7 Interdisciplinarity requires careful stewardship of powerful knowledge

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Knowledge boundaries

The world faces a number of problems that have unclear boundaries and which emerge from such a complex and shifting interplay of causes that these causes are almost impossible to fully identify, let alone address. These 'wicked problems,' as they are known, include the seemingly intractable issues of social injustice and environmental degradation. Universities are tasked with tackling such issues in two ways, through knowledge creation and through the education of young people. While universities are not the only social spaces reflecting on how best to address these issues, they are often the ones referred to in national policy as having this particular role to play.

There is, however, a concern that the ways in which universities organize themselves are not the best fit for undertaking this complex work (Mukuni and Price 2013; Van Duzer *et al.* 2020). There is a strong sense that the complexity of such 'wicked problems' requires an ability to work across the silos of traditional disciplines. Critics of the status quo often argue that the knowledge of the academy is stilted and segmented and that significant changes are needed for higher education to meet the demands of the era (Tully and Murgatroyd 2013; Thorne and Davig 1999).

In response to such calls, a number of curriculum innovations have been put in place to move from theoretical knowledge structured into traditional disciplines to the more concrete and interdisciplinary with a focus on the 'real world.' These educational innovations include problem-based learning, outcomes-based learning, competency-based learning and so on. Such innovations generally focus on what people will do with the knowledge they acquire. Teaching and learning is thus structured in ways that allow students to engage directly with how the knowledge of the academy plays out in the workplace. Instead of focusing on the abstracted principles of individual disciplines, students are given opportunities to engage in real-world cases and are expected to select theoretical knowledge to resolve the practical problem set in front of them.

These educational innovations entail integration of subjects that have traditionally been taught quite separately. Students are supported to work

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across fields that have typically been inhabited by different researchers and different approaches to knowledge-making. The boundaries between disciplines classified into separate subjects are thus dismantled with the goal of developing learning that can work across artificial divides (Gerivani *et al.* 2020; Ghufron and Ermawati 2018).

Such innovative approaches have had many successes. Advocates of such innovations point to the greater levels of student engagement, the development of student autonomy and the extent to which students can enter the workplace and 'hit the road running' (Ge and Chua 2019; Ghufron and Ermawati 2018). There are indeed a number of benefits to approaches that more explicitly connect student learning to the practical implementation of knowledge and which allow students to move between disciplines that are traditionally carved into discrete 'subjects' on their timetables.

Critics of such approaches, however, raise a number of concerns, in particular, concerns about the more radical versions of such initiatives. The more extreme versions of these curriculum experiments seem to largely dismiss the idea that knowledge takes on different forms and that understanding how knowledge is made in different fields is key to the notion of 'powerful knowledge' (Shay 2013; Wheelahan 2007, 2009; Young and Muller 2013). These critics argue that too strong a focus on the immediately implementable can come at the cost of access to abstracted principles which allow us to move from a particular context to some future context, the likes of which we may not even be able to currently imagine. These critics argue that it is only if students have mastered the underpinning fundamentals of the disciplines that they can apply these across contexts in the workplace. The ideal curriculum, they argue, therefore sits somewhere in the middle: students are given access to the foundational knowledge and acquire an understanding of the abstracted principles underpinning such knowledge, and they are also exposed to a range of situations that require an application of such knowledge across the subject boundaries within which they may have studied it.

Hung (2019: 264) stresses that a 'critical element to successfully solve the problem [in a problem-based learning curriculum] is making sure that all disciplines have been taken into account,' but the literature on such educational initiatives provides little discussion on how the different forms of knowledge being integrated have been taken into account. Although Gerivani *et al.* (2020: 47) state that 'integration has been accepted as an important educational strategy in medical education,' Reddy and McKenna (2016) found, in their analysis of a problem-based learning medical curriculum, a lack of support for integration by academics. Klement *et al.* (2017) also note that a challenge to subject integration is ensuring support from faculty. While there are many possible reasons for resistance from academics who wish to hold on to traditional disciplinary divides, among them may be their sense of stewardship of knowledge, especially as there are very few deliberations in the literature about how the knowledge is structured within the constituent subjects of the curriculum.

It is important to note that while integration may be undertaken in the interests of interdisciplinarity – that is, to ensure better transfer of knowledge in the real world in which problems do not remain within disciplinary boundaries – such mergers are frequently undertaken for reasons of financial and logistical efficiency, which can ignore pedagogical implications. Klement *et al.* (2017), for example, indicate that the integration of Anatomy and other subjects in their study emerged at least in part as a requirement from their professional body and state that their goals for merger were to ensure better curriculum management and standardized examination, without any discussion on the nature of Anatomy and Physiology as sets of knowledge.

This chapter offers a case study of one such merger of disciplines: the merger of Anatomy and Physiology, into one subject, Human Biology, in the Faculty of Health Sciences at a South African university. Physiology and Anatomy are increasingly being taught together as one subject in various medical and allied health science curricula around the world (see, for example, Montayre and Sparks 2017), with some concerns being raised about whether students have sufficient time for all the constituent sub-sections (Rockarts *et al.* 2020). Many reasons are given for the integration of these two subjects, though in our literature search we found none that engage directly with the nature of the knowledge being integrated.

Case study of human biology

The larger study from which this chapter comes (De Bie 2016) tracked the curriculum of the two original subjects and the resultant merged subject from 1994 to 2013. The merged subject, Human Biology, was taught to students studying Occupational Therapy and Physiotherapy, who had previously been taught separately. Bringing together students studying towards different professions can allow shared learning between these related professions by students who would often work together in their future careers. Both the mergers of the subjects and the bringing together of the student body can thus be seen to have a clear and credible rationale. But, as this case study will show, where such mergers take place without due understanding of the different nature of knowledge in different disciplines, the results can be problematic and undermine the possibilities for cumulative learning.

This study asks the question: How does the structuring of the foundational Human Biology curriculum shape students' access to professional knowledge? The study explored whether the organization of the interdisciplinary curriculum of Human Biology served the fundamental needs of the two professions, and whether, as a matter of social justice, students' access to powerful knowledge was enabled by the form that the curriculum assumed. In order to interrogate the effects of merging two subjects, Anatomy and Physiology, into one, Human Biology, we drew on concepts offered to us by Legitimation Code Theory (LCT).

LCT concepts: Specialization and Semantics

The study drew on two LCT dimensions – Specialization and Semantics – in order to map out what was legitimated in the curricula of Anatomy and Physiology, and to then look at legitimation in the integrated Human Biology curriculum.

Specialization is used to identify the means by which a particular field of study legitimates knowledge and knowers in ways that are specific to it and differ from other fields (Maton 2014; Maton and Chen 2020). Specialization requires us to establish the extent to which the acquisition of specific forms of knowledge, practices and processes are central to the specialization of the field. This measure of the relations to the *object of study* is known as *epistemic relations*. Specialization simultaneously requires us to establish the extent to which particular dispositions or 'ways of acting, thinking or being' are required of knowers in order for them to be considered legitimate members of the field. This measure of the relations to the *subject of study* is known as *social relations*. Having established the nature of the epistemic relations and the social relations, we are able to map these onto a cartesian plane to establish the specialization code.

Given that this study looked at two subjects taught separately, Anatomy and Physiology, and then the curriculum after their merger to become one subject, Human Biology, Specialization allowed us to map the changes in the nature of what it is that was deemed to be legitimate. It should be born in mind that while the plane illustrated in Figure 7.1 highlights four principal codes – *élite*, *knowledge*, *knower* and *relativist codes* – there are an infinite number of positions within any of the quadrants. Furthermore, any area of

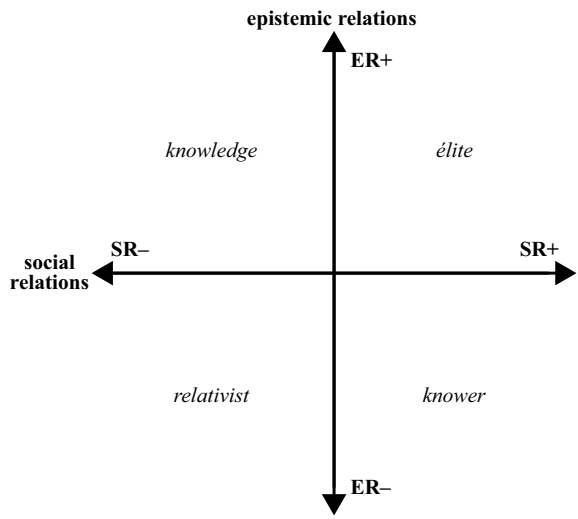

Figure 7.1 The specialization plane.

knowledge will undoubtedly inhabit various spaces, though it is likely that one will dominate. 'Code clashes' are where different positions come together in some way (Maton 2014); this can be where the understandings of the student and teacher differ regarding the expectations of a field of study, for example (Maton and Chen 2020). Specialization was used to interpret the epistemic relations and social relations, and thereby the specialization code, of the Anatomy curriculum, the Physiology curriculum and then the curriculum of the integrated Human Biology.

Semantics was also drawn upon in our analysis. Semantics is concerned with how the nature of meanings and offers two continua against which data can be mapped (Maton 2013, 2014, 2020). *Semantic density* conceptualizes the complexity of meanings condensed within knowledge practices. Here we shall use the concept to look at the ways in which meaning was communicated in curricula. Curricula which demand access to highly condensed terms and formulas are deemed to have stronger semantic density than those which rely more on everyday language. As a simple example, a cooking recipe might call for the addition of 'a cup of water,' and a Chemistry experiment in a school textbook might indicate '284mL H_2O'; the former has much weaker semantic density than the latter. The purpose of semantic density is not (or should not be) to make the text more difficult but rather to condense a lot of meaning into a text that can be readily communicated to other members of the field.

The other organizing principle in Semantics is *semantic gravity* (Maton 2009, 2013, 2014). This is an estimation of the extent to which the issue, concept or topic is tied to a particular context – that is, it has stronger semantic gravity – or whether the matter at hand can be applied across various contexts – that is, it has weaker semantic gravity. For example, the idea of semantic gravity can be considered as the extent to which what is being taught is connected directly to accessible real-world examples or students' own experiences (stronger semantic gravity) or whether what is being taught is more focused on principles rather than specific cases (weaker semantic gravity).

Ideally, teaching takes place in waves of semantic gravity where students are shown connections between (for example) more accessible real-world examples and more abstracted principled knowledge (line C in Figure 7.2). A flat-line of weaker semantic gravity (line A in Figure 7.2) can be problematic as students may battle to make sense of this highly abstracted knowledge if they cannot connect it to what they already know. A flat-line of stronger semantic gravity (line B in Figure 7.2) is equally problematic as students remain in the concrete realm of, for example, everyday experience or particular examples, without access to the powerful principles that would allow them to make sense of new contexts.

By using the tools offered by Specialization and Semantics, we were able to map the various ways in which legitimation was meted out in the Anatomy and Physiology curricula and the extent to which such legitimation shifted as the integrated Human Biology curriculum came into place.

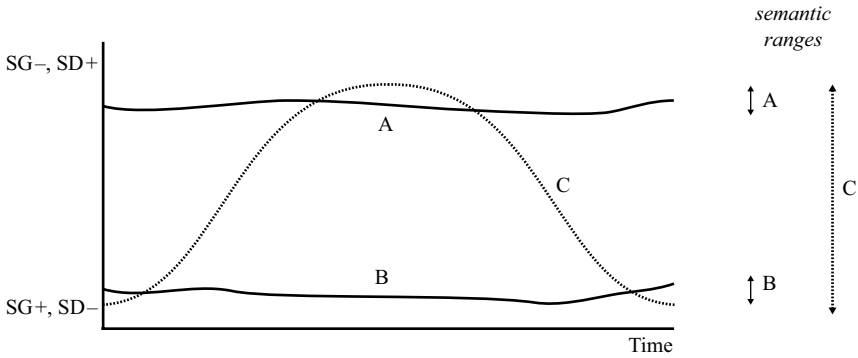

Figure 7.2 Three semantic profiles.

Research design

This case study is drawn from a much larger study that looked at data over a 20-year period, from 1994 to 2013, a period that included not only transitions in professional education but also extensive transformation in, and a different approach to, health delivery. In such a lengthy period, where both the fields of health and higher education saw enormous change, it is to be expected that this particular study would also evidence significant shifts. It is impossible to identify in the social world any particular macro, meso or micro shift that directly resulted in the curriculum shifts identified in this study. The realist position we take entails an understanding that events and experiences in the social world emerge from the complex interplay of multiple mechanisms (Archer 2000). This acknowledgement of epistemic relativism (Danermark *et al.* 2002) – that is, that our knowledge of the world is partial and subject to change on the basis of new information – should not be confused with ontological relativism, which suggests that all knowledge is personal and subjective. Using what Bhaskar (2016) refers to as judgemental rationality, as researchers we strove to identify the key causal mechanisms related to the effects on learning of the merger of Anatomy and Physiology to form Human Biology.

In particular, we were concerned with the function of knowledge itself. Knowledge is, somewhat ironically, often ignored in education research (Maton 2014, 2009). Common focus areas in educational research include the consideration of curriculum as a structure related to timetables and credits and so on, the consideration of students as individuals having a learning experience and the consideration of the university as a place of reproduction or disruption of social injustices. These are all important issues; however, there is a lack of focus on how knowledge differs from field to field and how such differences have effects on how the knowledge is taught and learned. This gap in much educational research has come to be known as 'knowledge blindness' (Maton *et al.* 2016).

Data in the form of Faculty Handbooks and Departmental Lecture Schedules for the 20 years under investigation were analyzed alongside detailed in-depth interviews with two lecturers in the Human Biology course, one who taught the Physiology sections and one who taught the Anatomy sections. Interviews were also conducted with a senior academic in Physiotherapy and a senior academic in Occupational Therapy. The data from these four interviewees is the focus of the case study presented in this chapter.

The two lecturers from the Human Biology course were interviewed for their understanding of what specializes the physiological and anatomical components of the Human Biology curriculum, what they considered as powerful knowledge for the professions and who they envisaged as the ideal knower. One Human Biology lecturer had Anatomy expertise and the other had expertise in Physiology.

The two lecturers from the two professional fields of Occupational Therapy and Physiotherapy were interviewed for their understanding of the extent to which the Human Biology curriculum prepared their students for each particular profession. While there are extensive overlaps between the professions of Occupational Therapy and Physiotherapy, they are distinguished in very specific ways.

Physiotherapy plays an essential role in helping people to maximize movement and to achieve optimal physical function. This involves consideration of the demands of daily living, and of occupational, recreational and sporting activities. Physiotherapists prescribe exercise programmes to promote physical activity and encourage an active lifestyle, which in turn contributes towards the prevention of health disorders. Physiotherapists are educated and trained to assess and treat a vast range of physical limitations and dysfunction by means of manual and electrotherapeutic techniques. In several countries of Western Europe, Australia and South Africa Physiotherapists are first-contact practitioners, which means that a referral from a medical doctor is not mandatory and a client can directly seek treatment from the therapist.

Occupational therapists believe that what people do every day has an important link with health and well-being. Illness or injury often disrupts people's ability to engage meaningfully in everyday occupations. Occupational therapists are trained to assess the person holistically, looking at all aspects of function, and analyze the environments where people live, work, play or pursue leisure activities so that they can understand how to improve function or adapt the environment in order to foster successful performance. Occupational therapy has developed various treatment modalities which enable people who have been ill, injured or disabled to recover their skills, or to develop new ones. In other words, occupation can be understood as being occupied in all facets of life rather than a concept of employment alone and the profession is centred on occupational functionality. Occupational therapists themselves admit to there being 'complex meanings and essential ties to human wellbeing ascribed to the concept of occupation' (Joubert 2010: 22)

and are described by their Professional Board as working with anyone who has a permanent or temporary impairment in their physical or mental functioning and helping with rehabilitation of neuropsychological deficits including memory.

The lengthy interviews with the four academics provide the data from which this case study is developed. The interviews lasted over an hour, and in three cases, follow-up interviews were undertaken. They were semi-structured in that a short set of questions was sent to interviewees prior to the appointment and were used to guide the interview, but the process generally followed the form of a conversation with the interviewer asking probing questions and follow-up questions on the basis of what the interviewee raised. The interviews were recorded, with the interviewees' permission, and transcribed. Before they gave their informed consent, the interviewees were all fully informed of the research intentions, the data collection process and their rights to anonymity and to withdraw from the study.

This chapter considers the views of the four interviewees from the perspective of the structure of knowledge in Anatomy, Physiology and the Human Biology curriculum, and their views about how such knowledge is applied in the two professions of Occupational Therapy and Physiotherapy. The LCT tools described above were thus the analytical frames through which the data was considered.

Results

The data shows that the merger of Anatomy and Physiology to form the Human Biology course was undertaken to ensure coherence across these two core subjects. As one of the interviewees explains:

> The purpose of Human Biology is to provide our students with the core knowledge of Anatomy and Physiology that underpins everything that we then teach in the profession-specific courses later.… Because all of their profession-specific courses rely on that basic level of knowledge that we expect them to acquire in Human Biology.
>
> (Lecturer in Physiotherapy department)

There was evidence across the data that Physiotherapists and Occupational Therapists both need to draw on the knowledge of Anatomy and Physiology in integrated ways in their workplaces:

> So, on the Anatomy side they need to have a thorough knowledge of the Anatomy of the cardiorespiratory system. They also have to have a thorough knowledge of neuro-Anatomy to underpin the physiotherapy treatment assessment, application of techniques as applies to those systems. Physiology wise, they need to have a good understanding of cardiorespiratory Physiology you know … in their third year they do quite an intensive neurology course where they look at assessing and treating

> head injuries, strokes (…) and they need to have a good grasp of Neurophysiology to understand the pathology on top of that.
>
> (Lecturer in Physiotherapy department)

There was thus consensus that being able to draw on knowledge from both disciplines in an integrated way was key to the work of both professions. Despite this, the data revealed significant concerns about the extent to which the Human Biology course was a good fit for purpose. There was a concern that bringing these two disciplines together had led to gaps and schisms in students' learning:

> But my concern is that they're exposed to it at a level where we're expecting and basic underpinning knowledge that isn't there.
>
> (Lecturer in Physiotherapy department)

> But we would have a student who would not have understood the basics about joints, different kinds of joints.
>
> (Lecturer in Occupational Therapy department)

In this focus on the interviewee data, we offer two findings that we believe would be useful to take into consideration where similar curriculum changes are brought about in other programmes. The first finding was a concern about coherence within the newly merged programme and suggests that there were at times a code clash that was insufficiently considered in the curriculation of the Human Biology course. The second concern pertained to the extent to which the academics who offer the courses were consulted in the development of the merged curriculum. Each of these will now be discussed in turn.

Coherence and connection

There was agreement in the data that students preparing to work in the fields of Physiotherapy and Occupational Therapy would face problems in the workplace requiring an adept movement between knowledges:

> … I think the applications of a lot of the subjects obviously had to change with the current knowledge of, um, the current clinical knowledge that we have. Like the increase in diabetes you know, the advent of HIV/AIDS etc. So, so I think, I think the essential knowledge of the topics are important, have been tailored as we've gone through the last couple of years. I've tried to make it a bit more relevant in terms of the current clinical problems that we encounter now.
>
> (Physiology Lecturer in Human Biology)

Understanding that these problems cannot be addressed by drawing on the expertise of only one particular discipline is important for students. It was

thus easy for the participants to acknowledge the justifications for bringing the two subjects together in ways that might allow students to see the complex interweaving of Anatomy and Physiology. Established disciplines with very clear boundaries can prevent students from making connections between them, and there is a need to ensure that the structures of the educational experiences do not prevent students from seeking creative understandings of and solutions to the intractable problems they face.

However, the dominant view emerging from the data was that the merger of the two subjects did not readily allow for such movement between the knowledges offered by each discipline.

> I've inherited a situation that was fragmented. I was told to only go to a certain level and then therefore the next year we continued. And even for myself, I found this very disjointed because when I spoke to the students and I said remember we covered this last year, all you sat with was 120 blank faces. And I found I had to reteach almost in essence the first part of the course to be able to continue with the second part of the course which for me is a waste of time. So, you not only have to remind them of old knowledge, you have to remind them of new knowledge. Because of the way we are forced to teach, because we have to do it section by section, students get the impression that blood vessels and nerves come section by section.
>
> (Anatomy lecturer in Human Biology)

There is a possibility that because the fields of production for both Anatomy and Physiology are very well established, there may be a resistance by academics inhabiting these fields to redraw their boundaries. Bernstein (2003) distinguishes between a *field of production* (where research is undertaken and knowledge is made), a *field of recontextualization* (where the curriculum is developed) and a *field of reproduction* (where teaching, learning and assessment take place). There are always conflicts within and between each of these fields, and the participants in this study did indeed understand the fields of reproduction of Anatomy to be very distinct from the field of reproduction of Physiology:

> [Learning Anatomy entails] … to not only have to describe muscles, but try to integrate what is now going on around. Where this is sitting, in what region is it sitting, what defines that region. And then I also ask them to label diagrams. This is very important so that they know even though it's a 2D picture of what they're doing in 3D, it teaches them that everything has its own little region where it is going to be lying.
>
> (Anatomy Lecturer in Human Biology)

> I think they, they struggle with Physiology simply because of the nature of learning Physiology. Because it's much more conceptual … it is not just an identification as for Anatomy. I think it's much more of an

> applied, of an applied science to the concepts and I think that's why, and that's why they struggle because their learning methods that they come in with are not geared from, from day one. Their learning methods are not geared to learn in a, in a conceptual way.
>
> (Physiology Lecturer in Human Biology)

The lecturers agreed that the nature of the knowledge in Anatomy and Physiology differed and that therefore the pedagogical approach differed too. This led to one lecturer suggesting that students of the merged Human Biology curriculum needed a guide to show how these two had been brought together:

> A guide – a mind map – or a guidance to students on, so when we talk about movement it relies on this and that and you get this from, you know, Physiology lecturers and this from Anatomy lecturers and then we'll have a consolidation.
>
> (Lecturer in Occupational Therapy department)

The extent to which the resistance to teaching the two subjects as one merged offering was from the desire to maintain separate territories cannot be established, but there was a strong sense expressed in the interviews that bringing the two subjects together restricted the flow of cumulative knowledge-building within each field of Anatomy and Physiology. A key rationale for the dismantling of traditional disciplinary boundaries is to ensure better coherence of knowledge so students should be able to draw on understandings from different fields of knowledge. In our data, we found the academics believed that the new subject made things even more fragmented because the students had not acquired underpinning principles of either discipline.

> It is very confusing for students. I've heard complaints. But I said to them nothing is a stand-alone … because now they come with the stand-alone hand and all of a sudden, they have to learn and remember all of the other muscles that came beforehand.
>
> (Anatomy Lecturer in Human Biology)

> Clinical sciences is in crisis. It's not working at all and it concerns me greatly. For me the, the content that may still be missing. Because if students won't understand hypertension because the basics are missing, I'd have a problem. If students won't understand TB because the basics are missing, I'd have a problem.
>
> (Lecturer in Occupational Therapy department)

At times, the structuring of the programme such that both Anatomy and Physiology lecturers focus on the same body area was complicated for purely pragmatic reasons:

> … certain things to be taught at certain times but that policy cannot always be followed because I teach on other courses as well and therefore I'm only available at certain times so often sometimes we are out of sync. But we try to follow because they need the basis for Anatomy before they can do the applications in Physiotherapy or Occupational Therapy continuing of where the Anatomy has supposedly left off. But that in sync-ness doesn't always happen.
>
> (Anatomy Lecturer in Human Biology)

By teaching the Anatomy and Physiology aspects of a particular part of the body in an integrated way in the Human Biology curriculum, it was hoped that students would be able to understand the full complexity of the human body. While both fields have a strong emphasis on objects of study and students are expected to engage with extensive knowledge (ER+), Anatomy has a very low emphasis on dispositions of the knower (SR–), whereas Physiology has a somewhat stronger emphasis on dispositions (SR–) as the student was expected to relate both as a propositional learner and as an applied, procedural scientist kind of knower. There are thus subtle differences in the ways in which the two fields are specialized.

Perhaps more problematically, greatly increasing the semantic gravity (SG+) by simultaneously looking at the intricacies of both the Anatomy and the Physiology of the hand, as per the example earlier, had the unintended consequence of decreasing the students' access to more abstract concepts (SG–) relevant across specific body parts or beyond particular ailments.

> The muscles don't just start and end in a specific section. They cross the joints because obviously we know that as the muscle crosses a joint it moves that joint. So, it has implications for the other regions.… You cannot teach them piecemeal and expect the students to understand what is going on in those various areas. Like for example, your cardiovascular Anatomy is broken up by the respiratory Physiology sitting in the middle over there. It has to be taught – in a more integrated way because structure and function cannot be separated.… I look at the muscle, the origins and insertions. I look at what they do, how they work together as a group.… But you have to know what everything else is attached to and running through and what the support mechanism is in the body itself so that you know that everything works together. So that if there's a problem in the one area, it's going to have a knock-on effect for the rest of their systems going on around the skeleton.
>
> (Anatomy Lecturer in Human Biology)

While the aim of disciplinary integration was repeatedly expressed in the data, the academics indicated that in practice the Human Biology curriculum was experienced as two discrete subjects.

> So, the class test will have an Anatomy component and a Physiology component, Ja. But I'm saying within that paper, the … even if it's Cardiovascular say and they did, you know, two weeks of Cardiovascular Anatomy and they did two weeks of Cardiovascular Physiology, there won't be one question that is an integrated question of both Anatomy and Physiology. It will be the Anatomy for 10 marks and Physiology for 10 marks.
>
> (Anatomy Lecturer in Human Biology)

> Let me put it plainly, the aim is integration but the final test is not integrated. There's no, there's no question about that. That's the honest side of it. And I think that it would need really the Anatomists and the Physiologists to really sit in a, in a real engaging type of way to come up with something.
>
> (Physiology Lecturer in Human Biology)

Analysis of the curricula documents alongside the interviews allowed an understanding that the structure of the knowledge in the two disciplines, Anatomy and Physiology, differed in fairly significant ways (De Bie 2016). While both are hierarchical in the sense that new knowledge is typically added onto and subsumes prior understandings rather than transposing prior knowledge, they function in different ways. Physiology requires a deep understanding of systems in ways not required in Anatomy. This means that Anatomy can be taught in a more segmented way than Physiology. The Human Biology course, with its focus on a particular part of the human body thus worked fairly well for the more segmented knowledge of Anatomy but less so for the connected, system-focus of Physiology.

> Because if you look at that, Anatomy has the overwhelming bulk of the lectures, you can understand that in a way because there's a lot of work to cover but remember Anatomy is structure, Physiology is function and structure and function must be fully integrated so they can understand the functionality of those various systems.
>
> (Anatomy Lecturer in Human Biology)

> I think they, they struggle with Physiology simply because of the nature of learning Physiology. Because it's much more conceptual, it is not just an identification as for Anatomy. I think it's much more of an applied, of an applied science to the concepts and I think that's why, and that's why they struggle because their learning methods that they come in with are not geared from, from day one. Their learning methods are not geared to learn in a conceptual way.
>
> (Physiology Lecturer in Human Biology)

Following the merger, it was found that the ideal of disciplinary integration was not reached, and the segmental organization and structuring of the

curriculum negatively impacted on cumulative knowledge-building. After the merger the disciplines to some extent lost their shape, and in particular, the hierarchical knowledge structure was compromised. By not having access to the necessary disciplinary knowledge structures and their associated practices, students' ability for scaffolding and integrating knowledge into the clinical arena was constrained.

> And for me one of the things in their final year is that it's underpinned because they're not secure in their basic knowledge. They don't trust their basic knowledge.
>
> (Lecturer in Physiotherapy department)

> … students who may be too concerned about the structure and not so much about what the dysfunction of that body structure means in the big scheme of things.
>
> (Lecturer in Occupational Therapy department)

The organization of the current Human Biology curriculum was thus limited in its facilitation of cumulative learning. The merging of two subjects did not meet the goal of subject integration.

Curriculum input by academics

Curriculum decisions get made in the messy reality of society where any number of factors come into play. As indicated earlier, there are often international shifts and trends in education that are implemented with greater or lesser degrees of success across disciplines and geographical contexts. In the case of this merger, the data shows a sense that the decision-makers may not have ensured sufficient buy-in and understanding from those who became responsible for offering the course.

> As a component teacher on the Anatomy course, I do not make any decisions. I simply get told you are doing six weeks of … and that's the basis of it. I also get given the book, so just see that everything within the book is covered… so there is in essence no guidance being given on the depth, the clarity and the amount of work that you put into it. I simply get told what to teach. I've not been invited to any curriculum decision meetings simply because I teach components of the courses.
>
> (Anatomy Lecturer in Human Biology)

This is a common problem in curriculum reform, where academics are expected to implement the decisions of others and may feel that they have not been appropriately consulted with the result that their understanding of the context, and their disciplinary expertise may be insufficiently considered. Reddy (2011) in her study on problem-based learning in a medical programme argued that without significant input in the field of

recontextualization by those researching in the field of production and those responsible for teaching in the field of reproduction, curriculum experiments can easily be doomed.

In part this is because the academics teaching on the programme need to support the integrated course if they are to do it justice, and in part because academics might be able to point out distinctions in the knowledge structures being brought together and how these need to be taken into account.

> … but the scary part of it is that you could theoretically have a 40% Physiologist, 75% Anatomist and the student finishing on 65%. Now within that 65% if the Physiological knowledge going into the clinical, into the clinical third year is needed, you've got 40% Physiological basis that you're working with which is the, the scary part.
>
> (Physiology Lecturer in Human Biology)

> …if you lay the proper foundation, what you have to build on is that much steadier and that much all-encompassing than if you now suddenly have to start cramming in the third and the fourth year when they start going out and treating patients at the various clinics, they would either have that firm foundation they all have something good to build on. If that foundation is shaky and the Anatomy is shaky then it actually has a bad reflection on you in the coming years.
>
> (Anatomy lecturer in Human Biology)

The academics also expressed a concern about the teaching of future Physiotherapists and future Occupational Therapists the identical Human Biology curriculum in the same class. In keeping with discussions in the literature (French and Dowds 2008; Joubert 2010), both professions were identified in the larger study (De Bie 2016) as being having a very strong emphasis on the knowledge, skills and practices (ER+) at the same time as a strong emphasis on being a particular kind of knower, one who is compassionate and able to empathize with the patient (SR+); that is, they were both *élite codes* (Figure 7.3). There are, however, distinctions between them, with Physiotherapy having much stronger epistemic relations.

Furthermore, the semantic gravity is stronger in Occupational Therapy, which focuses on the patient's everyday context as the main concern, whereas Physiotherapy focuses on physical well-being more generally. There was a concern expressed that students would not understand the different ways in which that knowledge is drawn upon within their different, though connected fields:

> Physios are more clinical than OTs, they're more medical than OTs. OTs straddle the medical sciences and the social sciences. We don't have the tools to assess clinical conditions. It's not our focus. It's a different profession. Our basics aren't their basics.
>
> (Lecturer in Occupational Therapy department)

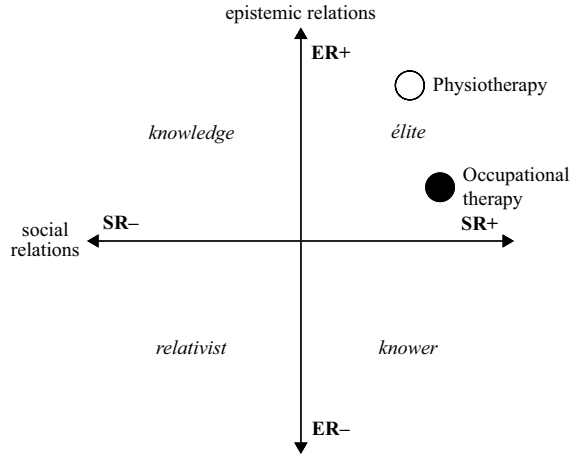

Figure 7.3 Specialization codes of the two professions.

There did seem to be an acknowledgement that there was 'increasing freedom' (Physiology Lecturer in Human Biology) for the Human Biology lecturers to make changes in the curriculum in the last few years and to work more closely with colleagues in the two target professions as they did so:

> So, the thing is, the, the question about the curriculum decisions and who makes them, is, is riveting because I think there has been a mind shift over the last five years in that.… And before that I think the baggage of the past was that, you know, Human Biology went on their own. They designed their course of Anatomy and Physiology and they ran it. Finished!
>
> (Physiology Lecturer in Human Biology)

It is therefore to be hoped that some of the concerns raised in this chapter can now be dealt with in this particular case. While few academics have the language with which to describe the structure of the knowledge and knowers legitimated in their courses, they may have a deep sense of what is needed in order to succeed in the field. Being able to articulate this, such as through the use of LCT, could be a strong starting point through which to engage in curriculum changes.

Conclusion

This case study offers the experiences of lecturers on a course that brought together two fields typically offered separately. It also considered the views of academics from the professional departments served by the merged course. All the academics were in favour of integration between subjects in ways that would allow the students, future health professionals, to draw from knowledge and practice across the separations of disciplines. However, it was clear

that merging two fields into one course with one study guide, one timetable and one set of assessments is not a simple process. The nature of the expertise requires different lecturers and the content itself cannot readily be fused. LCT allows us to see that distinctions between the fields may be more than historical and relate to the structure of the knowers and knowledge. This needs to be taken seriously into account if discrete subjects are to be merged to form one offering.

The case study also considered the extent to which those offering the merged course, and those in the departments served by the course, were able to participate in the decision-making regarding the merger. Academics steeped in particular fields might be inclined to protect their territories and so make negotiations around curriculum structures difficult, but as experts in the target fields, they also have a strong understanding of the nature of their fields.

Unfortunately, few academics have a language by which to articulate the nature of legitimation in their fields, making it difficult for them to steward the powerful knowledge they have to offer. LCT offers a language by which academics can articulate what is valued and why this is so, and therefore possibly be more able to consider what should be changed and what should be retained and we prepare our students to take on the wicked problems of this complex world.

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