway 2005) this may, because the initial differences between the groups are simply too large for any boundary-crossing activity to follow successfully.

Another consideration pertaining to whether or not academics and Work representatives will successfully hybridise knowledge concerns their relative positions of power. We have, for example, seen how curriculum interactions between Work and academic representatives are often skewed in favour of the academics. As Ensor (2001; 2002) suggests, despite post-1994 attempts by Government to make universities more accountable to Work and society, traditional universities have, by and large, managed to hold onto their academic power base. As she puts it, the dominant organising principles for new programmes are vertically structured disciplines. Where Work practices were brought into the traditional curriculum, for example, desktop publishing in applied language studies, they appear as separate modules.

Looking forward, Gibbons's (2005) thesis is that the university of the past was one in which what happened in the university was relatively impermeable. The university of the future is one in which "the new contract will be based upon the joint production of

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knowledge by society and science” (Gibbons 2005:5). The actualisation of the new contract will necessarily imply that individuals in institutions will engage with transaction spaces where knowledge difference is negotiated. If this is the case then the facilitation and management of hybrid forums and boundary crossing between disciplines and Work will become core work within the university, even if this was done to some extent in the past, and particular skills and resources will need to be developed to enable productivity within these processes.

In terms of skills, the development of academics as knowledge brokers would be important. Brokers are those who occupy positions of dual membership of communities. They use this multi-membership to transfer elements of one practice to another (Wenger 1998:109). In Work/academic boundary situations brokers may be those academics who have recently come from industry, or who still perform part-time industry work, though the problem may now be their under-developed disciplinary and teaching expertise, or what Schulman (1986) calls “pedagogic content knowledge”. Established academics could also spend ‘research time’ time at Work and be engaged with student Work projects in order to better act as brokers. This form of brokering work could be seen in the Finnish engineering project described earlier. Konkola *et al.* (2007) also describe lecturers acting as brokers in student health projects, and explain how the project itself serves to articulate the different expertise of lecturers, students and Work practitioners towards the solution of a Work problem. Work brokers are typically those who have been involved in education projects and thus have some knowledge of teaching and learning.

Being a broker does not necessitate direct involvement in both communities; it can also be more symbolic. In the chemistry advisory committee example, academics were able to act as brokers through thinking beyond the confines of their disciplinary cultures and ‘imagining’ how Work knowledge could be incorporated into the curriculum.

In the experiential sandwich year example discussed earlier, a Work broker had attempted to act as a bridge between academic and Work needs. It was possible to do this as they had been involved in an in-house bursary and mentorship schemes, and had conducted discussions on teaching and learning. Although they had the required expertise, the academics did not recognise it and consequently refused to accept the ideas of the industry representatives. Brokers, whether they are from work or from the academy, need to have confidence and courage to transgress into the knowledge of the other community, and to manage this transgression. It is always possible that they

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will be viewed as non-legitimate by members of the community into which they are transgressing.

For knowledge brokers to have a better chance of success there needs to be an enabling environment; having brokers alone is not enough. Moreover, there need to be hybrid forums consisting of Work and academic representatives, in which to conduct knowledge brokerage. One type of forum discussed here, the advisory committees, tended to meet only once or twice a year, meaning that the extent to which extensive and continuous boundary work can be done was limited. If advisory committees, and other hybrid curricula forums like them, are to be more productive, then specialist groups accreted around particular knowledge issues should hive off from the main group. They would interact over time. Interesting work has been done in Finland and France on the idea of 'boundary (or learning) laboratories' (Engeström 2001). Differences between cultures, knowledge bases or even procedures are deliberately raised and amplified by trained 'boundary analysts'. The role of the analysts is then to identify conflicts within each activity system and, over time, to position these as sites for further mutual development. Boundary analysts are also in a good position to support and develop attempts by representatives of either community to broker knowledge.

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