Knowledge-building

Educational studies in Legitimation Code Theory

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4 LCT in praxis

Creating an e-learning environment for informal learning of principled knowledge

Karl Maton, Lucila Carvalho and Andy Dong

Transcending the divide between theory and practice.

Introduction

It is a commonplace in social scientific research to argue that theory and practice should be related. The frequency with which proclamations recur, however, attests to how far the rhetoric outreaches reality. Theory often remains separated from the practice it purports to explain and transform. As this volume highlights, Legitimation Code Theory (LCT) enables false dichotomies to be overcome, whether between concepts and data (Chapter 2), quantitative and qualitative methods (Chapter 3), theories from different disciplines (Chapter 5) or, as we illustrate in this chapter, 'the canonical opposition between theory and practice' (Bourdieu 1996: 179). That LCT is a 'practical theory' (Chapter 1) manifests in myriad forms. Principally, an ever-growing body of research attests to its capacity to provide practicable solutions to practical problems. Such studies typically bring theory to bear on the analysis *of* practice or articulate the implications of analysis *for* practice. This chapter, however, explores an arguably closer relation: embedding theory *within* practice or (to distinguish this focus) what we shall refer to as 'praxis'. Specifically, we explore a form of praxis where theory is invisibly integrated into action.

To clarify our focus we shall distinguish between *explicit praxis* where theory is voiced and *tacit praxis* where theory is silent. Consider as an example different uses of the LCT concept of *semantic waves*, which describes recurrent movements between simpler, concrete meanings and more complex, generalized meanings, and vice versa (Maton 2013, 2014a). Macnaught *et al.* (2013) describe a pedagogic intervention in which the concept of 'semantic waves' was explicitly taught to schoolteachers as part of shaping the knowledge they express in classroom discourse. In this training the concept was voiced – *explicit praxis*. However, though it informed their subsequent teaching, the teachers typically did not explicitly discuss 'semantic waves' in the classroom. In this teaching the concept was

significant but not made manifest – *tacit praxis*. The use of LCT concepts to generate explicit praxis is growing rapidly, particularly in academic development and academic literacy programmes.[1] However, this form is not always feasible or welcomed. In education, possibilities may be limited by a perceived lack of time or capacity to teach and learn both content knowledge and a meta-language for understanding the nature of that knowledge. Beyond education, explicit use of technical concepts may be viewed as militating against informal learning. In such contexts tacit praxis offers an alternative where actors need not learn the theory – they may engage in practices based on a theory without being fluent in or even knowing about the framework itself.

Tacit praxis thus offers the potential for theory to guide practice on a large scale. However, the means whereby theory can be systematically transformed into praxis remains underexplored. This is a particularly pressing issue for tacit praxis as concepts must be translated into the discursive practices that characterize the context without losing their integrity. Basil Bernstein (2000) provided a starting point by distinguishing between 'internal languages of description' or how constituent concepts of a theory are interrelated, and 'external languages of description' or how concepts are related to their referents. What he termed 'strong external languages of description' that translate between theory and the specificities of different data are crucial for knowledge-building by bringing disparate phenomena within the purview of an integrating theory. Chapter 2 (this volume) describes the creation of a 'translation device' for relating theory and data. However, integrating theory with practice has been less discussed. Maton (2014b: 209) extends Bernstein's ideas to describe 'external languages of enactment' for translating between theory and actions and suggests that each kind of practice requires its own language of enactment. Continuing our example above, the concept of 'semantic waves' can be enacted within a range of practices in education (classroom practice, student assessments, research publications, etc.) as well as beyond the field (legal proceedings, parliamentary procedures, etc.). Accordingly in the pedagogic intervention (Macnaught *et al.* 2013), enacting semantic waves in secondary school classrooms in History and Biology required translation of the concept into specifically pedagogic terms that, moreover, were appropriate to this level of education and these subject areas. To this end, genre-based pedagogies developed by the 'Sydney School' of systemic functional linguistics were drawn upon to translate semantic waves into pedagogic practices. Thus an *external language of enactment* is a means for embedding theory into practice in ways appropriate to the concrete particularities of that situated and contextualized action. It is a *translation device for praxis*. This raises the question of how such a device can be developed.

In this chapter we discuss the process of creating external languages of enactment through a case study of a mobile e-learning environment embedding the LCT concepts of *specialization codes* into learning activities within

a museum. In doing so, we also demonstrate the flexibility and functionality of the framework. First, we illustrate its capacity to embrace diverse contexts. Thus far, this volume has focused on studies of universities (Chapter 2) and schools (Chapter 3); here we venture beyond formal education to explore informal learning. Second, we show how LCT enables not only the analysis but also the generation of practice. Maton (2014b: 210) distinguishes 'organizing frameworks' that highlight issues for analysis and 'analytic frameworks' that provide means for analysing those issues. To this we add 'design frameworks' that enact the findings of analyses within praxis. Here LCT serves both as analytic framework, revealing the organizing principles of knowledge practices, and as design framework, embedding those principles within an e-learning environment.

The case study is a mobile e-learning environment called 'Design Studio' that was created by Lucila Carvalho as part of her doctoral research at the University of Sydney under the supervision of Andy Dong and Karl Maton.[2] The study is reported in Carvalho (2010) and selected findings published in Carvalho and Dong (2007) and Carvalho *et al.* (2009). Here our concern is less the product of the study than its production. In particular we focus on how external languages of enactment were developed to create a translation device between theory and tacit praxis. This represents a retrospective *re*-analysis of that process. In the case study in Chapter 2 (this volume) of how an 'external language of description' was developed within a qualitative study, the concept preceded the research. Here the concept of 'external language of enactment' emerged after the research, enabling a fresh understanding of the process and its methodological principles to be explicated. Thus, one wider insight into the 'craft of LCT' (Chapter 1, this volume) offered by this re-analysis is that not everything may be evident, intended or conceptualized prior to or even during research. Sometimes the logic underpinning a study becomes more explicit upon completion or when new concepts emerge that allow the gaze shaping the work to be converted into theory (see Chapter 1).

The chapter discusses the research process in five stages. First, we outline how the problem-situation occasioning the development of the e-learning environment shaped the choice of tacit praxis and LCT. We highlight how the specific theatre of social action and form of practice created a need for what we term *informal learning of principled knowledge* that, in turn, required a framework for enabling tacit praxis that embodied organizing principles of design practice. Second, we discuss how LCT concepts, specifically specialization codes, served as an *analytic framework* both for identifying the diverse organizing principles of design disciplines and for couching those principles in non-technical language suitable for museum visitors. Third, we describe how specialization codes served as a *design framework* for the e-learning environment by embedding organizing principles of design disciplines within an informal learning experience. We illustrate the external languages of enactment that underpin the architecture of

Design Studio. Fourth, we briefly discuss the resulting tacit praxis enabled by the environment. Finally, we stand back from the case study to consider the characteristics of external languages of enactment and their wider potential for informing practice.

The problem-situation: informal yet principled learning

Design Studio was developed and implemented in conjunction with the Powerhouse Museum in Sydney, Australia. The museum addresses topics such as history, science, technology, design, industry, decorative arts, music, transport and space exploration (Powerhouse Museum 2015). Its collection comprises approximately 385,000 objects and its exhibits aim at engaging visitors with a variety of learning experiences. At the time of this project (2005–08) there were 22 permanent and a varying number of temporary exhibitions which involved a range of experiences using touch-screen computers, audiophones, science experiments, virtual reality 3D theatres, performances, films, lectures, and public programmes. One section of the museum, the SoundHouse & VectorLab (subsequently renamed 'Thinkspace'), comprised an educational space that offered structured workshops to groups of students and/or teachers. VectorLab programmes focused on using computer systems in image production and manipulation through 2D, 3D, video and motion graphics. In 2008 a new programme was introduced at VectorLab that aimed to integrate design learning experiences into the various collections, exhibitions and online resources offered in the museum. The research re-analysed in this chapter began with the brief of creating an e-learning environment installed on a mobile computer to accompany visitors through the processes involved in designing an object. The aim was for visitors to engage with and learn about design by choosing an object to design and exploring their emerging design ideas through interactions with the mobile e-learning environment and museum surroundings. This remit shaped decisions about the kind of practice Design Studio would enable and the theoretical framework drawn upon to do so.

Choosing tacit praxis

Different problem-situations require different forms of relations between theory and practice. In this case, the specific theatre of social action and forms of practice created two potentially contradictory sets of demands on the e-learning environment that necessitated tacit praxis. These demands concerned the intellectual context of design knowledge and the social context of the museum.

First, design is a specialized field of knowledge practices. As with all such fields, to learn about design is to engage with principled constellations of concepts, procedures, skills and ways of thinking that are different to commonsense understanding. Thus, to enable participants to engage with and learn about design, the e-learning environment needed to incorporate

principles of design practice. This is more complex than might at first appear. Design comprises a series of diverse fields (including engineering, fashion, digital media and architecture) that in turn comprise a series of specialisms (such as mechanical and civil engineering, textiles and haute couture in fashion, and landscape and urban architecture). As research on the project soon showed, actors in each field view 'design', and what is valued as meaningful or valuable within 'design', in different ways (Carvalho and Dong 2007; Carvalho *et al.* 2009). Questions of what knowledge one needs to design, what are legitimate kinds of 'design knowledge' and who can be described as a legitimate 'designer' are hotly contested in the field. Thus, the e-learning environment needed not only to incorporate principles of design but to embrace the varied range of these principles that underlies the diverse knowledge practices of its constituent fields.

Second, a museum is an informal learning context. Museums typically emphasize relatively self-driven experiences – visitors usually have a high degree of freedom to wander around. In such settings, visitors select the exhibition rooms they wish to enter, the exhibits with which they wish to engage, and the extent of curatorial information they wish to access. A museum experience is thus characterized by opportunities to experiment, interact and choose where to go and what to do. The mobile e-learning environment for the Powerhouse Museum needed to reflect this freedom of choice. Another feature of such informal learning contexts is that specialized prior knowledge of participants cannot be assumed. In this case, visitors to the museum were unlikely to be familiar with either formal design knowledge and practices or the diverse criteria of meaningfulness and value characteristic of specialized fields of design. Thus, the e-learning environment needed to be couched in language accessible to the uninitiated, rather than specialized terminology, and capable of offering guidance, if elicited, regarding participants' emerging ideas as they proceeded through the collections and interactive activities offered by the museum.

In short, the remit with which Carvalho and Dong began the project was to develop a mobile means of enabling a flexible and accessible learning experience of the principles of design practice within the specific setting of the museum's collection and exhibits. This can be understood as informal yet principled learning. Such a formulation may appear contradictory: it involves both opportunities for learner choice and structured principles of knowledge. Moreover, the technological affordances of mobile e-learning environments, such as portability and interactivity, do not by themselves resolve this apparent contradiction, for they do not capture the nature of that which is to be learned. They offer informal but not necessarily principled learning. To embrace both sides of this equation required, therefore, a means of enabling *tacit praxis*: a theoretically-informed understanding of specialized knowledge practices (to enable the resulting practice to be principled) but one that is not itself an explicit aspect of the experience (to facilitate the informal nature of learning).

Choosing LCT

Tacit praxis presupposes a means of determining the organizing principles of practice and a means of embedding those principles within new practice. In this case study, it required a theoretical framework for exploring the diverse knowledge practices of design and embedding their organizing principles within an e-learning environment. Given the proclaimed significance of both knowledge and e-learning to contemporary society, one might expect a surfeit of theories to choose from. We are said to be living in 'knowledge societies' (Stehr 1994) in which 'lifelong learning' is not restricted to formal educational institutions and childhood. Accordingly, commentators on e-learning (Spector 2013) and 'learning on demand' (Allen and Seaman 2010) anticipate a proliferation of e-learning environments to enable learning anywhere at any time. Yet neither the sociology of education nor educational technology research adequately addresses these environments.

On the one hand, 'education technology has managed to largely escape the sustained critical attentions of sociologists of education' (Selwyn 2006: 418). A sociology of educational technology barely exists. Where technology is addressed, research typically sidelines issues of designing e-learning environments to explore how pre-designed environments are used and implications of their use (e.g. Selwyn 2010). Crucially for the project discussed here, studies overwhelmingly suffer from sociological reductionism that creates 'knowledge-blindness' (Maton 2014b). They typically treat knowledge practices as reflections of the interests of social categories of knowers, obscuring the forms taken by knowledge practices mediated or enabled by technology.[3]

On the other hand, educational technology research typically suffers from a different form of 'knowledge-blindness'. Under the influence of psychology, approaches construe 'knowledge' as subjective states of consciousness and mental processes or, in 'social' versions, as aggregates of individual minds or communities of practice. Knowledge is thereby understood in terms of knowing and the focus becomes generic processes of 'learning'. Knowledge itself represents a 'missing piece of the puzzle' (Howard and Maton 2011). This also holds for accounts of the design process. Instructional designers and professionals who produce the functionality, content, and interactive activities of e-learning environments tend to focus on technical matters of instructional design and view pedagogic encounters as primarily constituted by rules of human-computer interaction (e.g. Clark and Mayer 2011). The forms taken by the knowledge practices to be learned in the e-learning environment remain largely obscured.

Thus, faced with thoroughgoing knowledge-blindness in education research, Carvalho and Dong perceived a pressing need for a theoretical framework that could capture the principles of design practice with which museum visitors could engage through the e-learning environment. As

extensively shown elsewhere (Maton 2014b), LCT provides a multidimensional framework for revealing the organizing principles of knowledge practices. When the research began in earnest during 2006–07, Specialization was the most elaborated and empirically illustrated dimension of LCT (e.g. Maton 2000a, 2000b, 2004, 2007) and it was to this that Carvalho and Dong turned. Specifically, the study focused on *specialization codes*, comprising modalities of strengths of *epistemic relations* (ER) between knowledge practices and their proclaimed objects of study, and *social relations* (SR) between knowledge practices and their actors, authors or subjects (see Chapter 1, this volume). Practices may more strongly (+) or weakly (–) emphasize each relation, and these two strengths together give four principal *specialization codes* (see Figure 1.2, page 12). Simply put, these codes declare that legitimacy depends on: specialized knowledge, skills, principles or procedures (*knowledge codes*; ER+, SR–), subjective attributes of actors (*knower codes*; ER–, SR+), both specialist knowledge and knower attributes (*élite codes*; ER+, SR+), or neither (*relativist codes*; ER–, SR–).

In creating Design Studio, Carvalho (2010) used these concepts in different ways within an exploratory phase and a developmental phase. First, the concepts provided an analytic framework for exploring the organizing principles of knowledge practices in four illustrative design disciplines (architecture, engineering, fashion, and digital media). As well as highlighting the specialization codes of these fields, this exploratory phase generated a non-technical vocabulary for describing these organizing principles. Second, the concepts served as a design framework for building a series of external languages of enactment of the specialization codes in learning activities. This developmental phase embedded the organizing principles within an e-learning environment to facilitate informal learning of principled knowledge. We now turn to discuss these two phases, before exploring the tacit praxis arising from the use of Design Studio by museum visitors.

Creating a vocabulary for languages of enactment

In the exploratory phase Carvalho employed a mixed-methods approach, comprising: ten interviews (two experienced professional designers each from architecture, engineering, fashion and digital media, and two museum staff); a card sorting activity (with nine participants from design and non-design backgrounds); and an online survey (139 respondents, comprising professionals, academics, and students from tertiary design institutions). As outlined above, the first aim of this phase was to identify the specialization codes characterizing four design disciplines. Results of this aim are discussed in Carvalho (2010) and Carvalho *et al.* (2009). In summary, the research characterized engineering as a knowledge code, fashion as a knower code, architecture as an élite code, and the nascent field of digital media as including both knowledge codes and knower codes. However, reflecting the principal concern of this chapter with relating theory and practice, our focus here is on a second aim:

developing a non-technical vocabulary to translate these specialization codes into terms accessible to non-specialists in tacit praxis.

The need for such translation reflects the nature of knowledge practices. Changing technical terms into everyday language is not straightforward. As highlighted in Maton (2014b), the meanings of practices within a field depend on the *semantic structure* of relational meanings constituting that field. Thus, the same practice or term may have divergent meanings depending on the relational networks within which it resides. Failure to recognize semantic structures leads to confusion, such as assuming the word 'gravity' in 'semantic gravity' has the same meanings in LCT as it does in other intellectual fields. This is the case not only for technical concepts but also for everyday words woven into the semantic structure of a field. Studies by Sarah Howard, for example, show that for schoolteachers the meanings of words such as 'experience' and 'knowledge' depend upon the subjects they teach (see Chapter 3, this volume). Similarly, in the exploratory phase Carvalho found that designers used 'everyday' words differently. For example, when discussing 'originality' and 'creativity' in interviews, an engineering designer referred to the application of physics and mathematics to solving practical problems in new ways, while a digital media designer emphasized the significance of an individual's background and personal experiences (Carvalho 2010: 76–84). Where the former emphasizes the creative application of specialized knowledge and practices from design, the latter foregrounds the subjective attributes of the designer. These reflect different organizing principles; in LCT terms, they represent a knowledge code and a knower code, respectively. Thus even non-technical language is infused with the specialization code dominating a field.

Directly rendering academic language into everyday language is, therefore, problematic and Carvalho could not simply ask designers to describe their practice in non-technical terms. To recontextualize practices from field A into tacit praxis within field B without compromising their integrity, one needs to determine the organizing principles of practices in field A and then translate those organizing principles into the practices of field B. This involves two moments of translation: from practices into legitimation codes and from legitimation codes into practices. As we shall discuss, these moments may be simultaneous and mutually informing. In the case study, field A comprised the languages of design and field B equated to everyday language. The first translation thus involved determining the specialization codes of design fields, translating their practices into LCT concepts. However, this alone is not enough; employing LCT terms within the e-learning environment would simply replace design terms with sociological concepts. Carvalho also needed to translate the specialization codes into everyday language. A key part of the exploratory phase thus became the development of a non-technical vocabulary that could serve as the basis for external languages of enactment. This involved the creation of what Carvalho (2010) called the 'Controlled Vocabulary List' or 'CVL'.

A language for enactment

To create the CVL, Carvalho employed a mixed-method approach through a series of qualitative and quantitative studies exploring possible terms for describing professions and professionals in design. For a fuller discussion of its evolution, see Carvalho (2010: 50–8). The final study, which we shall focus on here, involved nine participants from both design and non-design backgrounds and used two sets of flash cards. One set contained words for describing a profession (e.g. 'systematic', 'social', 'empathic'), the other set contained words for describing a professional (e.g. 'a methodical person', 'a tasteful person', 'a sensitive person'). Participants effectively used the flash cards to classify words according to their emphasis on epistemic relations, social relations, both, or neither. First, Carvalho introduced participants to the notion that some professions and professionals may emphasize skills, techniques, procedures or specialized knowledge and others may emphasize the attributes of the actors involved. Second, participants were asked to read the words on each flash card from the 'professions' set and assign the card to one of four categories, according to whether it characterizes a profession emphasizing specialized skills and/or knowledge (Category 1), a profession emphasizing a person's dispositions or attributes (Category 2), either of these (Category 3), and neither of them or is unsuitable for describing a profession (Category 4). Third, participants performed the same exercise for 'professionals'.

As discussed in Chapter 3 (this volume), to reflect the relational mode of thinking embodied by LCT, empirical analysis should begin not from the four principal codes but rather from the two relations that generate those codes. Though the number of categories used to develop the CVL may tempt the reader into viewing them as reflecting four codes, Carvalho's CVL method began from the two relations: Category 1 words express stronger epistemic relations and Category 2 words express stronger social relations. Table 4.1 shows the final list of words in these two categories for 'profession' and 'professionals', in descending order of agreement (e.g. 'scientific' and 'technical' were placed in Category 1 by nine participants and 'driven by knowledge' by five participants). In further stages of the project (including the survey and e-learning environment), Carvalho used these two categories to generate descriptions reflecting different specialization codes. Knowledge-code descriptions (ER+, SR–) drew on Category 1 and avoided Category 2; knower-code descriptions (ER–, SR+) drew on Category 2 and avoided Category 1; and élite-code descriptions (ER+, SR+) combined words from both groups. The other two categories comprised words subsequently avoided in the project. Category 3 words ('clever', 'difficult', 'stimulating', 'forward thinking', 'innovative', and 'interesting') were ambivalent, expressing stronger epistemic relations and/or stronger social relations, and so excluded from the project. Category 4 words ('average', 'old-fashioned' and 'boring') were deemed unsuitable by participants and thus similarly avoided.

Table 4.1 Controlled vocabulary list (adapted from Carvalho 2010: 58)

ER+ (Category 1)		SR+ (Category 2)	
job or profession	worker or professional	job or profession	worker or professional
scientific	a scientific person	social	a social person
technical	a technical person	empathic	a tasteful person
methodical	a procedural person	driven by taste	an empathic person
systematic	a methodical person	fancy	a glamorous person
objective	an objective person	glamorous	a sensitive person
procedural	a problem solver	individual	an individualist person
skilful	a systematic person	influential	
driven by knowledge		elegant	

The CVL provided a starting point for translating the specialization codes characterizing design fields into ordinary language within the e-learning environment. It was built on further by the online survey (Carvalho 2010: 59–65), such as through questions asking respondents to use three words from the CVL to describe design disciplines, three words to describe designers, and further words of their own. Moreover, the CVL also helped provide a basis for further exploration of the organizing principles of design fields. One item asked participants to read 14 short profiles of fictitious designers and decide which, if any, of the four design disciplines (architecture, engineering, fashion and digital media) they associated with each profile. Words from the CVL, alongside emerging themes from interviews, were used to compose and inform these profiles, such as: 'X is a very technical and methodical person. That is why s/he chose this sort of work' and 'X is a sensitive person and knows when her/his work is completed because it just feels right'. The survey also explored the degree to which respondents associate a host of different strategies (such as drawing from personal experience and following methodical procedures) with their own field and included the quantitative instrument for determining specialization codes discussed in Chapter 3 (this volume).[4] Thus, the two moments of translation mentioned above – from empirical description in the language of one field to conceptual redescription and from conceptual redescription to empirical description in the language of another field – may be mutually informing and developed together rather than separate and discrete. In the exploratory phase, Carvalho combined qualitative interviews, card sorting tasks, and the online survey to develop both an account of the specialization codes of fields of design and the basis for a language of enactment embedding those codes within the e-learning environment.

Creating languages of enactment

The developmental phase comprised the creation by Carvalho of Design Studio, an e-learning environment for installation in a mobile digital device.

Upon entering the environment, museum visitors are greeted by a host, who introduces them to the general field of design and the design experience. As illustrated by Figure 4.1, the host invites visitors to choose an object to design from eight options. The host then invites visitors to select a 'virtual design advisor' to guide them through the design experience in the form of short films or written text. Visitors may choose one of four male and four female advisors, have an advisor assigned to them, or proceed without an advisor. Having also chosen the degree of support they wish to receive, visitors engage with three learning tasks based on phases of the design process: understanding the problem, creating a plan, and developing a design concept. Throughout these tasks the advisor can provide information about each learning task, explain why designers perform that kind of activity, suggest strategies for completing each task, and highlight issues for reflection about the design process upon its completion. As they proceed through the tasks, visitors interact with both Design Studio and the museum's collection to learn about the process of designing the kind of object they have chosen.

As outlined earlier, the remit of engaging museum visitors in learning about design practice meant Design Studio needed to embrace *both* the diverse organizing principles of design *and* the freedom associated with informal learning contexts. We now discuss these issues in turn, focusing on how external languages of enactment embedded outcomes of the exploratory phase into the e-learning environment to meet these needs.

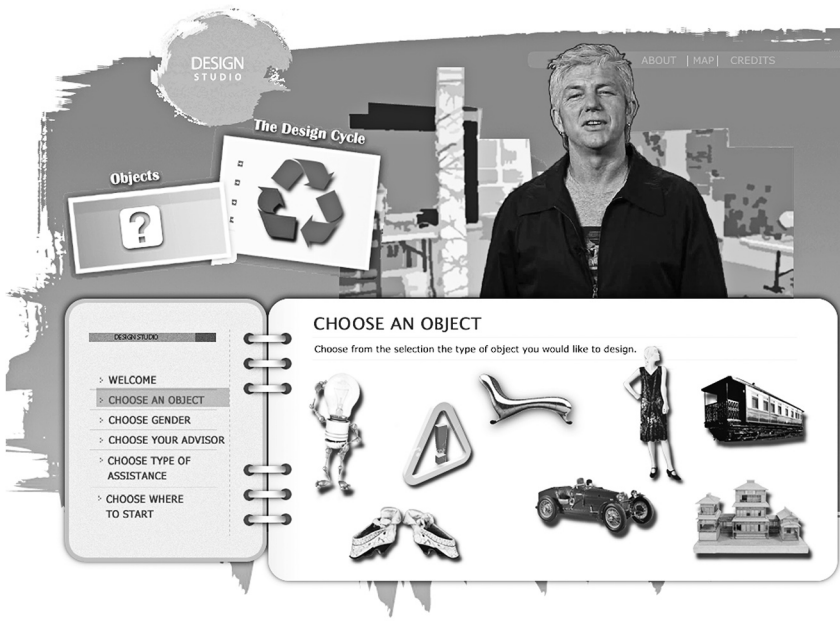

Figure 4.1 Screenshot from Design Studio: choosing an object to design.

Principled knowledge

The exploratory phase revealed one set of organizing principles (specialization codes) underlying fields of design and generated the basis for a vocabulary in which to express those principles in everyday language. To embed the specialization codes within Design Studio, a series of external languages of enactment were developed by Carvalho (2010) to express design ideas and practices in four different ways, reflecting a knowledge code, knower code, élite code, and relativist code. These translation devices for embedding theory in tacit praxis provided the screenplays and written materials featured within the e-learning environment. Thus, Design Studio comprises five different 'design studios' or pathways through the learning experience, four hosted by a virtual advisor embodying a specialization code and offering a differently principled way of learning about design. (The fifth pathway allows participants to eschew a virtual advisor.)

As summarized above, visitors are first offered a choice of objects to design (Figure 4.1). Each object tacitly represents a discipline analysed in the exploratory phase: car and train for engineering, chair and house for architecture, dress and shoes for fashion, and 3D character and icon for digital media. Visitors then choose the gender and kind of designer they wish to serve as an advisor. As Figure 4.2 illustrates, learners are offered four advisors who, when clicked on, give a short speech introducing how they view design and their characteristics, practices and beliefs, including personal

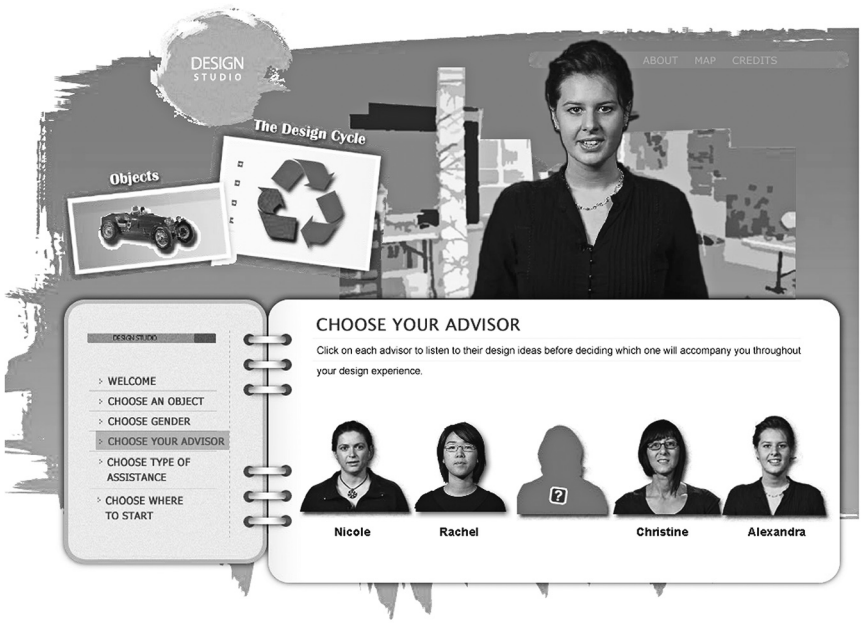

Figure 4.2 Screenshot from Design Studio: choosing an advisor (Carvalho 2010: 146).

likes and dislikes. Though each advisor reflects a specialization code, the presence of these concepts remains tacit: what the learner encounters is only the fictional name and a film of the speech. For example, the introductory speech of the knowledge-code advisor begins (with the name depending on which gender has been previously chosen):

> Hi, my name is Rachel/Roger! I believe there is always a right way of doing things. I am a very practical kind of person!… People say I am very clever and skilful, but my brilliant ideas just come out of being methodical and careful in designing, and of course being interested in stuff and reading a lot. There is a lot of knowledge developed in design, so if you just follow the rules and procedures that have been tried and tested you are guaranteed to be successful. I like doing puzzles, crosswords, following manuals and instructions, reading scientific magazines. I don't like big parties, and people who talk about feelings all the time.
>
> (Carvalho 2010: 203–4)

As this illustrates, each script incorporates language gleaned by Carvalho from the interviews, survey data and CVL (Table 4.1) of the exploratory phase. For example, the speech above positively endorses 'skilful', 'methodical', 'knowledge', and 'procedures' and disavows being social and discussing feelings. In short, Rachel/Roger tacitly emphasizes epistemic relations and downplays social relations as the basis of legitimacy: a knowledge code (ER+, SR–).

Table 4.2 outlines an external language of enactment for introductory speeches, comprising the specialization code of each advisor, summaries of their characteristics, and brief extracts from scripts. In addition to the knowledge code of Rachel/Roger, Table 4.2 illustrates that: Christine/Christopher valorizes personal expression, intuition and developing an 'eye', and dislikes rules and methodical people, embodying a knower code (ER–, SR+); Alexandra/Alexander emphasizes both technical knowledge and talent or intuition, embodying an élite code (ER+, SR+); and Nicola/Nicholas argues that anyone can do design and that it is neither special nor different to other work, embodying a relativist code (ER–, SR–). (Figure 4.2 shows a fifth option, labelled '?', which enables participants to ask Design Studio to suggest an advisor. The suggestion depends on the object chosen, matching the specialization code of the field associated with that object according to the findings of the exploratory phase. For example, for the dress, Alexandra/Alexander, the knower-code advisor, would be suggested, reflecting the code dominating fashion design).

This briefly illustrates one external language of enactment for one part of the environment: introductory speeches by advisors. The full screenplay (Carvalho 2010: 202–44) shows that the specialization codes of the advisors underlie activities throughout the e-learning environment, shaping which parts of the museum's collections and exhibits learners are advised to

Table 4.2 An external language of enactment: advisors' introductory speeches (adapted from Carvalho 2010: 203–7)

Specialization code	Summary of advisor characteristics	Extract from script: 'Introductory speech'
ER+, SR– (knowledge code)	Methodical, practical, careful, follows procedures and impersonal rules. *Likes*: puzzles, crosswords, manuals, instructions. *Dislikes*: socializing, talking about feelings	Hi, my name is Rachel/Roger! I believe there is always a right way of doing things. I am a very practical kind of person! … People say I am very clever and skilful, but my brilliant ideas just come out of being methodical and careful in designing, and of course being interested in stuff and reading a lot. There is a lot of knowledge developed in design, so if you just follow the rules and procedures that have been tried and tested you are guaranteed to be successful.
ER–, SR+ (knower code)	Design as personal expression, learning through intimate inter-personal relationships, intuition, developing an 'eye'. *Likes*: looking at art, talking to talented people. *Dislikes*: rules, 'technical stuff', methodical people.	Hi, my name is Chris! I believe the basis to good design is one's own personal expression. Each design piece says something about the person who creates it. There is not a set way of doing things and I definitely don't believe in rules. The best way to learn design is from a master-apprentice sort of relationship, which means 'learn by doing' rather than from a book. I like chatting and exchanging ideas with others … I think that if you want to be a good designer, you will need to use your own intuition and develop a certain 'eye' for it.
ER+, SR+ (élite code)	Combines technical knowledge and talent or intuition, following procedures and 'refined eye'. *Likes*: scientific programmes, creative art, original movies. *Dislikes*: anything average or commonplace.	Hi, my name is Alex! I believe a good designer needs to follow a process with specific procedures but at the same time the designer also needs to put him/herself into their work. Basically you need a combination of great sensibility with a refined eye for designing, as well as skills and technical knowledge. … I can successfully mix knowledge and talent within my design practice. I think that to be a good designer you will need to learn how to use your personal abilities and intuition in addition to skills and knowledge.
ER–, SR– (relativist code)	Average person, anyone can do design, nothing special needed, work not specialized. *Likes*: sports, beach, spending time with friends. *Dislikes*: philosophy, rules, 'nerds', sensitive people.	Hi, my name is Nic! I am what you would call an 'average common person'! I got into design because I was curious about innovative stuff. I quickly picked up some design skills and knowledge without too much effort. I believe anyone can effectively do the type of design work I do, because nothing really special is needed. My work is no different from the work other people do.

interact with, the nature of the learning tasks and suggestions on how to achieve them. As we stated earlier above, different problem-situations require different languages of enactment for translating between theory and practice. This holds not only for the overall project but also, fractally, for each part of the design experience. Thus, each kind of advice (goals of the task, reasons for undertaking the task, strategies for completion, suggestions for reflection) for each of the three tasks in the design process (understanding the problem, creating a plan, developing a concept) required its own external language of enactment tailored to that specific action. As with the introductory speeches, these drew on the vocabulary developed in the exploratory phase to generate scripts in which LCT concepts were only tacitly expressed.

For example, a key role of advisors is to suggest strategies for completing learning activities, including visiting specific objects in the museum, approaching other people for ideas, and conducting research online. Table 4.3 illustrates how specialization codes were enacted by Carvalho in advice concerning the task of understanding the design problem. Here Rachel/Roger (knowledge code) suggests that designers must be aware of 'standard practices in their field', conduct reading and research, and goes on (not included in Table 4.3 for reasons of space) to offer procedural, step-by-step guidance and templates to be completed by the user. Throughout these strategies epistemic relations are emphasized and social relations downplayed; for example, when suggesting ideas to ask other people the advice states 'Make sure you ask the same question to at least three people' and offers a template for questions. In contrast, Chris (knower code) suggests the visitor 'imagine how people would experience the object they are designing' and 'what feelings such an object would evoke', an empathy task emphasizing social relations. Other suggested knower-code strategies include reflecting on their past experiences or personal likes and dislikes, and asking other people to describe their favourite house (for example). Chris does not emphasize methodological consistency or offer templates (downplaying epistemic relations) but instead provides exemplars and models, such as interviews with designers (emphasizing social relations). Thus, specialization codes tacitly underpin every aspect of the forms taken by the pathway through the design experience.

Informal learning

In addition to engaging visitors in learning principles of design practice, the e-learning environment also needed to embrace the freedom and flexibility associated with museum contexts. Accordingly, Design Studio incorporates multiple opportunities for learners to experiment and choose their own pathways through the design experience. To achieve this, Carvalho developed external languages of enactment that drew on a concept integrated within specialization codes: 'framing'.

Table 4.3 An external language of enactment: advisors' introduction to strategies for understanding the design problem (adapted from Carvalho 2010: 140)

Specialization code	Summary of advisor characteristics	Brief extract from script: 'Understanding the design problem – How?'
ER+, SR– (knowledge code)	Methodical, practical, careful, follows procedures and impersonal rules.	Designers must always be aware of standard practices in their field. They need to keep up to date with what is going on and they often do that by reading and researching the topic, and exchanging ideas with their peers.
ER–, SR+ (knower code)	Design as personal expression, learning through intimate interpersonal relationships, intuition, developing an 'eye'.	Designers often need to imagine how people would experience the object they are designing. Designers need to think about what feelings such an object would evoke. It is also important to consider that different people like different things and have different ideas. By talking to others and researching on the topic you can be reminded of things you didn't think of.
ER+, SR+ (élite code)	Combines technical knowledge and talent or intuition, following procedures and 'refined eye'.	Designers must always be aware of standard practices in their field. They need to keep up to date with what is going on and they often do that by reading and researching the topic, and exchanging ideas with their peers. Designers also often need to imagine how people would experience the object they are designing. It is important that designers think about what feelings such an object would evoke.
ER–, SR– (relativist code)	Average person, anyone can do design, nothing special needed, work not specialized.	Different people have different ideas. By talking to others or having a look at similar objects you can be reminded of things you didn't think of.

Bernstein (1977) defined 'framing' as the degree of control available within any specific context or category. For example, in educational contexts the strength of 'framing' refers to the degree of control over *selection*, *sequencing*, and *pacing* of educational knowledge, where 'strong framing' (+F) indicates greater control by a teacher, and 'weak framing' (–F) indicates greater apparent control by students. In LCT the concept of 'framing' is integrated, alongside its sister concept of 'classification' (C), within 'epistemic relations' and 'social relations'. 'Framing' forms part of their inner structure – for example, 'ER+' (stronger epistemic relations) condenses 'ER(+C, +F)' (stronger classification and stronger framing of epistemic relations) – and can be made explicit when required. Expanding on these conceptual relations is beyond the scope of this chapter (see Maton 2014b). Here we shall just highlight that, to embrace the openness and flexibility required for informal learning contexts, Carvalho brought this integrated concept to the fore to shape the e-learning environment.

As illustrated by the left-hand menu in Figure 4.1, Design Studio offers learners a choice of: gender for their advisor, four advisors or being assigned an advisor (or having no advisor), the 'type of assistance' they desire, and where in the design process they wish to begin. Moreover, there are opportunities to change advisor pathway or skip tasks. Thus, drawing on 'framing', learners are offered opportunities to choose what guidance to receive (selection), where in the design cycle their experience will begin (sequencing), and when to receive advice (pacing), according to different strengths of framing. The options for 'type of assistance' offer three choices that enact stronger, medium and weaker framing through the experience, tacitly expressed as 'full guidance', 'guidance as required' and 'no guidance'. Subsequently, four kinds of advice are available to learners, concerning: goals of the task, its purpose, strategies for completion, and reflection. With 'full guidance', all information is made available as part of the proposed learning activities; with 'guidance as required', each kind of advice is available separately for accessing in a new screen, if desired; and with 'no guidance' just the task is displayed. Thus, while offering principled pathways through the design process, the external languages of enactment were intended by Carvalho to enable visitors considerable freedom to choose how these were experienced. Enacting theory need not constrain a sense of agency in praxis.

Enacting tacit praxis

The research project was intended to explore the *possibilities* of creating an e-learning environment capable of embodying design practices. Thus, considerable weight was given to its exploratory and developmental phases. Practical limitations of time and budget restricted opportunities to explore in depth experiences facilitated by Design Studio. Nonetheless, a suggestive pilot study was undertaken by Carvalho that examined the praxis enabled by

the environment. A group of 13 students from year 10 of an inner city private school participated in the study at the Powerhouse Museum in Sydney. This began with an interactive demonstration by Carvalho of how to use Design Studio, after which participants were grouped into pairs and each pair given a MacBook containing Design Studio. The pairs were allowed to choose to begin from any location within the museum, and given one hour to explore as they wished. Afterwards participants completed an online survey into their perceptions of design disciplines, the museum experience, and interactions with Design Studio, and engaged in an unstructured focus group discussion. Carvalho (2010: 149–65) offers a fuller account of results from the study. Here we briefly focus on the environment's capacity to enable tacit praxis by negotiating the potentially competing demands posed by informal learning of principled knowledge.

In terms of informal learning, Carvalho (2010) concluded that an informal experience was facilitated by Design Studio. Participants enjoyed the combination of support and freedom to wander. In both the survey and focus group, they described finding its content useful and appreciating suggestions of which exhibits and objects to visit. They also described the approach of using the museum's collection to obtain insights for their own designs as offering a sense of purpose but without constraint. Participants also claimed to have learned about defining ideas to work with, organizing thoughts about design, and considering perspectives to include in the process.

In terms of principled knowledge, the participants appear to have engaged in practices reflecting the specialization codes of the four design disciplines. The majority of participants (eight) selected an advisor that matched the dominant organizing principles of the associated discipline of their chosen object. However, understanding of these principles remained tacit. When relating their choice of advisor (and thus specialization code), participants tended to highlight appearance (six), chance (four), or personality (two). Ontological and epistemological issues were downplayed: two participants described their advisor selection as related to design ideas and only one highlighted their design object as the key factor. Thus, while reflecting the organizing principles of design fields, their praxis only tacitly articulated these principles. Nonetheless, their given reasons reflected the design object they chose. Participants highlighting the appearance or personality of the advisor, a knower-code emphasis, had overwhelmingly chosen to design a dress (eight), an object associated with the knower-code field of fashion.

As emphasized above, Carvalho's pilot was necessarily limited in scope. A study of a wider demographic of participants would reveal more about the capacity of Design Studio to appeal to a broad spectrum of museum visitors. Tracking movement of participants within the museum and their engagement with exhibits would also enable insights into the organizing principles underlying visitors' experiences of the design process. Moreover, the study

raises further questions, such as how the dispositions of visitors relate to their choice of objects, advisor codes and degrees of guidance, what visitors learn about the principles of design practice … among many others. However, this chapter aimed not to address such questions but rather to illustrate how external languages of enactment can be developed to facilitate tacit praxis, which they appear to have achieved in Design Studio.

Conclusion

To paraphrase Theodor Adorno (1998), theories draw credit from a praxis that has yet to begin and no one knows whether anything backs their letters of credit. Indeed, most fail to ever pay out. Too often theory and practice remain distanced. A growing number of studies are using LCT to overcome this dichotomy by analysing and informing practice. In this chapter, we focused on illustrating how the framework can be embedded within praxis through external languages of enactment, realized in the case study as the architecture and contents of an e-learning environment.

A key characteristic of such languages is making explicit relations between theory and practice. All practices are informed by a theory of some kind, though the degree to which that theory is articulated differs; we all employ principles of enactment, but some are more explicit than others (see Chapter 2, this volume). External languages of enactment make those principles explicit and thereby available for feedback or criticism, enabling practice to be improved, and for adoption or adaptation by actors in other contexts of social action, enabling cumulative experiences. For example, Tables 4.2 and 4.3 are structured so that when read from left to right they translate theory into practice, and when read from right to left they translate practice into theory.[5] This echoes the form taken by 'external languages of description', discussed in Chapter 2 (this volume). Where the latter offer translation devices between theory and data, external languages of enactment represent translation devices between theory and praxis. Thus, the right-hand columns of the Tables here contains not data collected in a study but rather creative *enactments* of the concepts within specific theatres of social action.

Comparing the Tables also highlights how each unit of action requires its own means of translation from theory, to maintain the integrity of the situated practice being addressed. In short, one does not impose a single realization of the concepts across all contexts. Thus their right-hand columns comprise scripts tailored to informing the acts of choosing an advisor (Table 4.2) and engaging with the design problem (Table 4.3). Nonetheless, both relate to the same concepts (left-hand columns), ensuring that the organizing principles of different kinds of activities can be compared and, in this case, aligned to ensure a consistently principled experience. Moreover, the realizations need not be as extensive as in this case study. Design Studio comprised five distinct pathways through a design experience, four reflecting a specialization code, with multiple options for a wide range of kinds of

advice. We have touched on but brief excerpts of lengthy written materials (see Carvalho 2010: 149–65). However, external languages of enactment may vary from brief, broad-brushed indicators couched in general terms to lengthy and detailed descriptions of precise actions. They can thus be tailored to the needs and affordances of the problem-situation.

That languages of enactment make explicit the means whereby theory informs practice does not necessitate making the theory itself explicit within the resulting praxis. In the case of Design Studio, the external languages built on Carvalho's 'CVL' method to translate theory into terms comprehensible to noviciates to design practice but without explicitly voicing LCT concepts. One need not learn or even know of LCT to successfully engage in praxis using Design Studio. Thus, theoretically-informed practice does not require the practitioner to be theoretically informed. This has implications both within and beyond education. As highlighted at the outset of this chapter, a common argument in education against enacting theories in classroom practice is that time constraints or the aptitudes of students render teaching and learning additional ideas unfeasible. Languages of enactment abrogate such obstacles without sacrificing the potential visibility of the principles involved. They offer the possibility of *both* explicit translation between theory and practice (manifested in external languages of enactment) *and* tacit praxis. Beyond education, teaching the theory itself would likely be deemed inappropriate in informal learning contexts. However, by embodying tacit praxis, informal learning need not be unprincipled, and principled learning need not be formal. In Design Studio, these ostensibly contradictory demands were negotiated through embedding specialization codes through the entire pathways, thereby enabling principled design experiences, while avoiding technical language and offering the flexibility expected of such contexts.

In enabling informal yet principled learning, the environment also illustrates how the knowledge-blindness characterizing much educational technology research and instructional design can be overcome. In bringing knowledge into the picture, LCT helps recast thinking about educational technology, enabling 'what is to be learned' to play a key role in instructional design. In the case study, LCT functioned as both an analytic framework for revealing the diverse organizing principles of knowledge practices, and as a design framework for embedding those principles within a mobile e-learning environment. Thus, against knowledge-blindness, using LCT as an analytic framework brings it into view, and against beliefs that including knowledge may restrict actors' freedom, using LCT as a design framework enables informal learning of principled knowledge through tacit praxis.

The ways in which LCT can enable praxis have only begun to be explored. Methodologically, the creation of a CVL offers a means for enabling the theory to remain tacit, but its form here raises questions for further study. For example, as discussed in Chapter 3 (this volume), it is not easy to determine single words or short phrases that evoke the same

specialization codes for everyone. However, creating a CVL represents a potentially valuable method, when triangulated with other methods, such as interviews and surveys. It is also suggestive for researching other academic and professional fields. Using specialization codes to explore how the same words may express different organizing principles, in the ways 'creativity' does in design fields, could provide a valuable indicator of boundaries around and interplay between different fields. Theoretically, the framework offers more than we have illustrated here. For example, the dimension of Semantics (Chapter 1, this volume) illuminates issues, such as moving between everyday understandings and formal knowledges, that would be invaluable for understanding and enabling informal learning (e.g. Carvalho and Goodyear 2014). Nonetheless, the preliminary case study we have discussed suggests that the framework represents a fecund basis for further projects that bring theory and practice into fruitful relation. LCT offers a means to not only interpret the world but also to change it.

Notes

1 See the LCT website (www.legitimationcodetheory.com) for information on pedagogic enactments; see also Blackie (2014), Clarence (2014), Macnaught *et al.* (2013), and Quinn and Vorster (2014).
2 The study was part of a Linkage Project (LP0562267) funded by the Australian Research Council and the Powerhouse Museum.
3 Exceptions using LCT include Carvalho and Goodyear (2014), Chen *et al.* (2011), Howard and Maton (2011), and Howard *et al.* (2015).
4 Carvalho (2010) adopted the final iteration of the questionnaire item from the music studies, the most developed version at the time (Chapter 3, this volume).
5 In Table 4.2 'likes' and 'dislikes' are summarized in the middle column for brevity of presentation. As shown by the introductory speech of Rachel/Roger quoted earlier above, these form part of each speech, as sentences of spoken prose, directly following the extracts quoted in the right-hand column.

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