USING LEARNING DESIGNS TO REPRESENT AND ASSESS REFLECTIVE LEARNING FOR UNDERGRADUATE MEDICAL STUDENTS

by

Laura Michelle Naismith

A thesis submitted to the
University of Birmingham
for the degree of
Master of Philosophy

Division of Medical Sciences
School of Medicine
University of Birmingham
November 2007

Abstract

Situated within the broader context of demonstrating professionalism amongst doctors in the UK, this thesis investigates the feasibility of using the IMS Learning Design (LD) specification as a framework for creating and assessing the personal development plans (PDPs) of undergraduate medical students. PDPs provide a documentary representation of the students' internal reflections on their previous experiences and future learning needs and LD supports the sharing and reuse of learning designs by providing a conceptual vocabulary for describing the active nature of teaching and learning processes.

Two main research activities are presented in this thesis. Firstly, a grounded theory analysis of the PDPs of final year medical students at the University of Birmingham was undertaken in order to develop a descriptive activity model of the activities that the students self-select for their own professional development. Secondly, a gap analysis of this model against the LD specification demonstrated that LD provides a sufficiently flexible conceptual vocabulary to describe the students' PDPs students as learning designs, with some limitations. The findings of these research activities were then considered with respect to how they may be used to inform the design of an LD-based assessment system to facilitate the assessment of reflective learning.

Acknowledgements

A sincere thank you to all who made this possible, especially:

- To David Davies, my supervisor and friend, for providing the map, but letting me choose my own route;
- To Stephen Kelly for always having an open door and making me feel welcome;
- To the team at CETADL/CLIC for their encouragement and unflagging support;
- To the University of Birmingham for providing this opportunity;
- And finally to Joe Horneck, my partner and best friend, for sharing in this adventure with me and for making everything better.

Thank you also to the many colleagues, friends and relatives who so generously offered their time, support and feedback.

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1. Introduction

This thesis investigates the feasibility of using the IMS Learning Design (LD) specification as a framework for creating and assessing the personal development plans (PDPs) of undergraduate medical students. Section 1.1 situates this aim within the broader context of demonstrating professionalism amongst doctors in the United Kingdom through a career-long commitment to continuing professional development (CPD). Section 1.2 introduces the concept of reflective learning and highlights its importance in determining appropriate CPD activities. Section 1.3 describes the nature of PDPs and discusses their use as a means of representing reflective learning. Section 1.4 describes the rationale for the selection of LD as a means of representing PDPs for assessment purposes and Section 1.5 presents the research questions that guided the study to investigate its feasibility. Finally, Section 1.6 concludes by presenting an outline for the remainder of this thesis.

1.1 Demonstrating professionalism in medicine

Professions, including medicine, have come under intense scrutiny in recent decades. In the UK, the public's confidence in the expert abilities of the medical profession has been undermined by high profile examples of clinical performance failures, such as the case of Harold Shipman (Ham & Alberti, 2002). This has led to a re-examination of the role of the medical profession to determine the best way that it can serve both individual patients and the wider society (Cruess & Cruess, 2000). According to the Medical Professionalism Project (2002), "professionalism is the basis of medicine's contract with society" (p. 116). At a time when Professor Sir George Alberti (2002) , President of the Royal College of Physicians of London, views the medical profession in the UK to be "under attack from the media, and

sometimes from the government" (p. 91), finding the means to demonstrate this professionalism to society is becoming increasingly important.

The Charter on Medical Professionalism lists 'commitment to professional competence' as a key responsibility of professionalism:

> *Physicians must be committed to lifelong learning and be responsible for maintaining the medical knowledge and clinical and team skills necessary for the provision of quality care. More broadly, the profession as a whole must strive to see that all of its members are competent and must ensure that appropriate mechanisms are available for physicians to accomplish this goal*. (Medical Professionalism Project, 2002, p. 116)

Doctors in the UK are required to provide evidence that they are committed to lifelong learning by undertaking appropriate and sufficient continuing professional development (CPD) activities. This evidence is used for both appraisal and revalidation purposes (Chief Medical Officer, 2006). CPD, however, involves more than keeping knowledge and skills up-to-date. It also includes "preparation for a changing role in the organisation, new responsibilities and promotion" (Challis, 1999, p. 373) that *"*enables professionals to expand and fulfil their potential*"* (Calman, 1998, p. 5), and as such is important for doctors at all stages of their careers.

Early practice is recognised as influential in developing a physician's "personalised pattern of practice" (Eraut, 1994, p. 11). Recent training initiatives, such as Modernising Medical Careers (MMC) (NHS, 2006a) have made it clear that a commitment to CPD is expected of junior doctors as well. The MMC Foundation Programme for junior doctors in the UK introduces a national curriculum, upon which both a formal training programme and workplace-based assessments of competence are based (NHS, 2006b).

The General Medical Council (GMC) (2003) has outlined the importance of using the principles of professional practice, including CPD, as the basis of the undergraduate medical education curriculum. To this effect, Simpson *et al.* (2002) identify 'outcomes for personal

development' as one of twelve principle domains of learning outcomes used to ensure that graduates of Scottish Medical Schools develop into competent and reflective practitioners.

It has been noted that students, upon entering medical school, "become immediately engaged in a process of acculturation into the medical profession" (Challis, 1999, p. 371). Indeed, medical education can be seen as an identity development process (Slotnick, 2001), where students both gain knowledge and experience in the 'how' of being a physician and learn what it means to be part of the medical community. If professionalism is to be embedded within a doctor's identity, it is clear that this process must be initiated as early as possible.

1.2 Continuing professional development and reflective learning

Previous research has demonstrated that the impact of CPD can be enhanced if activities are linked to individual learning needs (Firmstone *et al.*, 2004). Effective identification of learning needs involves reflection on past activities and their outcomes, and as such there has been a renewed focus on the importance of reflective learning to CPD. Though professionals are continually learning on the job, this reflective, self-directed learning is seen as essential to produce doctors that are "prepared for lifelong learning and able to meet the changing needs of their patients" (Spencer & Jordan, 1999, p. 1280) and as a means for incorporating learning into their general professional knowledge base (Eraut, 1994).

The concept and merits of reflective learning have long been recognised by educationalists, and reflective learning is gaining popularity as a means of developing professional competencies in medicine. Inherent in the concept of reflection is the belief that people learn by doing, or through experience. Dewey (1916) talks about experience as involving both something we actively *do* and something we passively *undergo* and Kolb (1984) presents learning as a cycle initiated by active, physical engagement in concrete

experience. Race and Brown (1998) critique Kolb's notion of a unidirectional 'cycle' and instead proposes a model, analogous to how ripples spread in a pond, where the phases of Kolb's learning cycle interact and overlap. In this model, the 'wanting' starts the action and reflection is seen as the 'digesting' of 'feedback' from the external world on an individual's actions (the 'doing').

Boud *et al.* (1985) maintain that experience by itself does not constitute learning. Like Kolb and Race, they believe that reflection is necessary to build on this experience in order to formulate and test knowledge, which ultimately leads to new learning and new experiences. Schön (1983) termed this kind of reflection to be 'reflection-on-action', and also introduced the concept of 'reflection-in-action' to describe a type of reflection that occurs during the experience itself. Reflection-in-action is about challenging assumptions in order to address situations of uncertainty, uniqueness or conflict.

Dewey (1916) emphasised that reflection should involve mental engagement. Reflection is "the discernment of the relation between what we try to do and what happens in consequence" (p. 116). Kottkamp (1990), encompassing some of the ideas of Schön (1983), presents the following extended definition that captures the essence of reflection as intended by this thesis. Reflection is:

> *A cycle of paying deliberate, analytical attention to one's own actions in relation to intentions – as if from an external observer's perspective – for the purpose of expanding one's options and making decisions about improved ways of acting in the future, or in the midst of the action itself.* (Kottkamp, 1990, p. 183)

1.3 Personal development plans as a representation of reflective learning

Though active, reflection is essentially an internal process that must be represented before it can be made public. Eisner (1993) describes representation as "the process of

transforming the contents of consciousness into a public form so that they can be stabilised, inspected, edited, and shared with others" (p. 6). PDPs are becoming increasingly common as a means by which the reflective learning process is represented (see, for example Field, 1998; Ajeneye, 2005; UK Centre for Legal Education, 2006). A PDP is a document that contains some reference to identified learning needs, details of corresponding self-selected activities intended to fulfil these needs and a set of measurable learning outcomes which provide the evidence that the learning needs have been fulfilled. PDPs thus make the backward and forward connection that is central to experience (Dewey, 1916), explicit.

Though PDPs may vary in form, scope and intended audience, the minimum data set, according to Holloway (2000), should include the individual's name, details of when and how it will be reviewed, a list of SMART (specific, measurable, attainable, resourced, time-limited) objectives, strategies for achieving these objectives in terms of activities, resources and time limits, and details of the measures that will be used to evaluate the success of achieving the objectives. Details of the intended timescale are necessary to situate the planned development activities within the context of other work and life commitments.

The past decade has seen a wealth of initiatives to introduce PDPs across the continuum from medical education to professional practice (Challis, 2000). Since the introduction of the new General Medical Service (GMS) contract in April 2004, general practitioners (GPs) have been required to compile PDPs on an annual basis (Royal College of General Practitioners, 2005). Junior doctors are required to compile a PDP as part of their Foundation Learning Portfolio (NHS, 2006c). PDPs have also been suggested as a meaningful activity for dentists (Firmstone *et al.*, 2004) and are a key component of the Progress File initiative in UK higher education (Quality Assurance Agency for Higher Education, 2006).

This thesis takes the view that reflective learning is a competency that can be developed, demonstrated and, ultimately, measured. In particular, the assessment of PDPs has been suggested as a measure of the capacity of the learner to engage in reflective learning (Roberts *et al.*, 2006). The empirical evidence base for the assessment of reflective learning is small (Schutz *et al.*, 2004) and there is even some disagreement within undergraduate medical education as to if reflective learning should even be assessed at all (Driessen *et al.*, 2005). Assessment, however, is "a statement to the trainees of what is important" (Mohanna *et al.*, 2004, p. 131) and thus can provide the extrinsic motivation for them to engage in reflective learning in the first place (Albanese, 2006). Assessment also brings legitimacy to the process, thus providing a means of reassurance to students, lecturers, the medical profession, the government, and ultimately the general public, that reflective learning is of central importance to the medical school curriculum. PDP assessment is already performed informally as part of the appraisal process for both GPs and NHS career grade doctors. As appraisal has been recently linked to revalidation (Chief Medical Officer, 2006), the objective and reliable assessment of PDPs will likely become increasingly important.

Before proceeding further, it is important to note that there are somewhat conflicting uses of the term PDP. Within a medical context, PDP is usually used to mean a document, but PDP has also been adopted as a term amongst the higher and further education sector to describe a process of career planning and development for students (Higher Education Academy, 2006). In this thesis, the term PDP will be used solely as a reference to the documentary representation.

1.4 Rationale for representing personal development plans as learning designs

Recent trends in education, including lifelong learning, globalisation and the possibilities offered by new technologies, have introduced new requirements for flexible and open learning environments that can be accessed independent of time and place (Koper & Manderveld, 2004). Technology specifications, such as the Learning Object Model (LOM) (IEEE Learning Technology Standards Committee, 2005) and the Shareable Content Object Reference Model (SCORM) (Advanced Distributed Learning, 2006), have been developed to both describe learning objects, which are self-contained 'chunks' of learning material, and to support their interoperability between different learning environments. While these specifications help to separate learning content from the specific delivery mechanism used (Ellaway *et al.,* 2005), they only provide limited means for specifying relationships between different types of objects within a learning environment (Koper & Manderveld, 2004). In response, the Open University of the Netherlands (OUNL) set out in 1998 to develop a specification that would provide "a pedagogical framework of different types of learning objects" that could express relationships between learning objects and define the structure for their content and behaviour (Koper & Manderveld, 2004, p. 539). This specification was developed by abstracting from pedagogical approaches described in the literature. While there were several concurrent efforts to develop educational annotation languages (Rawlings *et al.*, 2002), it was the OUNL's educational modelling language (EML) that later acted as the basis for the development of the IMS Global Learning Consortium's Learning Design Specification (LD).

This thesis proposes the use of LD as a framework through which PDPs be represented and assessed. LD was chosen as the basis of this framework because it is based

on the premise that learning is an active process. Specifically, LD takes the view that, in order to learn, "people in specific groups and roles engage in activities using an environment with appropriate resources and services" (Koper & Tattersall, 2005, p. viii), which is a direct challenge to the learning object model of learning as a process of consuming content (Koper & Olivier, 2004).

LD provides a conceptual model that can be used to describe teaching and learning processes in "semantic, formal and machine-interpretable way" (Koper, 2006, p. 13). By using this consistent notation, many kinds of educational designs can be created and reused across learning contexts. LD presumes that educational practices to promote learning have underlying design ideas and principles that could be captured by an explicit representation, or *pedagogical model* (Koper & Olivier, 2004). A pedagogical model can be described as "a set of rules that prescribe how a class of learners can achieve a class of learning objectives in a certain context or knowledge domain in the most effective way." (Koper & Olivier, 2004, p. 98). A learning design thus "specifies under which conditions, what activities have to be performed by learners and teachers to enable learners to attain the desired learning objectives" (Koper & Olivier, 2004, p. 98).

1.5 Thesis aims and research questions

The aim of this thesis is to investigate the feasibility of using LD as a framework for creating and assessing the personal development plans of undergraduate medical students. The specific research questions this thesis will address are:

1. What types of self-selected learning activities currently feature within the personal development plans of undergraduate medical students?
2. Does LD present any limitations to representing the personal development plans as learning designs?

3. How can this representation be used to facilitate the reliable assessment of a student's capacity to engage in reflective learning?

LD is a relatively new specification, having been released in February 2003. Consequently, this thesis takes an exploratory approach to the use of LD and does not attempt to prove that it is the ultimate means of representing PDPs, but merely that it is an appropriate and technically feasible means of facilitating the assessment of reflective learning.

1.6 Thesis overview

Chapter 2, *Literature Review,* provides background material for this study through a review of relevant prior literature, including a review of how practicing physicians engage in self-directed learning and the difficulties they encounter in creating achievable PDPs, issues around the assessment of reflective learning and previous work evaluating the pedagogical expressiveness of LD. Chapter 3, *Methodology,* describes the predominantly qualitative study that was designed to investigate the research questions that this thesis sought to address. Chapter 4, *Activity Model*, and Chapter 5, *Gap Analysis,* document the study's findings, whilst Chapter 6, *Implementation Model,* describes how an LD-based representation of undergraduate medical students' PDPs can be used to support and assess reflective learning. Finally, Chapter 7, *Discussion and Conclusions,* summarises the findings of this study in light of the literature, considers its limitations and suggests ways in which it can influence future research and practice.

2. Literature Review

This chapter reviews prominent literature that is relevant to the issues explored in this thesis. Section 2.1 reviews the rich body of literature on how practicing physicians select learning activities for their continued professional development. Section 2.2 examines the difficulties faced by physicians attempting to create a realistic, time-constrained personal development plan and Section 2.3 discusses issues around the assessment of reflective learning. Section 2.4 provides some background information on the use of LD and evaluates previous work to explore its pedagogical expressiveness. Finally, Section 2.5 concludes this chapter by summarising the key issues from the literature that this thesis will investigate.

2.1 Characteristics of physicians' self-directed learning activities

When aiming to support medical students in developing their reflective, self-directed learning capabilities, it is important to consider how they are likely to behave as practicing physicians. Slotnick (1999) proposes that the process by which physicians undertake learning activities is motivated by either *specific* or *general* problems. Specific problems tend to be related to the needs of individual patients, while general problems are more likely to be linked to general gaps in knowledge and skills. Jennett *et al.* (1995) identified three distinct forms of self-directed learning: formal self-directed learning, which corresponds to Slotnick's definition of general problems; semi-structured learning, corresponding to the definition of specific problems; and informal, self-directed learning, which doctors tend to view as part of their daily routine and can include such activities as journal reading, ad hoc conversations, interactions with drug or equipment company representatives, and attendance at regular events like departmental or practice conferences. Furthermore, GPs are much more likely to

keep up-to-date via their professional networks, rather than through direct appraisal of research-based evidence (Gabbay & le May, 2004).

Moore *et al.* (1995) investigated the forces that impacted on physicians' attendance at formal continuing medical education (CME) events such as short courses, conferences, workshops and symposia. They categorise their purposes for participation by the desired outcomes, including educational outcomes, such as gaining more information about a specific technique or treatment; regulatory outcomes, such as fulfilling the requirements of medical license, hospital privileges, or professional society membership; and social outcomes, which relate to the physician's "desire for a change of pace from busy office practice" (p. 223). They argue that attendance at formal CME events forms part of a physician's broader information-seeking strategy in which they consult a wide variety of resources, including print sources (e.g. journals), discussions with peers and mentors, formal CME activities, non-print media and practice audits.

While there is a growing body of knowledge as to the types of activities that physicians self-select for their continuing professional development, little is known about the types of professional development activities that are self-selected by medical students. Slotnick (2001) argues that, for physicians-in-training, their "ways of knowing how to satisfy their needs in clinical settings must change dramatically" (p. 1016), as they lack the experiences and insights of practicing clinicians.

Even practicing clinicians, however, face difficulties in selecting appropriate CPD activities. Eraut (2001) identifies three problem areas in CPD: "the identification of learning needs, prioritisation of those needs, and matching prioritised needs to learning opportunities and activities" (p. 9), areas that are all specifically addressed in the creation of a PDP.

2.2 Physicians and personal development plans

In addition to acquiring the necessary knowledge and experience to become practicing physicians, undergraduate medical students must also become familiar with the processes by which they will be assessed as professionals. In general practice for example, PDPs have been used for the formative assessment of reflective continuing professional development for a number of years (Roberts *et al.*, 2006). Challis *et al.* (1997) describe a study in which 34 general practitioners volunteered to participate in a programme designed to encourage reflective practice. They were required to develop a personal education plan in which they identified their individual learning needs and presented an outline methodology for meeting these needs. They were also expected to document their progress towards attaining the plan through a portfolio. A key component of the programme was the mutual support offered through a co-mentoring group.

The plans were often found to be overly ambitious for the breadth and depth of learning that could be realistically undertaken within the time allowed (15 hours). Even though the voluntary nature of this study would suggest that the GPs were highly motivated, there were many reports of insecurity in completing the paperwork. Emphasis on the need for structured support diminished after six months, which was interpreted as an increase in the doctors' confidence.

Ramsay *et al.* (2003) interviewed 14 general practitioners in order to discover the factors that either helped or hindered the adoption of both PDPs and practice professional development plans (PPDPs). Among the conditions for successful adoption of PDPs and PPDPs include:

- the doctors are given ownership over the process through elective external leadership and facilitation;

- the plans are structured around clear learning needs, including uniprofessional needs, multiprofessional needs, practice needs, population needs and clinical governance requirements;
- the amount of paperwork is limited;
- the plans are limited to realistic aims in order to prevent over-ambitious targets;
- the doctors are clear about the target audience for the plans and how they are meant to be used, for example in terms of reassuring the public, demonstrating conformity to national standards and identifying underperforming doctors.

Whilst Ramsay *et al.* (2003) found that the doctors were strongly motivated by the connection between PDPs and revalidation, they were hindered by the time needed to learn and "to implement systems that facilitated new ongoing work requirements" (p. 175), suggesting that there is a need for further research in this area.

Appraisal was made a contractual obligation for all UK doctors in 2002 (Department of Health, 2000). The compilation of a PDP is now mandatory for GPs, but PDP assessment remains formative. The link between assessment and revalidation (Chief Medical Officer, 2006) has led to a contentious debate as to how PDPs could be assessed "in a reliable and valid way to determine a doctor's fitness to practice" (Roberts *et al.*, 2006).

2.3 Assessing reflective learning

Schutz *et al.* (2004) argue that if "reflection is a key skill in achieving the learning outcomes of particular courses and is acknowledged to have a positive impact on care, then it must be assessed" (p. 50). Assessment has multiple purposes, and may be broadly categorised into being formative or summative. Formative assessment aims to give feedback during the process of learning in order to help learners become more reflective and capable in assessing their own work. Learners appreciate the opportunity for this kind of feedback which does not

count toward final grade (Black & William, 1988; Bone, 2006). In contrast, summative assessment is aimed more at providing a record of achievement and may be used to determine the progression routes open to the learners. Summative assessment should provide learners with the opportunity to demonstrate conceptual understanding of the important ideas, to use professional instruments and processes, and to apply their understanding to solve new problems, think critically, and make informed choices/decisions (Atkin *et al.*, 2001).

In general, the following criteria are desirable for both formative and summative assessments (Mohanna *et al.*, 2004):

- It is *valid* and measures what it is supposed to measure.
- It is *reliable* – repeated application of the tool will lead to essentially the same result each time. Learners with the same level of performance will be judged equally regardless of who administers the tool.
- It is *practicable* in terms of cost, time and the skills of the assessors.
- It is *fair* to both the learners and the teachers. Differences between the learners that are irrelevant to the subject being assessed do not affect the result and the marking is not unnecessarily burdensome for teachers.
- It is *useful* to both the learners and the teachers. It discriminates between good and poor candidates.
- It is *acceptable* in terms of culture and gender.
- It is *appropriate* to what has been taught and learnt within the programme or curriculum.

Fade (2004) acknowledges that students need guidelines about what is expected of them, but argues against the development of detailed assessment criteria. Indeed, Pearson and Heywood (2004) suggest that the proscribed format for GP registrar portfolios in their study

had a demotivating effect. In contrast, Gordon (1992) found that introducing explicit standards for self-assessment "had the effects of reducing anxiety, increasing motivation, focusing attention, or otherwise facilitating learning" (p. 676), a position that appears to be supported through the work of McCrindle and Christensen (1995). They describe an experimental study in which forty university students taking an introductory biology course were randomly assigned to produce either a learning journal (experimental) or a scientific report (control) over a five week period. In each case, students were provided with explicit instructions as to the expected format. The journals and reports were examined on a weekly basis to ensure they had been completed, and were evaluated on the amount of learning demonstrated. The learning journal group demonstrated the ability to use more metacognitive strategies and more sophisticated cognitive strategies during a set learning task and also demonstrated significantly higher academic achievement as measured by their performance on a multiple choice exam.

The need for explicit and detailed assessment criteria seems to be related to the learners' level of professional maturity. For example, Driessen *et al.* (2005) suggest that portfolios should be well structured and guidelines should be explicit while students are learning to reflect, but that this structure should be given more freedom as their reflective skills develop. Schutz *et al.* (2004) agree, stating that assessment tools need to be "flexible enough to allow students to progress at their own speed and to demonstrate their abilities to reflect in a variety of ways" (p. 54).

According to Race (1993), the learner should be involved in the development of the assessment criteria. Robinson and Davies (2004) describe a study to explore the perceptions of final year undergraduate dental students towards assessment of clinical activities based on personal development diaries (PDDs). A total of forty students participated over the course of

one year. Six criteria for the PDD assessment were mutually agreed between students and staff: punctuality and preparation for the clinical activity, time management, professionalism, quality of clinical dentistry, cross-infection control and record keeping. The assessment instrument was a modified analogue scale. Descriptors of poor and excellent were given on either side of a 10 cm horizontal line. Both the teacher and the student made independent assessments by making a mark along the length of the line. There was also a section within the PDD for recording significant experiences, and there were opportunities for reflective discussion concerning ratings, behavioural patterns or problems. While there was no attempt to measure learning gains, results from focus groups with the students suggest that they valued the use of the PDDs in facilitating reflection, though they viewed the time required to complete them as a disadvantage.

Roberts *et al.* (2006) state that the purpose of PDP assessment is not to measure performance itself, but rather to assess the learner's to engage in reflective CPD. Challis *et al.* (1997) note that, when assessing PDPs, the completion of a learning cycle should be demonstrable and it should be apparent that activities were selected to match educational needs. Roberts *et al.* (2006) present six main criteria for the reliable and effective summative assessment of the PDPs of general practitioners. These include: a credible identification of learning needs, an achievable learning plan, a relevant assessment plan, a record of the work conducted, an understanding as to whether needs have been met and a resulting change in practice. They developed a corresponding marking matrix that achieved high construct validity in that it was able to successfully distinguish between different levels of performance.

It is also necessary to consider the practical aspects of assessing reflection. Schutz *et al.* (2004) describe an initiative at Oxford Brookes University, in which pre-registration nurses used learning contracts to identify objectives and to write reflective accounts of how

these were achieved. Eventually, the time-consuming and cumbersome nature of assessing the learning contracts led to "the search for new tools for assessing both competence and reflection" (p. 49). In the study by Roberts *et al.* (2006), 5 to 7 assessors would be needed to reach a summative reliability of greater than 0.8, a number which is clearly impractical in most academic and practice settings.

Flexible tools that can support medical students in developing their reflective learning capacities are clearly desirable (Schutz *et al.*, 2004). In order to be effective, such tools must both support students in authoring appropriate and achievable PDPs and also support tutors in providing high quality feedback. Educational modelling languages, such as IMS Learning Design, provide a means to address these issues by providing a standardised representational format that is both human and machine readable.

2.4 IMS Learning Design and pedagogical expressiveness

The IMS Learning Design (LD) specification (IMS Global Learning Consortium, 2006a) provides a common vocabulary that can be used to translate existing learning designs, such that they can be understood regardless of the pedagogical approach adopted (Koper, 2005). LD uses the basic metaphor of a theatrical play to specify how the learners and activities will be coordinated in time (Koper, 2005). A play has roles for one or more actors. The actors have a script that both contains their lines and specifies the order in which they must be delivered. The actors deliver their lines on a stage, which portrays the current scene taking place.

In LD, the *play* is contained within the *method* (Olivier & Tattersall, 2005). The method can be viewed as the script, providing the link between the roles, activities and environments associated with the activities. The play may be divided into one or more

sequential *acts.* The acts have *role-parts* that specify which *role* has to perform which *activity.*

Activities are further categorised into *learning-activities*, *support-activities* and *activity-structures* (Olivier & Tattersall, 2005). The *activity-description* describes what the person performing the role has to actually do, and make reference to the *environments* (the stage) that are available to perform these actions. Activities can also include a *title, metadata, learning-objectives* and *prerequisites*. Activity-structures can be used to group together a set of activities and activity-structures, which permits learning designers the ability to "create more elaborate sets of activities and choices to present to users on an individual basis" (Olivier & Tattersall, 2005, p. 32).

There are two predefined roles within LD – the *learner* role and the *staff* role, each of which may be further specialised. A learner may also "take up different roles at different stages of the learning process" (Burgos & Griffiths, 2005, p. 85). Multiple roles may be active at the same time and the end of each act provides a synchronisation point for simultaneous actions by different actors.

Figure 2.1 illustrates the basic structure of LD, with the asterisk indicating that the element may occur more than once:

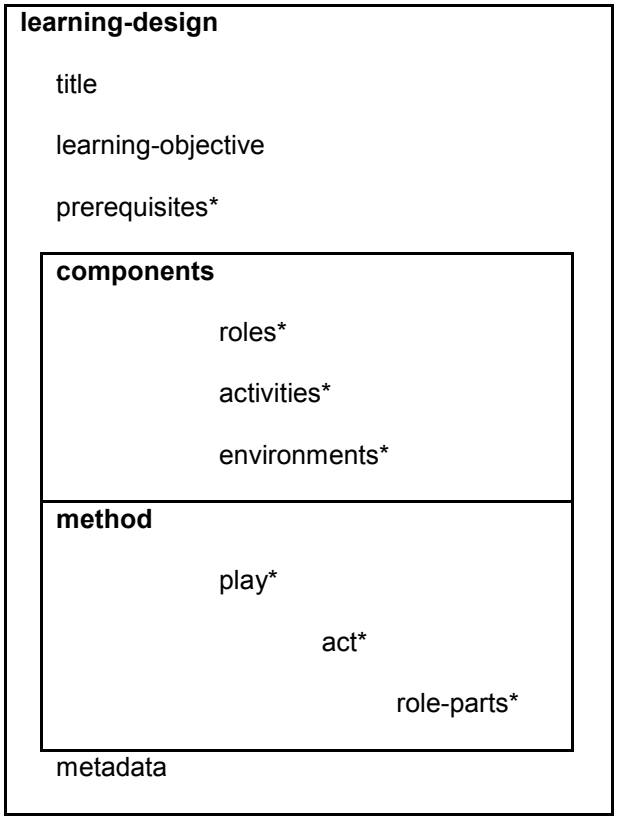

Figure 2.1: Overview of LD, reproduced from (Burgos & Griffiths, 2005, p. 93)

2.4.1 Implementation details

LD has three implementation levels: A, B and C. Level A is the simplest level of implementation and includes the basic vocabulary to specify roles, activities and environments. Level B adds to Level A properties, conditions, global elements and monitoring services, which allows for more complex learning designs. Properties can store information about a person, a role or an entire learning design and the state of these properties can be used to determine the learning flow. Level C adds to Level B the concept of notifications, which can be used to make new activities available to the learners (Burgos & Griffiths, 2005). Notifications can be triggered either manually or automatically in response

to events in the learning process, such as when a property value changes, an activity is completed or a condition evaluates to true (van Es & Koper, 2006).

LD is implemented as a specification written in extensible mark-up language (XML). In general, mark-up languages provide a means to encode documents such that they can be understood by both computers and humans. XML documents are written in plain text according to a number of simple rules, which are strictly enforced (W3Schools, 2006). Text-based tags called *elements* are used to denote particular types of information. An XML specification is essentially a consensus on what elements can be used to mark-up the data and what those elements are intended to represent.

The LD specification itself consists of three main documents: an Information Model, a Best Practice and Implementation Guide and an XML binding document (Olivier & Tattersall, 2005). The Information Model document (IMS Global Learning Consortium, 2003a) includes both a conceptual model that defines the terms that are used to define teaching and learning processes, as well as an information model that specifies the relationships between the components described in the conceptual model. The Best Practice and Implementation Guide (IMS Global Learning Consortium, 2003b) provides guidance as to how to implement the specification and the binding document provides example XML document instances.

2.4.2 Evaluation

The ability of LD to represent learning designs regardless of pedagogical approach is called *pedagogical expressiveness* (van Es & Koper, 2006). The following requirements, taken from the original specification for the Educational Modelling Language (EML – the language from which LD was derived), help to further define the meaning of pedagogical expressiveness (van Es & Koper, 2006):

- **Pedagogical Flexibility**: The language must be able to describe learning designs based on different theories and models of learning.
- **Completeness**: The language must be able to fully describe a unit of learning, including learning objects (both digital and non-digital), relationships between these objects and the activities and workflows of the staff and students who use these objects.
- **Personalisation**: The language must be able to describe personalisation aspects that allow the unit of learning to be adapted based on the preferences, prior knowledge, educational needs and particular circumstances of the learners.

There is still much exploratory work underway to "prove the concepts behind LD" (Koper & Tattersall, 2005, p. ix) and to determine the limits of this representation. Two of the primary domains in which LD has been investigated are computer supported collaborative learning (CSCL) (see, for example Caeiro *et al*., 2003; Hernández-Leo *et al.*, 2005) and the provision distance learning courses (see, for example Rasseneur *et al*., 2004; Tattersall *et al*., 2005). The pedagogical expressiveness of LD has also been tested in a systematic way, by randomly selecting 16 lesson plans randomly from an inventory of databases available on the Internet and coding them in LD (van Es & Koper, 2006). While there were some difficulties encountered in implementing specific activity and group management scenarios, it was indeed possible to represent each of the lesson plans with LD.

A number of limitations with LD have been previously identified. Caeiro *et al.* (2003) argue for a separation between an *activity* and the *environment* in which it is performed. This would allow an activity to be performed in multiple environments, in much the same way that LD currently supports the ability for an activity to be performed by different *roles*. They also

argue against the rigid, sequential nature of *acts* and instead propose the use of *transition information* to describe the routing conditions for the acts in a play.

Rasseneur *et al.* (2004) found two principal limitations in using LD to model a distance learning curriculum. The lack of a precise categorisation for *learning objectives* and *prerequisites* is suggested to inhibit the learner's ability to attain a comprehensive, conceptual understanding of the curriculum. Also, the fact that activities are not associated with beginning and ending dates may impede the learner from being able to evaluate his progress in light of various agendas (e.g. his own, the institutions, other learners').

LD can also be used to represent learner-centred approaches (Koper & Olivier, 2004). Rasseneur *et al.* (2004) propose an approach for managing individual projects, which they define as a set of features of a distance learning curriculum that the learner perceives to be linked and that he decides to approach in an integrated fashion. They propose that this could be modelled as an *activity-structure* within the complete learning design for the entire course. Whilst Koper (2004) proposes, in principle, that "it is also possible that a UOL, including the learning design, is designed specifically for and by learners themselves" (p. 104), projects where students use LD to author their complete learning designs, have thus far not featured in the literature.

There has been some previous work on the use of LD to promote reflective practice. Using LD provides teachers and learners with a vocabulary to explicitly describe their teaching and learning processes (Koper, 2005). The act of creating this explicit representation and sharing it with others has been previously suggested to promote communication and reflective practice amongst teachers in higher education (Casey *et al.*, 2005). Indeed, in the ACETS (Assemble, Catalogue, Exemplify, Test and Share) project (Ellaway *et al.*, 2005), a modified LD structure was used to describe exemplars in which teachers in the healthcare

professions reused digital learning materials, such that the format of the exemplars was "consistent and comparable" (p. 13).

Implementing LD, however, is not without its challenges. Casey *et al.* (2005) found that the terminology adopted by LD presented an initial barrier to teachers and required sensitive mediation to overcome. The teachers in the ACETS project had difficulty modelling their educational activities in an abstract way (Ellaway *et al.*, 2005). To overcome these challenges, Casey and Brosnan (2005) suggest that the best strategy is to start with the teachers' existing conceptions and then move outwards towards the use of new concepts and terms, rather than expect the teachers to adopt new frameworks from the outset.

LD has also been suggested to support reflective learning amongst students. Specifically, the JISC-funded Web Services for Reflective Learning (WS4RL) project (JISC, 2006) produced a generic web service specification for creating and reviewing personal information across multiple databases. Learners could thus provide links to evidence relating to previous education activities, achievements and skills when creating their learning designs. Rasseneur *et al.* (2004) propose the use of evaluation and regulation tools alongside learning designs to help the learner monitor his own progress and review it in the light of his original objectives.

2.4.3 Tools

Whilst LD representation used to be a mainly conceptual exercise, new tools are beginning to facilitate its exploration within mainstream educational practice (Baxendale *et al.*, 2006). Three main tools are needed to enable users to work with learning designs (Burgos & Griffiths, 2005): editors (see, for example Reload, 2006), runtime players (see, for example Open University, 2006) and repositories. The implications of the wide scale implementation of such tools, however, have yet to be investigated.

2.5 Summary of key issues

Whilst it is likely that practicing physicians have more insight when selecting learning activities for their continued professional development than medical students, they still face difficulties in identifying learning needs, prioritising them and matching these prioritised needs to learning opportunities and activities. As these areas are specifically addressed when creating a personal development plan (PDP), it is important to consider how medical students might be best supported in this process, as early practice is highly influential in developing their identities as reflective practitioners.

The effective introduction of PDPs relies on the development of systems that facilitate new work requirements. The link between appraisal and revalidation for doctors in the UK suggests that it is also necessary to consider tools to facilitate the practical, reliable and valid assessment of PDPs.

When assessing reflective learning, there should be sufficient structure to ensure that the learners clearly understand what is required of them, but enough flexibility to allow their skills to develop. Where possible, the learners should be involved in the development of assessment criteria. Relevant criteria for the summative assessment of PDPs include a credible identification of learning needs, an achievable learning plan, a relevant assessment plan, a record of the work conducted, an understanding as to whether needs have been met and a resulting change in practice.

The IMS Learning Design (LD) specification provides a conceptual model and vocabulary to facilitate the representation, sharing and reuse of a variety of educational scenarios. Initial work suggests that it is sufficiently flexible to describe a range of learning scenarios, with some limitations. LD can be used to support learner-centred approaches and reflective practice, but the current body of literature in this domain is limited.

3. Methodology

This chapter presents the methodology that was used to investigate the feasibility of using the IMS Learning Design (LD) specification as a framework for creating and assessing the personal development plans (PDPs) of undergraduate medical students. Section 3.1 identifies the target population for this study and describes the context in which they produced their PDPs. The data for this study consisted of PDPs that had been previously submitted to and assessed by the Medical School at the University of Birmingham. Section 3.2 justifies this selection of this data source, provides a quantitative analysis of the entire data set and describes the inclusion criteria by which a working data set was selected. Section 3.3 describes the first of two main research activities in this study: the development of an activity model based on a grounded-theory analysis of the PDPs. The second main research activity is described in Section 3.4: a gap analysis of the activity model against the LD specification. Section 3.5 describes how researcher bias was minimised within the study and Section 3.6 concludes this chapter by addressing the ethical considerations that arose.

3.1 Target population

The target population investigated in this study consists of 5th (final) year undergraduate medical students at the University of Birmingham who are working towards an MBChB degree. The final requirement that they must fulfil before they can provisionally register with the GMC and take up their first positions as junior doctors is to complete the last module of the Professional Development Programme: Special Study Module 8 (SSM8).

SSM8 represents the first formal opportunity for these students to demonstrate and be assessed on their individual capacities for reflective learning. It is intended to build upon their experiences with group reflective activities that are conducted during the Year 1 and

Year 2 components of the MBChB's Community Medicine strand. Within SSM8, students are required to arrange and carry out five to six weeks of personalised learning activities, with a particular emphasis on clinical learning experiences. They are required to submit a PDP that demonstrates an awareness of their own learning needs as well as their abilities to set and prioritise appropriate learning outcomes.

The summative assessment for the module consists of assessment of both the PDP and on a reflective learning report that is submitted during the clinical experience period. The time-pressured nature of the assessment of the final report has led to discussions that it should instead be integrated into the MMC Foundation Learning Portfolio (NHS, 2006c). In the future, the students' grade for SSM8 could therefore be based solely on the assessment of the PDP.

3.2 Description of the data

The primary data used in this study were actual PDPs submitted by students to the Medical School. Though increasingly neglected in research, documents can be a highly valuable data source (Silverman, 2001; McCulloch, 2004). In this study, the use of documents had several advantages. All SSM8 students were required to submit a PDP, and thus issues of selection bias could be avoided. The PDPs formed a major component of the summative assessment for the module and, as such, the students had motivation to construct high quality documents. The PDPs were constructed without researcher involvement or influence, thus further helping to eliminate possible bias, and finally, they were readily accessible through the Medical School archives, which greatly simplified data collection procedures.

In the 2004/2005 academic year, 246 students were on the register for SSM8. A total of 241 paper-based PDPs were retrieved from the Medical School archives by the Director of

Learning and Teaching and provided for analysis. Also provided was a paper-based summary of the student register, which listed the numerical mark given for each student's PDP, a set of paper copies of the files kept by the assessors to record marks and feedback, an incomplete set of paper copies of the mark sheets that were handed back to the students, and a six page handout about SSM8 that was distributed to the students in January 2005.

Each PDP had been assessed by two academic staff members in the Medical School. The workload for the first marking was split amongst five academic staff members, who each assessed approximately 50 submissions. Each PDP was given a numerical mark from 0-100, which was translated into a letter grade (A-E) based on the following categorisation: <40 = E; 40-49 = D, 50-59 = C; 60-69=B; >70 = A. A grade of 50 or higher was considered a pass. The mark sheets also gave the students a 'Yes' or 'No' as to whether they could go ahead with their activities as planned, and provided additional comments according to the following headings: 'Timetable/Location/Supervision', 'Rationale' and 'Learning Outcomes'. The Director of Learning and Teaching acted as a second marker for all the PDPs, in an effort to ensure consistency across the cohort. If a student was not given the go-ahead to proceed with his or her activities as planned, he or she was expected to review the comments provided and submit a revised PDP. The resubmission was reviewed by the Director of Learning and Teaching, but was not formally assessed.

The criteria by which the SSM8 PDPs are assessed was not represented externally, but instead appeared to be based on an internalised set of expectations, as well as intra-cohort and inter-cohort comparisons.

The handout described the purpose and intended outcomes of SSM8, as well as providing some guidance to students as to how to select appropriate activities and how the PDPs were to be submitted and assessed.

3.2.1 Inclusion criteria

In order for a PDP to be considered in this study, the selection of activities that it featured had to have been approved by the assessors. This was ascertained by reviewing the mark sheets and identifying whether the student was given a 'Yes' or a 'No' to go ahead with their activities. This was not necessarily related to the student receiving a high assessed mark, as the PDPs were also assessed for quality of the rationale for the selection of activities and the quality of specified learning objectives. Of the 241 student PDPs that were available for analysis, 102 had an assessed mark, but were missing mark sheets to indicate whether or not the students were given the go-ahead, two were missing all assessment data, and 12 were not given the go-ahead to carry out their planned activities. This reduced the number of PDPs for consideration to 125.

3.2.2 Representativeness of the selected PDPs

The only criteria available to determine if there were differences between the 'Selected' and 'Not Selected' groups were assessed mark and gender. An unpaired t-test was used to compare the mean of the assessed mark for the plans (Table 3.1). The two-tailed p-value equalled 0.461, which is not considered to be statistically significant.

Table 3.1: Comparison of Assessed Mark for SSM8 PDPs, Entire Data Set

Group	Mean	St Dev	N
Selected	57.69	8.790	125
Not Selected	56.61	13.77	121

The Fisher's exact test was used to analyse the 2x2 contingency table representing the composition of males and females in each group (Table 3.2). The gender of the student was determined by the title indicated on the register (i.e. Miss = female, Mr = male). This was not

specified for one student in the 'Not Selected' Group. The two-tailed p-value equalled 0.296, which is not considered to be statistically significant.

Table 3.2: Comparison of Number of Males and Females, Entire Data Set

Group	Females	Males
Selected	80	45
Not Selected	68	52

The selected group was therefore deemed to be representative of the entire cohort.

3.3 Activity model development

The first phase of this study consisted of analysing the PDPs in order to determine how they were currently structured and what types of activities featured within them. In theoretical terms, this may be interpreted as the development of a descriptive model. A model is a simplified representation of reality that identifies that important components of a system, but does not necessarily assume that there are relationships amongst these components (Grix, 2001). A successful model reduces the data by capturing the essential elements of the research topic while maintaining "both the richness and heterogeneity of the original information" (Polaschek *et al.*, 2001, p. 537).

3.3.1 Procedure

There are many ways to analyse documents and text. This analysis took a grounded theory approach (Glaser & Strauss, 1967; Strauss & Corbin, 1990), which focuses on the formation of theory from the observation and coding of textual data. Grounded theory has been referred to as an emergent methodology (Dick, 2005), implying that theory is concealed in empirical data. Grounded theory is considered to be particularly useful where there is a lack of previous research on the topic under investigation (Saradjian & Nobus, 2003). Though

grounded theory is usually applied to interview data, data collected via other methods can also be used (Dick, 2005). Examples of alternate data sources used in grounded theory include field notes from participant observation (Hubert & Hollins, 2006), websites (Fleischmann, 2005) and narratives provided by research subjects (Polaschek *et al.*, 2001).

1. Sample selection

The first step in using grounded theory is to select a sample for analysis. The sample is likely to be defined by the research situation, but should be made as diverse as possible. Grounded theory advocates the use of purposive sampling (Dick, 2005) to increase the diversity of the sample and uncover additional properties of identified categories.

As mentioned previously, the only criteria on which to formulate sampling criteria were assessed mark and gender. Previous studies have shown that there are differences between males and females with respect to their clinical experiences as undergraduate medical students (Higham & Steer, 2004), which could be potentially be reflected in the activities that feature in their PDPs. As reflective learning has been shown to be associated with higher academic achievement (McCrindle & Christensen, 1995; Sobral, 2001), it is also conceivable that there might be observable differences based on the assessed mark of the PDP. Hence, these criteria were used to purposively sample the PDPs.

The set of 125 PDPs that met the inclusion criteria for this study was divided into eight categories based on these two criteria.

Table 3.3 displays the number of PDPs in each category. Note that there were no PDPs with a grade of 'E' that met the inclusion criteria for this study.

Table 3.3: Distribution by Gender and Assessed Mark, Working Data Set

	Female		Male	
	Count	**% of total**	**Count**	**% of total**
Grade A	9	7.2	5	4.0
Grade B	23	18.4	9	7.2
Grade C	41	32.8	28	22.4
Grade D	7	5.6	3	2.4

The PDPs were analysed in sets of eight, with one plan selected at random from each category. This meant that each category represented 12.5% of the total sample, which translates into over sampling of the female A, female D, male A, male B and male D groups and under sampling the female B, female C and male C groups.

2. Coding

Grounded theory relies on a process of constant comparison to identify categories and their properties (Glaser & Strauss, 1967). Following data collection, a process of coding is initiated wherein data is compared to data and then to theory as the analysis progresses. The researcher's notes on the relationships between the categories are recorded as memos.

In this study, a process of open coding was used "to discover, name, and categorize phenomena" (Strauss & Corbin, 1990, p. 181). The author, and sole researcher, analysed each PDP individually in four main stages. Firstly, the structure of the entire document was reviewed, which consisted primarily of reviewing the use of headings, subheadings, tables and lists. Secondly, the structure of how the planned activities were presented was reviewed. This included looking firstly at the number of activities and then at identifying common properties of activities by comparing the current document to previously analysed PDPs. The next step was directed at identifying different categories of activities and the properties of these categories. This was done by reviewing any prose found in the document on a line-by-line basis and labelling relevant concepts. The categories and their properties were refined

through an iterative process of comparison with previously analysed PDPs. Finally, any feedback provided to the student on the mark sheet was reviewed to identify any internalised expectations held by the assessors about the particular activities selected by the students.

Selective coding was also used to 'fill-in' any missing detail on the properties of the categories (Strauss & Corbin, 1990). This consisted of scanning the PDPs that were not selected in the initial sampling procedure for specific examples that met the criteria for the particular category. If the PDP was suspected to contain additional categories, it was included for detailed analysis.

3. Theoretical saturation

With grounded theory, sampling continues until theoretical saturation is reached in each category. Theoretical saturation assumes the following conditions have been met: new data does not reveal any new information about a category, the existing categories and properties can account for the new data and the relationships between the categories are well established and validated (Strauss & Corbin, 1990). Often, only a small sample is required to reach theoretical saturation. Sample sizes found in the literature varied from a minimum of 13 (Driessen *et al.*, 2005) to a maximum of 38 (Zink *et al.*, 2006).

In this study, the two main categories of activities, discussed in detail in Chapter 4, were identified after the analysis of a very small number of plans and theoretical saturation was suspected following the complete analysis of 16 PDPs. An additional 17 PDPs were selectively sampled to reveal additional properties of individual activity categories. None of the selectively sampled plans revealed the need to introduce new activity categories.

It should be noted that this analysis differed from traditional grounded theory in that it sought a sufficient number of categories to describe the students' activities, rather than a single 'core' category (Strauss & Corbin, 1990). There are, however, many examples in the

literature of grounded theory analysis resulting in multiple core categories, ranging from two categories (Kumar & Gantley, 1999) to 21 categories (Polaschek *et al.*, 2001).

4. Evaluation

In grounded theory, the criteria for evaluating the adequacy of the emerging theory are straightforward. Firstly, the theory has to fit the situation and secondly, the theory has to work, or help to make sense of the experience and to manage the situation more effectively (Dick, 2005).

A validation process, including both internal and external validation, was used to determine if these criteria had been met.

Internal validation

Firstly, the activity model was validated against the original data set of 125 PDPs by randomly sampling an additional 16 PDPs that had not featured in the original analysis.

The criteria of assessed mark and gender were used to determine whether or not the test data set was representative of the working data set, which is the set of 125 PDPs that met the inclusion criteria for this study. An unpaired t-test was used to compare the means of the assessed marks for the two groups (Table 3.4).

Table 3.4: Comparison of Assessed Mark for SSM8 PDPs, Working Data Set

Group	Mean	St Dev	N
Working Data Set	57.69	8.790	125
Test Data Set	54.93	3.900	16

The two-tailed p-value equalled 0.218, which is not considered to be statistically significant. The test data set consisted of PDPs from 9 females and 7 males. The Fisher's exact test was used to analyse the 2x2 contingency table representing the composition of males and females in each group (Table 3.5).

Table 3.5: Comparison of Number of Males and Females, Working Data Set

Group	Females	Males
Working Data Set	80	45
Test Data Set	9	6

The two-tailed p-value equalled 0.588, which is not considered to be statistically significant. The test data set was therefore deemed to be representative of the working data set. As the working data set was found to be representative of the entire cohort, the test data set can be inferred to be representative of the entire data set as well.

The activity model was translated into a coding framework and then applied to the test data set. As in the original coding process, each PDP was analysed individually in four main stages: analysis of the entire document structure, analysis of how the planned activities were presented, analysis of the individual activities and finally, analysis of any feedback provided.

External validation

In order to validate the activity model externally, it was presented to the Director of Learning and Teaching at the Medical School, followed by a 40 minute semi-structured interview to explore his views as to whether he felt that the model was plausible, in accordance with his observations and generalisable across student cohorts.

Notes were taken during the interview, which was also recorded with the consent of the Director. Following the interview, the "note expansion" method was used to produce a complete summary (Frechtling & Sharp, 1997). In this method, the recording is reviewed to ensure that the notes include all of the main points and to clarify any ambiguous issues. Comments that were deemed to be particularly relevant to the evaluation were transcribed verbatim. This note expansion method is less time-consuming than producing a complete verbatim transcript, and is ideal for gathering rapid feedback.

3.3.2 Other methods considered

Initially, corpus linguistics techniques (Barnbrook, 1996) were investigated for this analysis. Corpus linguistics is the study of language through collections of machine readable texts (corpora) that have been acquired from real-world samples. Corpora are typically large, though Barnbrook (1996) notes that "the most common features of the language will be well represented even in relatively small quantities of text" (p. 25). Basic linguistic techniques include the analysis of word frequency, the analysis of word patterns in context (concordance) and the analysis of word pattern frequency (collocation). The frequency analyses allow for the set of texts matching the research criteria to be statistically compared to other known corpora, such as the Bank of English (Cobuild, 2004).

A number of factors contributed to the ultimate rejection of these techniques for this analysis. Firstly, the PDPs were not available in machine-readable form, though this could have been resolved by using a scanner with optical character recognition (OCR). More fundamentally, the desired outcome of this analysis was not information about the language that the students were using to describe their activities, but rather on identifying the types of activities they were performing. Corpus linguistics techniques would also not be particularly helpful in ascertaining document structure.

Content analysis (Neuendorf, 2002) is an increasingly popular technique in the domain of quantitative research. Neuendorf defines content analysis as "the systematic, objective and quantitative analysis of message characteristics" (p. 10). It is broader than corpus linguistics techniques, which would allow more flexibility to investigate document structure and activity characteristics. Like corpus linguistics, however, content analysis is focused on measuring the frequency of specified variables. In its attempt to meet the standards of the scientific method, content analysis stipulates an a priori research design that requires the variables,

measurement techniques and coding rules to be established before the observation begins. A grounded theory approach may be used to discover these variables (Neuendorf, 2002), but the ultimate aim of this method is on measurement, rather than interpretation. As such, this method was deemed unsuitable for this analysis.

3.4 Gap analysis

Following the development of the activity model, the next stage in the study was to investigate the suitability of LD for representing the PDPs as learning designs. Two of the key proponents of LD, van Es and Koper (2006), acknowledge that "little is known about the possibility of expressing current educational practices with LD" (p. 230). As such, there are no established methods for ascertaining the suitability of LD for representing a particular learning scenario.

Caeiro-Rodríguez *et al.* (2005) propose a benchmark for evaluating the expressiveness and suitability of LD that is based on the identification of perspectives and patterns and Ellaway *et al.* (2005) explored the use of an adapted version of LD for teachers to record teaching activities. The study by van Es and Koper (2006) is thus far unique in the literature, however, in that it that features a systematic testing of the pedagogical expressiveness of LD. This study has thus been relied upon heavily in this stage of the research.

Several criteria were used by van Es and Koper (2006) to investigate the suitability of using LD to represent a randomly selected set of 16 lesson plans. First, they state that it should be possible to match the concepts found in the lesson plan with LD's conceptual model. Then, the static components of the lesson plans can be mapped onto LD. Parallel activities and dynamic workflow considerations are then investigated and represented using either the conceptual vocabulary or with conditions and properties. Additional considerations

in their study, such as addressing personalisation aspects and informing learners when certain activities take place, are beyond the scope of this study.

Situations in which LD could not directly represent the components of a particular learning plan can be defined as either recoverable or non-recoverable errors (van Es & Koper, 2006). A recoverable error describes a situation in which a component could not be matched with a term in the LD conceptual vocabulary. Recoverable errors thus highlight potential weaknesses in the specification itself. In contrast, a non-recoverable error describes a situation in which it is not at all possible to express the learning plan with LD.

This procedure can be interpreted as a type of gap analysis. Gap analysis is a general term for any technique that seeks to detect the discrepancies, or gaps, between two sets of measurements. Examples from the literature include gaps between perceived and actual customer service quality (see, for example Brown & Swartz, 1989), existing and desired biodiversity protection zones (see, for example Strittholt & Boerner, 1995) and planned and actual project performance (see, for example Winch *et al.*, 1998). This study was primarily concerned with the gaps in which an activity model property could not be matched with an element in LD. Situations in which a mandatory LD element did not match up with an activity model property were also considered.

3.4.1 Procedure

The procedure by which the gap analysis was conducted is similar to the document analysis method employed by van Es and Koper (2006), as this method was found to be the most effective and reliable of the three methods employed in their study. In this case, the 'document' to be analysed was the activity model itself.

It is necessary for the person carrying out the document analysis to "have extensive experience in LD coding and have an awareness of the possibilities the specification offers"

(van Es & Koper, 2006, p. 239). In order to meet these criteria, the LD Information Model document (IMS Global Learning Consortium, 2003a), which describes both the conceptual model and the formation model, was reviewed in-depth by the author. This helped to ensure a correct understanding of the LD terminology. Where necessary, clarification was sought from the worked examples in the LD Best Practice and Implementation Guide (IMS Global Learning Consortium, 2003b).

Next, an attempt was made to match each activity model property to a specific LD element, or set of elements, with any identified gaps being noted. Situations in which the information model's description of an LD element was not sufficiently robust to determine whether it was an exact match were also identified as gaps. Finally, the identified gaps were reviewed to determine if a suitable alternative could be suggested.

3.4.2 Other methods considered

In their study to assess the pedagogical expressiveness of LD, van Es and Koper (2006) employed two additional methods: expert analysis and learning design coding. For the expert analysis, they recruited two experts who were familiar with LD and had previous experience in using it. van Es and Koper are both based at the Open University of the Netherlands, where there is a substantial community of LD enthusiasts and it was not difficult for them to find experienced LD coders. Each expert rated the ease of representing a lesson plan using a three point scale (no problems, recoverable errors, non-recoverable errors). If errors were noted, they were asked to indicate the part of the lesson plan to which they applied.

This method was not deemed to be suitable for this study. Whilst it was highly efficient, it was not found to be particularly effective or reliable. It was difficult to find "LD

coders that had sufficiently broad experience" (van Es & Koper, 2006, p. 248), and analysis of the initial rating only showed a slight agreement between the two experts.

The learning design coding method involved following the procedure described in the Best Practice and Implementation Guide (IMS Global Learning Consortium, 2003b). Firstly, an analysis phase is carried out in order to represent the learning scenario as a narrative. Secondly, the narrative is modelled as a UML activity diagram. UML (Unified Modelling Language) is a standards-based language for specifying, constructing, visualising, and documenting the artefacts of a software-based system (ALMA Software Glossary, 2000). UML activity diagrams are used to model the procedural flow of a sequence of actions, such as buying a concert ticket or registering for an online course (Bell, 2003). The activity diagram then forms the basis for an LD-compliant document instance. The document instance can be considered as an outline of the structure of the learning design. The final phase was the creation of a Unit of Learning, in which the document instance was bundled with the associated content and resources.

This method was not adopted for this study. Whilst it was found to be as effective as the document analysis, it was substantially less efficient in that it was ten times more time-consuming (van Es & Koper, 2006).

3.5 Researcher bias

A mainly qualitative approach was deemed to be most appropriate to answer the research questions posed by this study. One of the most common criticisms of qualitative research is that is strongly subject to researcher bias, which can be addressed by forming a research team that includes several skilled qualitative researchers (Mays & Pope, 1995). By definition, however, the expectation for a postgraduate level study is that it is designed and

carried out by a single researcher. Whilst this inherent limitation is acknowledged, it was still possible to adopt a number of strategies in order to ensure a rigorous study design.

Bias in this context is defined as the holding of certain preferences, beliefs or viewpoints that may inhibit impartial judgement (Bias, 2000). Mehra (2002) notes that it is important to recognise that all qualitative research is biased to some degree and that bias can be observed even at the level of deciding on a research topic. This study began with several biases, including the belief that learning is an active process, the notion that a person's capacity for reflective learning can be developed and a willingness to explore technology to support this process.

As mentioned previously, the use of pre-existing documents from a compulsory student assignment helped to avoid issues of selection and researcher bias. While the author was not employed by the Medical School and thus had no influence on the design of the SSM8 curriculum or the assessment procedures used, the selection of grounded theory as a principle research method helped to address areas of potential institutional bias. By starting with the students' PDPs, the activities that feature within the activity model are those that the students have selected for themselves, which may or may not be the same activities that are recommended or encouraged by the Medical School. It also helps to ensure that LD is evaluated based on how well it can represent the students' activities, rather than starting with LD and carefully selecting only those activities that can be represented by it.

Using the activity model as the basis for the gap analysis also helps to avoid bias towards a particular technological implementation. LD is evaluated based on whether or not it can sufficiently represent the activity model, rather than the activity model being evaluated based on whether or not it ascribes to the principles and concepts of LD.

Quantitative summaries of the qualitative data are used in an attempt to further avoid researcher bias in the way that the results are presented (Mays & Pope, 1995). Here, the quantification helps to condense the results to ensure they can be understood easily (Mays & Pope, 1995). It is also important to emphasise that the findings of this study are situated in, and thus strongly dependent upon, the context in which they were investigated (Mehra, 2002).

3.6 Ethical considerations

Grix (2001) identifies five necessary ethical considerations when designing a research study: harm, consent, deception, privacy and confidentiality. McCulloch (2004) notes three additional ethical considerations when using documents: copyright, freedom of information and data protection. This section discusses how each of these considerations is related to the overall study design.

1. Harm

Individuals involved in the research need to be protected against both physical harm and also psychological harm in the form of stress or embarrassment. As this analysis was based on historical documents that were submitted for assessment, their analysis did not present any risks to the students in terms of their future career opportunities.

2. Consent

Individuals should be able to choose whether or not they participate in a research study. Burman and Kleinsasser (2004) acknowledge that this is not always possible when using work from past students, but advise proceeding cautiously to prevent exploiting students' vulnerabilities. Though it was not possible to obtain explicit consent from the students who submitted the PDPs, this study had the full co-operation of the Medical School's

Director of Learning and Teaching. Using grounded theory as the methodology for analysis meant that only a sample of the PDPs needed to be reviewed and analysed in depth, thus limiting any potential for exploitation. Data from the PDPs, including assessment and feedback data, is also presented anonymously in this thesis, such that no individual can be identified.

3. Deception

Deception involves misrepresentation or omission of facts related to the purpose, nature, or consequences of a research study. No deception was involved in this study.

4. Privacy

Information used in a research study must be used and presented in such a way as to protect the individual's anonymity. As mentioned previously, all data from the PDPs that is presented in this thesis is presented anonymously. To further prevent any possible identification, the locations in which the students performed the activities (e.g. local hospitals) are also presented anonymously.

5. Confidentiality

Information given by or about an individual must be kept secure from others. In this study, the access to the student PDPs and feedback was restricted to the Medical School Education Unit, who holds the primary responsibility for administering and assessing SSM8.

6. Copyright

According to University of Birmingham regulations, the copyright for original work produced by a student belongs to the student who authored it (Kendall, 2007). As such, extracts from the PDPs should be properly attributed. Similarly, the feedback provided to the

students by the markers should also be attributed to the academic staff member who authored it. In this study, short extracts from the students' PDPs were used to illustrate key categories and themes in the activity model. Examples of the feedback given by the academic staff members are used to highlight the current difficulties encountered in the assessment process. As the PDPs must be used anonymously to comply with other ethical considerations, guidance was sought from the Legislation Manager in the University's Information Services Department as to how to balance these concerns. He suggested that the use of short extracts without attribution is permissible, providing that it is acknowledged that the work remains copyright of the students and academic staff members, but recommended that longer quotations (i.e. 50-100 words) be cited anonymously (Kendall, 2006).

7. Freedom of information

As the University is a public institution in the UK, it has a legal responsibility to comply with the Freedom of Information Act (Crown Copyright, 2000). Student work that is held by the institution, as in this case, may be the subject of a valid freedom of information request (Campbell, 2005). In this study, permission to access the PDPs was granted by the Medical School's Director of Learning and Teaching and as such, a freedom of information request was not necessary.

8. Data protection

The Data Protection Act (DPA) (Crown Copyright, 1998) assigns legal responsibility to protect the personal data of individuals, and includes rules as to how the data may be gathered, processed and stored. Personal data is identifying data that relates to a living individual, including facts and opinions made by or about the individual. In the context of this study, this includes data available from the student register (e.g. name, sex, assessed

mark) as well as some data available from the PDPs (e.g. location of students' placements, their opinions about their personal development) and the feedback data provided by the academic staff members who acted as assessors. The PDPs did not contain any sensitive personal data, as defined by the DPA.

Schedule 2 of the DPA outlines the conditions for processing personal data, at least one of which needs to be met. In this case, the students gave their consent to the processing of the PDPs for the purposes of assessment when they submitted them to the Medical School. Though the students did not provide explicit consent for the data from their PDPs to be processed by this study, Section 33(2) of the DPA stipulates that "the further processing of personal data only for research purposes in compliance with the relevant conditions is not to be regarded as incompatible with the purposes for which they were obtained" (Crown Copyright, 1998, 33(2)). The relevant conditions are that the processing of the data is not used to make decisions with respect to particular individuals and that it is not processed in such as way as to cause substantial damage or distress to any of the data subjects. In this study, the analysis of the students' PDPs aimed to identify activity characteristics common across the cohort and was not used to make any decisions about the individuals themselves (e.g. to revise their assessed mark). In order to avoid any damage or distress, the data from the PDPs is presented anonymously such that no individual can be identified. This study should therefore be deemed to be in compliance with the DPA.

4. Activity Model

This chapter presents the findings of the grounded theory analysis of the SSM8 students' PDPs as a descriptive activity model. This model provides an abstract representation of the students' self-selected professional development activities such that the pedagogical expressiveness of LD for describing PDPs can be evaluated. Section 4.1 considers the overall structure of the documents, whilst Section 4.2 identifies properties that were common to all activities. Section 4.3 describes the activity categorisation in detail, whilst Section 4.4 presents an analysis of the feedback provided by the assessors. The results of the external and internal validation procedures are presented in Section 4.5 with Section 4.6 providing a summary of this chapter's main findings.

In this chapter, short extracts from the students' PDPs and the feedback provided on them are used to illustrate key categories and themes in the activity model, as well as to highlight the expectations held by the assessors. In order to comply with the Data Protection Act (Crown Copyright, 1998), these extracts have not been credited to their authors and any identifying details have been replaced with asterisks (***). It is acknowledged that the copyright for these extracts rests with their original authors.

4.1 Document structure

The six page handout that was distributed to the students at the beginning of SSM8 stipulated some requirements for the structure of the PDPs. They were instructed to be a maximum of two sides of A4 and to adhere to the following format:

- **Personal Details**: Name and Guild (Student ID) Number
- **Proposed Timetable/Location/Supervision:** For each week of the six week period, students were required to identify the nature of the proposed experience

(e.g. A&E, Respiratory Medicine, Microbiology), where this experience was to be undertaken, the clinician or academic the student has chosen to supervise the experience and whether or not the student had started negotiating this placement.

- **Rationale for Selection of Experiences**: For each experience, students were required to explain how it would fulfil their learning needs.
- **Learning Outcomes**: Students were required to identify eight to ten specific learning outcomes relating to their chosen experiences. These were to be detailed enough to provide a basis for judging whether or not the plan was effective.

In the set of 16 PDPs that were analysed in detail, the stipulated requirements were often used as headings, resulting in highly structured documents. Each PDP that was analysed gave the document a title (e.g. 'SSM8 Preparation', 'SSM8 Part 1', 'SSM8 Report: Part 1') and included the required personal details in either the document header, or in an initial section.

In most cases, the next section of the PDPs presented a week-by-week overview of student activities for the period. In the original set of 16 PDPs, 10 presented this information in list format, five in tabular format and one as a combination of list and tabular formats. Eight of the students who used a list format identified the stipulated requirements for each activity (e.g. Location, Supervisor) using a consistent format, with three of them using headings as identifiers. For the other two students who used a list format, this information had to be extracted from longer text descriptions of each activity. Fifteen of the 16 students referred to the weeks by number (e.g. Week 1, Week 2), with the other student using the specific dates that the weeks commenced instead. In total, seven of the 16 students stipulated the specific dates that their activities were to take place.

Activities were differentiated from each other using two main methods. The primary method was by analysing the student-provided titles that appeared in the PDP. If the titles changed from week to week (e.g. Week one – 'OSCE tutor', Week 2 – 'Shadowing PRHO'), this was interpreted as a change in activity. The secondary method used to identify changes in activity was to detect changes either in the location in which it was performed, or the supervisor nominated by the student. For example, one student specified 'House Office Shadowing' for Weeks one and 2, but specified two different hospitals and supervisors, and as such, these were interpreted as two different activities. It is acknowledged, however, that this is a matter of interpretation, as it may be possible to view these activities as contributing parts of a larger activity. Figure 4.1 presents a breakdown of the number of proposed activities per student. This ranged from a minimum of three to a maximum of seven, with most students specifying either five or six activities.

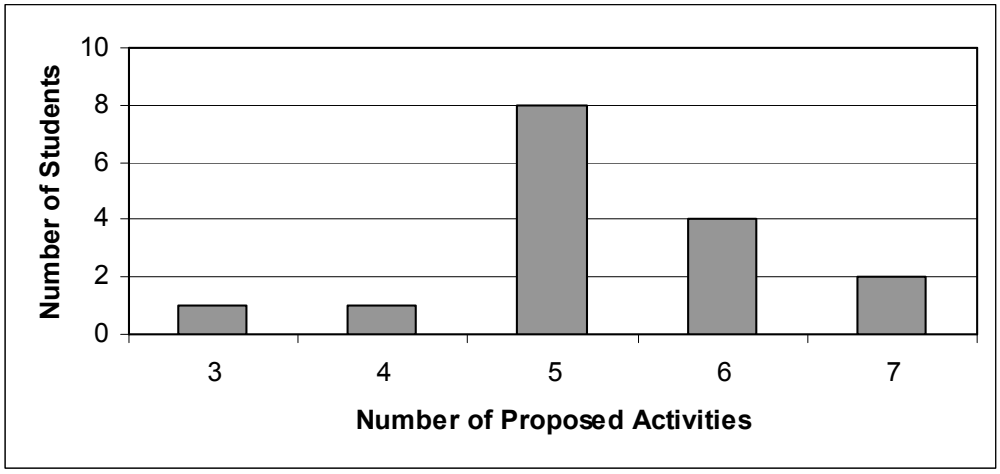

Figure 4.1: Number of activities featuring in SSM8 student PDPs

To explain their rationale for the selection of activities, 10 students used a separate 'Rationale' section, five students included this as part of the week-by-week activity overview, and one student did not appear to specify any rationale for the selection of activities. Of the 10 students who used a separate section, eight of them referred to each activity separately, using

either the week number or a short description of the activity as a subheading. The other two students did not clearly delineate each activity using headings, but did refer to each separately within their prose. Of the five students who included the rationale section as part of the week-by-week activity overview, four used a subheading to identify this component, while the other student included it within his prose.

Eleven students included learning outcomes as a separate section at the end of the document, four included them as a subheading in the activity overview, and one student did not appear to specify any learning outcomes. The learning outcomes were presented as either bulleted or numbered lists. Most students had separate learning outcomes for each activity, even though they may have been presented as a common list. There were two examples of students who wrote an additional paragraph instructing that some or all of the learning outcomes provided applied broadly across the SSM8 period.

Figure 4.2 presents a breakdown of the number of proposed learning outcomes per student. This ranged from a minimum of zero to a maximum of 18, with most students specifying between nine and 11 learning outcomes.

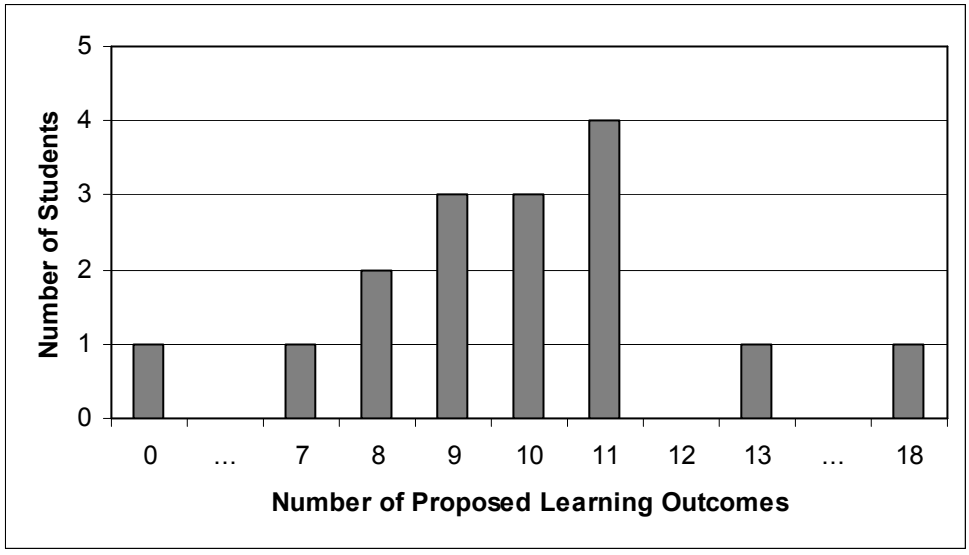

Figure 4.2: Number of proposed learning outcomes featuring in SSM8 student PDPs

4.2 Activity properties

The original set of 16 PDPs specified 85 activity instances. Selective sampling contributed 17 additional activity instances to the analysis, for an overall total of 102 activity instances.

The following nine properties were identified as being common to all activities: title, duration, concurrency, location, supervisor, progress, rationale, learning outcomes and approach.

1. Title

This property corresponds to the requirement in the handout to specify the nature of the proposed experience. Activity titles were specified in the activity overview section either as a heading or within a table. Most often a title was specified as two or three words (e.g. 'A&E', 'Shadowing PRHO FY1', 'Remedial Teaching'), though in some cases the titles were longer and more descriptive (e.g. 'Write up Elective research project for publication in Anaesthesia', 'Shadowing the house officer who is doing my second job, general surgery with breast, laparoscopic and paediatrics').

2. Duration

For most students, the basic unit of activity duration was the five day working week, though occasionally shorter activities such as remedial teaching sessions were specified in days or half-days. Most activities took place during the working day, though some students specified activities that were taking place during the evening or on the weekend.

3. Concurrency

Most activities took place during independent time periods, though in some cases two or more activities were undertaken concurrently during the same time period. For example, one student proposed that she would undertake a clinical placement in General Practice and a clinical placement at a mortuary during the same three week period. This property thus specifies whether or not the activity occurs concurrently with one or more others and if so, which ones.

4. Location

Most activities took place either at a named hospital in the West Midlands or at the Medical School. In some cases, students travelled outside the region for their activities, either to other parts of the UK or abroad.

5. Supervisor

The supervisor was normally a named clinician or academic, though in some cases only the role was specified (e.g. 'House Officer'), or it was not specified at all.

6. Progress

This property was used to indicate how far the student had progressed in negotiating an activity. The way this was to be indicated was not stipulated, so students adopted a variety of phrases including 'negotiated', 'confirmed', 'arrangements in place', 'provisional acceptance, awaiting confirmation', 'TBC', 'placement provisionally arranged, but project details to be confirmed', 'experience will be negotiated once new PRHOs start in April', 'none'. In some cases, the value of this property was not specified.

7. Rationale

As stipulated by the handout, this property was used to specify how the proposed activity would fulfil the student's learning needs. Most students used this property to address the following requirements: providing details of the particular learning focus for the experience; its relation to identified weaknesses, future career plans or an area of interest; why this learning need was a priority; and how the experience was expected to meet their needs.

With respect to the learning focus for the experience, three main categories were identified: preparation for PRHO/FY1 year, career development and assessment.

8. Learning outcomes

This property was used to provide specific details as to what the student wanted to get out of a particular activity or set of activities. Though stipulated as separate requirements in the original handout, the learning outcomes were often a summary and/or repetition of phrases from the rationale. The phrases used were classified into 19 categories, which are related to the three main learning foci identified. Table 4.1 provides the details of these learning outcomes, including their relationship to the three learning foci identified in the Rationale property.

Table 4.1: Identified Learning Foci and Learning Outcomes

Learning Foci	Related Learning Outcomes
Preparation for PRHO/FY1 Year	become familiar with PRHO/FY1 role
	become familiar with running of the hospital
	develop confidence in ability to undertake PRHO/FY1 role
	practice clinical skills needed for PRHO/FY1 placement
	develop professional relationships
	develop clinical skills
	gain experience in managing patients
Career Development	explore career interest
	develop professional skills
	develop research skills
	become familiar with the research publication process
	disseminate research findings to community
	develop teaching skills
	learn about other health systems
	develop ability to communicate effectively with patients in another language
	gain insight into patient experience
Assessment	achieve successful assessment result
	address knowledge/experience gaps
	enhance career prospects

9. Approach

Students typically made reference to how they were planning to carry out a particular learning activity in their prose. Proposed values for this property include 'self-directed', 'in teams' (i.e. small, self-selected groups), 'student-requested placement' and 'organised by an external body'.

4.3 Activity categorisation

The grounded theory analysis of the PDPs resulted in the identification of nine main activity categories. This section describes the activity categories, in terms of the properties identified in Section 4.2. Table 4.2 presents an overview of the relative frequencies of each activity.

Table 4.2: Relative Frequencies of PDP Activities

Activity	Number of PDPs Featured In		Total Number of Instances	
	Original Set	Selectively Sampled	Original Set	Selectively Sampled
PRHO/FY1 shadowing	16	3	20	2
Clinical placement	15	6	29	6
Research dissemination	9	1	11	1
Self-directed preparation for academic assessment	8	1	10	1
OSCE tutoring	5	-	5	-
Organised teaching/skills session	4	-	5	-
Non-clinical placement	2	2	2	2
Language study	1	4	1	4
Other	2	1	2	1

1. PRHO/FY1 shadowing

In order to practice medicine in the UK, a doctor must be registered with the General Medical Council (GMC) (General Medical Council, 2006a). Graduates of UK Medical Schools are eligible to apply for provisional registration with the GMC and must do so before beginning clinical training (General Medical Council, 2006b). Doctors holding provisional registration with the GMC must satisfactorily complete a 12 month internship before they can apply for full registration. The internship must include at least three months of medicine and three months of surgery. The remainder must be spent in a recognised clinical speciality, including up to four months in general practice. This internship year is commonly referred to as the pre-registration house officer (PRHO) year.

Foundation Year 1 (FY1) of the MMC Foundation Programme effectively replaces the traditional PRHO year, wherein GMC requirements for full registration are fulfilled through three four month placements in medicine, surgery and another speciality (NHS, 2006b). This programme was implemented nationally in August 2005 (NHS, 2006d), and as such the SSM8 students in this study were in the first group to make the transition.

The GMC website (2005) states:

> *Before medical students graduate*, they *spend some time (at least one week) shadowing a house officer. If possible, this should be in the hospital, practice, or another clinical setting in which they will do their first PRHO post. Ideally, they should shadow that post itself.*

This activity was the only required component of SSM8, as specified in the handout. The students selected which house officer they wished to shadow and were expected to make the necessary arrangements on their own. Though this activity featured in all of the originally analysed PDPs, selective sampling revealed one PDP where it was not present, due to the need for the student to focus on preparing for finals examinations.

This activity was identified by the use of either 'shadow' or 'shadowing' was used in activity title. Examples of title included 'PRHO shadowing', 'House Officer shadowing' and 'Shadowing the house-officer whom I will be taking over from in August, general medicine'. In 17 of the 22 instances, the duration of the planned activity was one week, in four it lasted two weeks and in one selectively sampled case it lasted four weeks. In 21 of the 22 instances, PRHO/FY1 shadowing was not concurrent with any other activities, though one student who planned to perform two weeks of shadowing combined the second week of the activity with a research dissemination activity. In 19 of the original instances, shadowing took place at a hospital in the West Midlands, though there was one instance of a student pursuing a placement outside the region in Blackburn. Selective sampling revealed two additional placements outside the region in Leicester and Winchester. The students nominated a clinician or existing house officer was to supervise, though in many cases this person was not named, as the details of the rotations had not yet been finalised.

Featured learning outcomes

- **become familiar with PRHO/FY1 role**: Sixteen students identified a need to familiarise themselves with the PRHO/FY1 role: 'gain insight into future job', 'determine what is expected', 'determine exactly what role will be'.
- **become familiar with running of the hospital:** Sixteen students made references to becoming familiar with the physical layout of the hospital as well as with particular policies and procedures: 'to understand the geography of *** hospital', 'to acclimatise myself with *** Hospital and the way the hospital functions', 'to get a feel for the ward on which I shall be working'.
- **develop confidence in ability to undertake PRHO/FY1 role:** Ten students made specific references to increasing their level of confidence in clinical skills and patient

management: ‘to ensure I quickly become a competent and confident member of the team’, ‘develop confidence in my abilities as a PRHO’, ‘feel comfortable and confident’.

- **practice clinical skills needed for PRHO/FY1 placement:** This was mentioned by nine students: ‘concentrate on improving those practical skills that I feel are essential as an FY1 doctor (e.g. ABGS, venflons, catheterisation)’, ‘to be comfortable in the practical procedures that come with the job’, ‘to ensure my blood-taking and other minor practical skills are well polished’.
- **develop professional relationships:** Nine students made references to meeting and working with specific people (e.g. supervising consultant), teams or roles (e.g. other hospital staff): ‘to work closely with the members of my team’, ‘develop a professional relationship with the consultant(s)’, ‘to get to know Dr. *** and Dr ***’s team’.
- **gain experience in managing patients:** Five students indicated that this activity would help them to gain experience clerking and instigating appropriate management of common disease presentations: ‘to gain more experience in the clerking and management of common acute patient presentations’, ‘become familiar with the procedures and treatment protocols’, ‘to deal effectively in managing patients’.
- **explore career interest:** One student was considering his PRHO/FY1 placement field as a future career prospect: ‘I am seriously considering [Rheumatology] as a future career’.
- **achieve successful assessment result:** One student specified: ‘I also want to use it as an additional tool for my surgery finals’.

Additional properties

- **Rotation**: In addition to the required shadowing component, four students also chose to shadow a house officer that they were to replace at a later stage. This property identifies which rotation the student is undertaking.

2. Clinical placement

The handout specified that the aim of SSM8 was to assess individual learning priorities, with an emphasis on clinical learning. A clinical placement is defined as an activity that involves observation of and/or interaction with patients in a medical care setting (e.g. hospital, GP surgery) or is specifically concerned with improving knowledge of patient care management (e.g. a microbiology placement to find out how infections are managed in hospitals). The students select the type of clinical placement they wish to pursue and are expected to make the necessary arrangements on their own. This was the most popular activity to feature in the students' PDPs, though there was wide variation in the specific nature of the placements.

Students commonly referred to this activity by the name of the related speciality (e.g. 'A&E', 'Radiology', 'General practice', 'Ophthalmology'). In 15 of the instances this was qualified by one of the following terms: 'experience', 'placement' or 'attachment'. A minority of students provided titles that were indicative of the aims of their placement (e.g. 'Anatomy Revision', 'Research project in gynaecological plastic surgery'). Clinical placements varied in duration from a minimum of one week to a maximum of three weeks. The total duration of clinical placements for students varied from one week to four weeks. In 27 instances, this activity did not occur concurrently with any other activities. Locations were diverse and included hospital wards, general practice surgeries, prisons and care homes as well as working

alongside pathologists, paramedic crews, midwives and drug and alcohol addiction counsellors. Selective sampling also revealed a number of students who pursued international placements, primarily through volunteer organisations, in locations such as Israel, Ghana and India. A named clinician was normally identified as providing supervision for these placements.

Featured learning outcomes

- **explore career interest:** Nine students mentioned the desire to explore particular career interests: 'interest in general practice as a career', 'interested in the possibility of working abroad', 'evaluate this as a potential career path', 'I currently wish to have a future career in paediatrics and hope that this time will provide evidence to confirm this', 'gain further insight into careers in Obstetrics and Gynaecology'.
- **practice clinical skills needed for PRHO/FY1 placement:** Six students focused on immediate clinical needs: 'practice those basic life support skills needed as a PRHO FY1', 'improving my skills in interpreting radiological results [which is] relevant to my immediate future role as a PRHO', 'necessary for my foundation year [to] improve my skills in the interpretation of plain film radiographs'.
- **gain experience in managing patients:** Six students wished to gain further experience in patient management: 'focus my learning on improving the way I formulate management plans for patients who present for the first time', 'familiarise myself with the management of various acute situations', 'develop skills of examination and management'.
- **address knowledge/experience gaps:** Five students identified gaps in their learning: 'improve my basic anatomy knowledge, which I identify to be lacking', 'the highly specialised field of plastics is something I have not been sufficiently exposed to', 'my

exposure to and understanding of radiological investigations has been insufficient', 'advance the knowledge of operative anatomy', 'develop a greater knowledge of options available to the patients'.

- **develop clinical skills:** Four students were looking to develop a broader range of clinical skills: 'observe/assist in any practical procedures taking place (e.g. ECGs, phlebotomy, minor operations)', 'enhance basis surgical skills', 'improve my neurology clinical skills'.
- **achieve successful assessment result:** Three students selected clinical placements that would help them to prepare for assessments: 'prepare me for the GUM station in the CBM final exam', 'As I have a distinction viva in Community-Based Medicine [...] I have provisionally arranged an additional placement', 'preparation for my Surgery finals examination'.
- **develop professional skills:** Three students talked about improving professional skills, namely communication skills: 'help me with my communication skills', 'I also wish to improve my counselling skills', 'further develop my communication skills'.
- **enhance career prospects:** Two students felt that clinical placements would make them more employable: 'I feel this experience would put me at an advantage', 'I hope that this would help me get a job within this specialty in the future'.
- **learn about other health systems:** Two students were interested to explore the workings of other health systems: 'learn what is involved in the working and management of a surgery in my hometown of Jersey', 'gain experience of another developed European medical system'.
- **develop research skills:** Two students specifically pursued clinical research placements: 'honing my research skills to include data analysis and discussion', 'I

intend to conduct a small research projects [which would be] a valuable learning opportunity'.

- **develop ability to communicate effectively with patients in another language:** One student pursued a placement in a German hospital to: 'improve my ability to speak German in a medical setting'.
- **develop professional relationships:** One student was specifically interested to 'develop a professional network' in his field of interest.
- **become familiar with running of the hospital:** One students wanted to: 'familiarise myself with *** hospital, as I will be there during my last rotation of foundation year 1'.
- **gain insight into patient experience:** One student pursued a paediatric placement to 'gain insight into how organ donation has impacted upon the lives of recipients and their families'.

Additional properties

- **Nature of organisation:** This property may assist in record-keeping, as well as in promoting the diverse nature of clinical placement opportunities to students. Possible values could include 'NHS-based', 'National, Non-UK' (e.g. foreign hospitals) and 'International' (e.g. international development agencies).
- **Related professions:** This property is intended to capture information about placements with clinicians who are not medically-qualified doctors, including nurses, paramedic crews and midwives.

3. Research dissemination

This activity consisted of writing up a current or previous research project for dissemination to the academic community. Common phrases used in the title of this activity included 'write-up' or 'writing-up' and 'publication'. Seven students planned to dedicate one week to writing up a single project, one student specified she would take two weeks, one student planned to carry out this activity during the second week of PRHO/FY1 shadowing and one student featured three instances of this activity, lasting one week each. The most popular locations for this activity were the Medical School and a named hospital in the West Midlands, though one student specified that he was planning to spend part of his allocated time at the Wellcome Library in London and one student was planning to present his poster at a conference held at the Birmingham International Convention Centre. The students typically nominated a named academic or clinician as the supervisor for this activity.

Featured learning outcomes

- **become familiar with research publication process**: Six students mentioned specifically that this activity would help them to gain insight into the research publication process: 'to appreciate the process involved in making a piece of research publishable', 'gain useful insight into the technicalities behind the process of publication', 'familiarisation with the process of publication.
- **enhance career prospects**: Five students felt that having a good publication record would make them more employable in the future: 'this will improve my CV', 'having a published piece of work looks good on Curriculum Vitae and makes me more employable', 'in order to distinguish oneself from others in the medical field, publications are an essential tool'.

- **develop professional skills**: One student planned to work with two colleagues and felt that this activity would help him to 'improve my team working skills that are so important in both academic and clinical work' and 'improve my organisation and time management skills'. The student preparing the poster presentation stated that this activity would 'improve my communication skills, as I will have to defend my work'.
- **develop research skills**: One student commented that this activity would help him to develop skills as a researcher: 'One of the keys to research is the ability to write papers and achieve their publication'.
- **disseminate research findings to community**: One student was particularly interested to 'have the recommendations of the research published so that they could be implemented'.

Additional properties

- **Research topic:** Most students included details of the project that they were writing up for publication. The most frequently cited topics were those completed as elective projects during previous modules (e.g. SSM6), but there were also examples of writing up intercalated degree dissertations and research projects that were to take place during the SSM8 period.
- **Publication format:** Though the instances identified in the original set of 16 PDPs indicated a desire to pursue journal publications, selective sampling revealed an additional instance of pursuing a poster presentation for a conference.
- **Publication targeted:** The specific journal or conference selected for publication.

4. Self-directed preparation for academic assessment

This activity included preparations for academic assessments such as finals exams and distinction vivas. Common phrases used in the title included 'revision', 'examination' and 'viva'. There was also one example of a student who explicitly stated that she would use part of the SSM8 period to write up the SSM8 report and one selectively sampled instance of a student preparing to undertake a PhD viva. In three instances this activity occurred concurrently with other activities also intended as preparation for assessment, including student-selected clinical placements and organised remedial teaching. A location was specified in four instances: Medical School (3) and library (1). A named academic was specified as supervisor in one instance.

Featured learning outcomes

- **achieve successful assessment result**: Though not specifically stated by any of the students, it is presumed that the main motivating factor behind their preparation was to achieve a successful result.
- **enhance career prospects**: Two students felt that a successful assessment result would make them more employable: 'I hope that this will increase my chances of gaining distinctions in these subjects and therefore help me with my future career plans' , 'In terms of advancement of my career and personal development, there is probably no greater thing that I could do than gain my PhD'.

Additional properties

- **Topic:** The name of the module or subject matter to be assessed (e.g. 'Paediatrics', 'Surgery', 'Community Medicine', 'SSM8').

- **Nature of assessment:** The type of assessment (e.g. finals exam, distinction viva, report).

5. OSCE tutoring

The objective structured clinical examination (OSCE) is commonly used to assess clinical skills in UK medical students (Howe *et al.*, 2004). At the University of Birmingham, final year students are invited to apply to run a mock OSCE tutoring programme for third year students. This activity took place during the first week of the SSM8 period at the Medical School. It was typically denoted by a title of 'OSCE tutor' or '3rd year teaching'. For four of the students, this was the only activity they planned for the first week, though one student planned to participate in the OSCE tutoring programme during the evenings, while pursuing a clinical placement during the day. Three of the students nominated a named academic as their supervisor, while the other two did not specify a supervisor.

Featured learning outcomes

- **develop teaching skills**: All five of the students felt that this activity would help them to gain skills and experience in small group teaching that would be called upon during their PRHO/FY1 placements: 'I look forward to teaching medical students next year [...] OSCE tutoring will give me valuable experience in preparing and delivering an education talk/lecture', 'I intend to gain skills and experience in teaching. I'm working in a large teaching hospital where I will be expected to teach medical students', 'this placement will [...] help to make me a more effective teacher so that when I am a junior doctor I can give effective tuition to medical students'.
- **practice clinical skills needed for PRHO/FY1 placement**: Two students commented specifically that their participation in the OSCE tutoring programme would allow them

to further develop their own history taking and clinical examination skills: ‘revise clinical skills for the PRHO year’, ‘improve my clinical skills [...] in history and clinical examination’.

- **enhance career prospects**: One student was interested in medical education as a future career prospect: ‘I hope that this will give me a valuable insight into the challenges that teaching medicine to others might involve’.

6. Organised teaching/skills session

This activity involves attendance at a teaching or clinical skills session that is organised, designed and delivered by an academic or medical institution. Two of the instances involved remedial teaching sessions that were to take place at the Medical School, while the three other instances were clinical skills sessions lasting that were to take place at hospitals in the West Midlands. Duration was typically specified in days or half days, though one student proposed three weeks of this activity, which occurred concurrently with both a clinical placement and self-directed preparation for academic assessment. No supervisors were specified for this activity.

Featured learning outcomes

- **achieve successful assessment result**: One student mentioned that remedial teaching would help him to ‘acquire the skills and knowledge for success in the exams’ and to ‘have a greater idea of the format of the surgical finals’.
- **practice clinical skills needed for PRHO/FY1 placement:** Two students identified clinical skills sessions as an opportunity to refine their skills: ‘These sessions are a priority as they encompass basic skills that a house officer should be able to perform’, ‘to improve my basic surgical skills, particularly suturing’.

- **enhance career prospects:** One student felt that an operative surgery course would be 'appropriate for my hopeful future career as a surgeon'.

Additional properties

- **Topic:** The title or nature of the session (e.g. 'Surgery 1', 'Injections & Cannulations', 'Catheters').

7. Non-clinical placement

Non-clinical placements are differentiated from clinical placements in that they are outside medical practice and therefore do not involve direct interactions with patients. One instance involved a volunteer organisation that recruited doctors to practise medicine in developing countries and the other involved a placement in a school working alongside Advanced Skills Teachers and providing a medical perspective on certain aspects of the curriculum. Selective sampling revealed two additional instances: one student was pursuing a placement in medical journalism through the BBC and one student was working with a volunteer organisation to develop undergraduate teaching materials to raise the awareness of health issues amongst asylum seekers. These placements varied in duration from one to two weeks and took place within the specified community organisations. Two students nominated a named Medical School academic as their supervisor, while the other two left this unspecified.

Featured learning outcomes

- **explore career interest**: For three students, the main focus of the non-clinical placements were to gain insight into various career prospects: 'practicing medicine in a developing country is something I am seriously considering during part of my

career', 'I have given much consideration to the possibilities of working alongside schools in the future', 'a taster in this subject would be excellent in determining how I scope my future career'.

- **develop professional skills**: The student pursuing the school placement felt that this provided 'an excellent opportunity to develop my communication skills with young people [...] which is likely to hold me in good stead in the future, whatever my final career path'.

Additional properties

- **Nature of organisation:** Similar to clinical placements, this property may assist in record-keeping, as well as in promoting the diverse nature of non-clinical placement opportunities to students.

8. Language study

This aim of this activity was to acquire or develop communication skills in a foreign language. Though only one instance of this activity featured in the original set of 16 PDPs, the student stated that five others were planning to participate with him. A process of selective sampling was initiated to determine additional properties of this category and four additional instances (from four different PDPs) were selected for analysis. Four of the five students allocated a specific block of time to this activity, ranging in duration from three days to three weeks. The other student planned to attend one two hour session per week over the six week period. This activity took place in a number of locations: home (1), language centres in the West Midlands (2), language centre in London (1) and language centres abroad (1). Four students did not specify a supervisor, while the other student named her personal tutor as her supervisor.

Featured learning outcomes

- **develop ability to communicate effectively with patients in another language:** For three of the students, learning another language was motivated by an immediate desire to communicate more effectively with patients in their region during the FY1 year: 'the ability to speak Punjabi would enable me to communicate with Punjabi speakers without the need for interpreters or other family members', 'I will become equipped to communicate with those with hearing difficulties', 'I hope to be able to converse better with the Hispanic population in Baltimore [...] when I undertake my placement there in June'.
- **enhance career prospects**: The motivation for the other two students was career-related, as they both planned to spend time working abroad in the future: 'it would be an invaluable aid to working abroad in the future', 'I feel that the ability to speak Spanish is a useful skill, especially if I ever wish to work for a time in either South America or in fact most of the United States'. It is presumed that these students are intending to be able to communicate with colleagues (e.g. by giving a case report in another language) as well as will patients.

Additional properties

- **Mode of Study**: Various modes of study were cited including immersion courses abroad, organised courses in the UK and self-study.
- **Language**: Examples of languages studied included Spanish, Punjabi and British Sign Language.

9. Other

In the original set of 16 PDPs, there were two instances of activities that were not covered by any of the previous categories. One involved a student preparing for a presentation on the life of a medical student for the Royal College of Physicians, whilst another involved a student revising the use of ECGs as a diagnosis tool. Selective sampling revealed an additional instance involving self-directed study of medical ethics and law. In all instances, one week was allocated to this activity, which occurred independently of other activities. The Medical School and a West Midlands' hospital were specified as the locations for this activity, with a named academics or clinician providing supervision.

Featured learning outcomes

- **address knowledge/experience gaps:** The two students pursuing self directed study had previously identified gaps in their knowledge: 'Ethics & Law is definitely an area of medicine that I have found myself lacking', 'focus on any other areas of weakness that could potentially cause problems during my time as a PRHO'.
- **develop professional skills:** The student preparing the presentation felt that it provided 'an excellent opportunity to focus on developing my interpersonal and presentation skills'.

4.4 Assessor feedback

In an effort to improve the students' SSM8 experience, feedback was provided under the following headings: 'Timetable/Location/Supervision', 'Rationale' and 'Learning Outcomes'.

Timetable/Location/Supervision

The feedback provided under this heading suggests that the assessors have set expectations as to how long certain activities should take: 'Week 1 - will the OSCE tutor take up the whole week?', '2 weeks seems to be a long time to prepare for 1 viva', 'Shadowing 3 teams in 2 weeks! Surgery course at RHH is it really a whole week long?'.

Rationale

The feedback provided under this heading section was cursory, with the following phrases being used: 'Fine' (2 students); 'Good' (6 students); 'Vague' (3 students); 'OK' (1 student); 'Arguments are well made' (1 student).

Learning Outcomes

In most cases, the feedback provided under this heading was also cursory. There were, however, three cases in the students were prompted to think about what they specifically wanted to get out of their PRHO/FY1 shadowing activities:

> *Think about what you actually want to get out of that week. Thinks like - ordering tests, interpreting the results, who to contact in Radiology, what is the arrest procedure, what does a 2nd on involve, how do emergencies get admitted and who does it?*

4.5 Evaluation

Both internal and external validation procedures were used to evaluate whether the activity model fit the situation and helped to make sense of the experience and manage the situation more effectively.

4.5.1 Internal validation

The document structures adopted by the PDPs in the test set were consistent with the document structures that featured in the original data set. The PDPs in the test set also used the stipulated requirements as headings, again resulting in highly structured documents. All

16 of the test set PDPs had a document title (e.g. 'SSM 8 Stage 1 Submission', 'SSM 8 Report: Part One') and included the required personal details in either the document header, or in an initial section.

As in the original data set, the next section of the PDPs presented a week-by-week overview of student activities for the period. In the test set of 16 PDPs, 9 students presented this information in list format and four in tabular format. Three students presented this information in a paragraph of prose, which was a format not seen in the original data set. Six of the students who used a list format identified the stipulated requirements for each activity (e.g. Location, Supervisor) using a consistent format, with three of them using headings as identifiers. For the other three students who used a list format, this information had to be extracted from longer text descriptions of each activity. Fourteen of the 16 students referred to the weeks by number (e.g. Week 1, Week 2), one student used activity numbers and duration (e.g. 'Placement One, two weeks) and the other student referred to specific dates that his activities were to take place. Only four of the 16 students stipulated the specific dates that their activities were to take place.

As shown in Figure 4.3, the number of activities per student ranged from a minimum of three to a maximum of seven, the same range as in the original data set, with the majority of students specifying four activities.

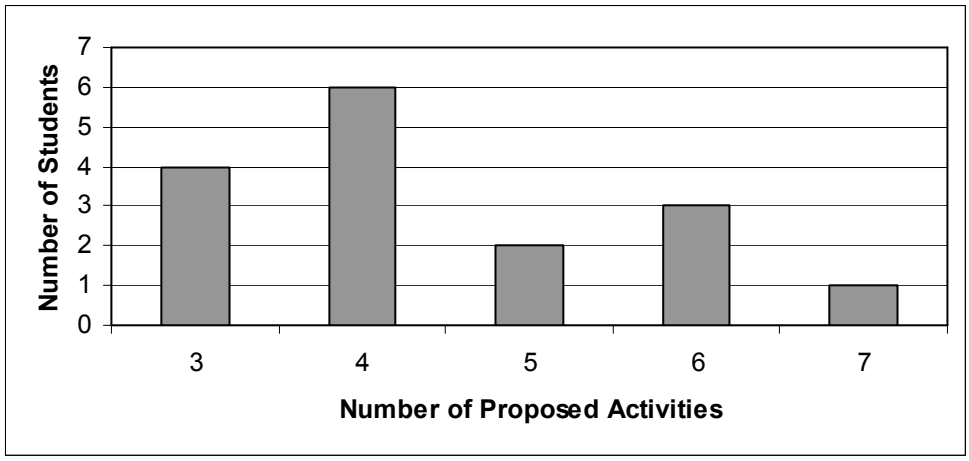

Figure 4.3: Number of activities featuring in SSM8 student PDPs, Test Data Set

To explain their rationale for the selection of activities, eight students used a separate 'Rationale' section and eight students included this as part of the week-by-week activity overview. Of the eight students who used a separate section, five of them referred to each activity separately, using either the week number or a short description of the activity as a subheading. The other three students did not clearly delineate each activity using headings, but did refer to each separately within their prose. Of the eight students who included the rationale section as part of the week-by-week activity overview, five used a subheading to identify this component, while the other three students included it within their prose.

Fourteen students included learning outcomes as a separate section at the end of the document, whilst the other two students included them as a subheading in the activity overview. As in the original data set, the learning outcomes were presented as either bulleted or numbered lists. Most students had separate learning outcomes for each activity, even though they may have been presented as a common list. Unlike the original data set, there were no examples of students who wrote an additional paragraph instructing that some or all of the learning outcomes provided applied broadly across the SSM8 period.

Figure 4.4 presents a breakdown of the number of proposed learning outcomes per student in the test set. This ranged from a minimum of zero to a maximum of 18, with most students specifying between seven and 10 learning outcomes. This is within the same range as the original data set.

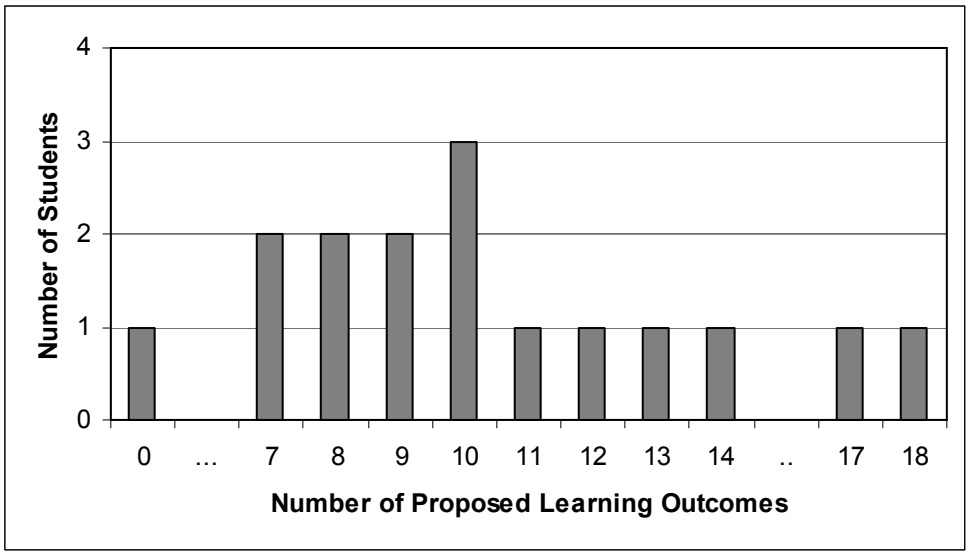

Figure 4.4: Number of proposed learning outcomes featuring in SSM8 student PDPs, Test Data Set

The test data set featured a total of 71 activities. Table 4.3 presents an overview of the relative frequencies of each activity in the test data set. No new activities were discovered during the validation process, which suggests the completeness of the activity model.

Table 4.3: Relative Frequencies of PDP Activities, Test Data Set

Activity	Number of PDPs Featured In	Total Number of Instances
PRHO/FY1 shadowing	14	19
Clinical placement	15	28
Research dissemination	3	3
Self-directed preparation for academic assessment	9	9
OSCE tutoring	4	4
Organised teaching/skills session	5	8
Non-clinical placement	-	-
Language study	-	-
Other	-	-

Compared to the original data set of 16 PDPs, many more students in the test data set had finals exams to prepare for, and consequently there was a greater focus on selecting assessment-related activities. Two of the students did not undertake PRHO shadowing during the SSM8 period – one because of a need to focus on finals examinations and the other because she was going to be working outside the region and the shadowing had be pre-arranged for her later outside the SSM8 period.

The 19 sub-categories were more than sufficient to describe the students' rationales and learning outcomes for the various activities. There was one example, however, where one of the sub-categories was featured in an activity for the first time. One of the students undertaking OSCE tutoring felt that it would help her to develop confidence in her ability to undertake the PRHO/FY1 role: 'would like to be able to [teach] with confidence [...] important in the near future when I take on my job'.

As in the original data set, the feedback provided under the headings of 'Timetable/Location/Supervision' and 'Rationale' was also cursory. Under the 'Learning Outcomes' heading, four of the 16 students in the test set were prompted to think about what they specifically wanted to gain from their PRHO/FY1 Shadowing activities.

4.5.2 External validation

The Director of Learning and Teaching at the Medical School felt that the activity model was a valid representation of the SSM8 students' PDPs:

> *I thought it was really very helpful and I think you've got the essence of the way that it works and the activities that are involved there.*

He did, however, observe some differences between the Medical School's intent for how the students would produce their PDPs and how the students actually produced them:

> *There is an issue in terms of developing tools for looking at these [the PDPs] which is about whether you draw on the student's understanding, or whether you are drawing on the expectations that we have of the student.*

For example, it was suggested to the students that they first think about their learning needs and devise achievable measures for their fulfilment (i.e. the learning outcomes). These would then feed into the activity selection process; with the rationale section being used to justify why one particular activity was selected as opposed to another. The Director agreed, however, that it appeared that many students started by selecting an activity and then constructed learning outcomes based on what they thought they would get out of it. This is a potential explanation for the repetitive nature of the rationale and learning outcomes sections.

When asked about the likelihood of generalisability of this model across student cohorts, the Director responded that it was in line with his observations over the last eight years:

> *What we find year on year is that the core activities that students undertake [...] remain the same. The outliers vary from one year to another.*

He did not, however, feel that these outliers would ascribe to a standard pattern.

The Director felt that the activity categories were likely to remain stable in the future, though their relative priorities may change, due to both internal and external influences on the Medical School. Externally, the process by which graduates of UK medical schools become practising doctors is in a state of continual change. As the requirements for this process change, the nature of the students' preparation will change. For example, the Medical Training Application Service (MTAS) is a new electronic tool that has been developed to assist in the NHS' recruitment and selection of junior doctors (NHS, 2006e). Whereas previously, the students would apply for PRHO/FY1 placements on a regional basis, they now have to apply centrally, which may affect the way in which they approach their shadowing. Internally, the undergraduate medical curriculum at the University of Birmingham is currently being developed to offer a higher proportion (up to 25%) of student selected activities throughout the five years. In the final year, the students will have one day per week for personalised learning activities and two weeks of dedicated time, in addition to the six week SSM8 period. The Director felt that that this would affect the way the students approached their learning:

> *I think there will be a much more professional pattern of learning, both in the fact that it's parallel with their work, which is the core curriculum [...], but also the fact that it's linear and they have got time to reflect and shift directions.*

The Director felt that this would likely lead to the selection of more career development activities, but that, "I don't think it will fundamentally change the nature of the activities" that feature in the activity model.

The Director did not, however, feel that the activity model was generalisable across UK medical schools. He attributed this to the independence of the UK medical schools in

setting their own curricula, rather than to deficiencies within the model itself. For example, all medical schools incorporate PRHO/FY1 shadowing, but this may be implemented as an organised placement, rather than as a student-selected activity. Similarly, the way in which the medical schools handle career exploration activities "varies hugely with the curriculum". Still, he felt that the activity model "would probably cover most of what people would do", with the possible exception of "the activity of selecting from a menu of additional courses", which is handled earlier in the course at the University of Birmingham.

4.6 Summary

Final year medical students at the University of Birmingham self-select a variety of activities to undertake during the six week SSM8 period. This chapter presented the results of a grounded theory analysis that was undertaken to develop a descriptive model of these activities such that the pedagogical expressiveness of LD for representing the PDPs could be evaluated. PDPs authored by the students were analysed in terms of document structure, activity properties and feedback provided by the assessors. Nine properties common to all activities were identified, including title, duration, concurrency, location, supervisor, progress, rationale, learning outcomes and approach. Three main categories of learning foci, stipulated in the rationale property, were identified: preparation for PRHO/FY1 year, career development and assessment. Learning outcomes were classified into 19 categories. A total of 102 activities were classified into nine activity categories including PRHO/FY1 shadowing, clinical placement, research dissemination, self-directed preparation for academic assessment, OSCE tutoring, organised teaching/skills session, non-clinical placement, language study and other. The feedback provided to the students tended to be cursory, but it was possible to identify some of the internalised expectations held by the assessors as to the likely duration of some activities. Based on both internal and external validation activities,

the activity model can be considered to be a valid representation of the self-selected activities of final year undergraduate medical students at the University of Birmingham.

5. Gap Analysis

This chapter presents the results from the gap analysis of the IMS Learning Design (LD) information model against the activity model presented in the previous chapter. Section 5.1 describes a learning design representation of the SSM8 students' PDPs and Section 5.2 presents the limitations that were encountered during this process. Section 5.3 provides a summary of this chapter's main findings.

Note that within this chapter, italics are used to denote specific LD elements and attributes.

5.1 Representing PDPs as learning designs

It was possible to represent the main properties of the activity model with a small subset of Level A compliant LD elements. In most cases, the activity model property could be mapped directly an LD element in a straightforward way. Table 5.1 provides a summary of the primary mappings.

Table 5.1: Mappings of LD Elements and Activity Model Properties

LD Element		Activity Model Property
learning-design		Entire PDP document
	title	Document Title
	learning-objectives	Learning Outcomes
roles		
	learner	Student (PDP Author)
	staff	Supervisor
learning-activity		Activity
	title	Activity Category
	learning-objectives	Learning Outcomes
	environment-ref	reference to Activity Location
	activity-description	Nature of activity, Details of specific activity properties
	time-limit	Duration
environments	environment	Activity Location
method	play	Timetable of Activities
	act	Individual Week

The *learning-design* element can be used to encapsulate the entire PDP document. The child element *title* then corresponds with the document title (e.g. 'SSM8 Preparation', 'SSM8 Part 1', 'SSM8 Report: Part 1'). The *learning-objectives* element maps directly on to the learning outcomes property of the activity model, as "learning objectives describe the intended outcome for the learners" (IMS Global Learning Consortium, 2003a). The *learning-objectives* element also appears at the level of *learning-activities*. The LD information model suggests that the *learning-objectives* found at the level of the *learning-design* provide a general description, whilst those at the level of *learning-activities* are more concrete (IMS Global Learning Consortium, 2003a). In this context, the *learning-objectives* at the *learning-design* element level can be used to map the learning outcomes that the student has identified for the entire SSM8 period. Each individual learning outcome can be referenced with an *item* element.

The *components* element of *learning-design* encapsulates the *roles, activities* and *environments* elements. The principle *learner* role in the PDP is that of the student who has authored it. The *roles* element may also be used to specify other roles in the student's learning process; including both learners (e.g. the other students involved in a research dissemination activity) and staff (e.g. a supervisor or mentor). The specific name and/or job title of the person adopting this role can be specified in the *information* element, which is a child element of both *learner* and *staff*. Note, however, that LD is typically used to define the roles in an abstract way, with roles being linked to particular people during instantiation (IMS Global Learning Consortium, 2003a).

The *activities* element consists of *learning-activities*, *support-activities* and *activity-structures*. A separate *learning-activity* element can be used to represent each learning activity that the student has selected in his or her PDP. The *title* of a *learning-activity* could be used to specify the activity category. The *learning-objectives* would correspond to the specific learning outcomes identified by the student. The *environment-ref* element could be used to reference one of the locations specified within the *environments* element. The *activity-description* can be used to describe the specific nature of the activity, and could encapsulate the additional activity properties identified in the activity model (e.g. 'Rotation' for PRHO/FY1 Shadowing). The *time-limit* element is used to specify when the activity has completed, which maps to the duration property of the activity model.

Activities with common learning outcomes can be grouped together into *activity-structures*. For example, an *activity-structure* directed at the outcome of achieving a successful assessment result may include self-directed preparation for academic assessment, organised teaching/clinical skills sessions and a clinical placement. *Activity-structures* could also be used to group activities that occur concurrently (e.g. a clinical placement that is

concurrent with a research dissemination activity), or to describe a set of possible activities that the student is considering. The *structure-type* attribute can take on a value of either *sequence* or *selection* (the default). A *sequence* would indicate that the student intends to pursue a particular set of activities in the order they are listed. The *selection* value indicates that the student intends to choose from the list, which can be further refined with the *number-to-select* element. If the value of *number-to-select* is equal to the total number of items in the *activity-structure*, this indicates that the student is intending to carry out all the activities, but that the order in which they are done is not important.

The *environment* element corresponds with the location property of the activity model. As with describing the roles, there is no inherent limitation in LD to using this element to describe specific places. The *environment* element in LD is quite detailed, providing the ability to specify both learning objects and services to be found within the environment. These elements do not correspond with any of the activity model properties, and could thus be left blank.

After the various components have been identified and described, the *method* element can be used to define "the dynamics of the learning process" (IMS Global Learning Consortium, 2003a, 3.1.12). The *play* element represents the workflow of the activities during the learning process. In this context, it can be interpreted as the timetable of the student's activities. If each week is represented by a separate *act*, the end of the week would provide a natural synchronisation point.

Acts consist of a series of concurrent *role-parts* to link the activities with the roles. "Each role-part relates exactly one role to exactly one type of activity" (IMS Global Learning Consortium, 2003a, 3.1.14). A minimum of two *role-parts* would be necessary in each act – a *role-part* that links the learner role with the learning activity and a *role-part* that links the

supervisor rule with the learning activity. This is similar to the structure adopted in Act One of the Versailles Role Play, one of the examples in the Best Practice and Implementation Guide (IMS Global Learning Consortium, 2003b).

Figure 5.1 illustrates how the key aspects of a PDP may be modelled with LD. For the sake of clarity, this example is simplified to only feature a single activity.

```
<imsld:learning-design identifier="SSM8-PDP" level="A">
        <imsld:title>SSM8 Preparation</imsld:title>
<imsld:components>
        <imsld:roles>
                <imsld:learner identifier="R-student"> </imsld:learner>
                <imsld:staff identifier="R-supervisor">
                        <imsld:information>Dr A Supervisor</imsld:information>
                </imsld:staff>

        </imsld:roles>
        <imsld:activities>
                <imsld:learning-activity ref=”A-PRHO-Shadow”>
                        <imsld:environment-ref ref=”E-H”>
                        <imsld:title>PRHO/FY1 Shadowing</imsld:title>
                        <imsld:learning-objectives>
                                <imsld:item>
                                        <imsld:title>Become familiar with the responsibilities and
                                        duties of a PRHO.
                                        </imsld:title>
                                </imsld:item>
                        </imsld:learning-objectives>
                        <imsld:activity-description>
                                <imsld:item>
                                        <imsld:title>Rotation:First</imsld:title>
                                </imsld:item>
                        </imsld:activity-description>
                        <imsld:time-limit>one week</imsld:time-limit>
                <imsld:learning-activity>
        </imsld:activities>
        <imsld:environments>
                <imsld:environment identifier=”E-H”>
                        <imsld:title>General Hospital</imsld:title>
                </imsld:environment>
        </imsld:environments>
<imsld:components>
<imsld:method>
        <imsld:play identifier=”PLAY-SSM8-PDP”>
                <imsld:act identifier=”Week1”>
                        <imsld:role-part identifier=”RP-student”>
                                <imsld:role-ref ref=”R-student”/>
                                <imsld:activity-ref ref=”A-PRHO-Shadow”/>
                        </imsld:role-part>
                        <imsld:role-part identifier=”RP-supervisor”>
                                <imsld:role-ref ref=”R-supervisor”/>
                                <imsld:activity-ref ref=”A-PRHO-Shadow”/>
                        </imsld:role-part>
                </imsld:act>
        </imsld:play>
</imsld:method>
</imsld:learning-design>
```

Figure 5.1: Partial LD representation of a SSM8 PDP

5.2 Limitations

There were three cases in which LD did not provide a standard mapping for an activity model property. This section considers each of these 'recoverable errors' in turn and provides suggestions as to how these properties may be represented with existing LD elements. In some cases, mandatory elements of LD did not map directly to properties within the activity model (e.g. the *identifier* attributes of *learning-design* and *learning-activity*). These can also be considered to be recoverable errors, as it would be possible to generate these values automatically within an LD-based assessment system. Such implementation considerations will be considered further in Chapter 6.

5.2.1 Rationale

The conceptual vocabulary presented in the LD information model is sufficient to describe the nature of the activities that the student has selected, but presents a limitation in terms of its ability to provide reasons why one particular activity or learning focus was selected over and above another. For example, one student proposed a clinical placement in Jersey, in an effort to both explore a career interest in general practice and to learn more about another health system. She also, however, specifies that she selected this particular type of learning activity because a similar experience in the past had met her learning needs well. Whilst this additional piece of information clearly indicates that she has reflected on her past experiences in order to select this activity, it would not be easy to detect within the current LD structure.

Most of the main LD elements contain a child element called *metadata*, which serves as a general-purpose placeholder for metadata. Metadata is defined by the Oxford English Dictionary (Oxford University Press, 2001) as "a set of data that describes and gives

information about other data". In this context, the rationale for selecting a particular activity can be interpreted to be data about the activity data, and as such would be appropriately placed within the *metadata* element of the *learning-activity* element. The *metadata* element could also be used to specify higher-order information about the activity, such as the Progress and Approach properties of the activity model. Similarly, rationale for specifying a sequence or selection of activities can be placed within the *metadata* element of *activity-structure*.

5.2.2 Feedback

LD was designed to represent and share units of learning, but it does not expressly consider the ability to assess or provide feedback on the learning designs themselves. In this context, the PDPs are given a numerical mark, which is translated into a letter grade for the student. The student is given a 'yes' or 'no' to go ahead with their activities as planned, and additional comments may be provided according to the following headings: 'Timetable/Location/Supervision', 'Rationale' and 'Learning Outcomes'. It is necessary to record the personal details of the student, as the PDP assessment is summative and is thus a determining factor in whether or not the student is able to progress to the FY1 year.

This information can also be considered as metadata, and may be placed within various *metadata* elements, depending on its specificity. A better solution, however, would be to use the *feedback-description* element, which is a child element of *method, learning-activity* and *act*. The *feedback-description* element refers to content that is displayed to the user when they complete the activity (IMS Global Learning Consortium, 2003a). This could be repurposed to refer to feedback on the means by which the activity is specified. At the levels of *method* and *act*, this would correspond to feedback that is provided under the heading of 'Timetable/Location/Supervision'. At the level of *learning-activity,* this would correspond to feedback provided under the headings of 'Rationale' and 'Learning Outcomes'.

A non-recoverable error is encountered, however, in attempting to provide this type of feedback for an *activity-structure*, as this element does not contain *feedback-description* as a child element.

5.2.3 Time-specificity

LD was designed to represent teaching and learning processes in an abstract way, independent of time and place. The Medical School currently requires SSM8 students to complete a web-based form, separate from their PDP, which indicates where they are going to be at any given time during the module. The students are required to keep this updated if there are any changes to their plans (e.g. a clinical placement falling through, or the rescheduling of a PRHO/FY1 placement). Allowing this information to be specified within the learning design would allow the Medical School to more easily identify the students' whereabouts, which would facilitate individual administration and emergency notifications. It is also important in that it allows students to obtain a comprehensive understanding of time-management issues (Rasseneur *et al.*, 2004), and may facilitate any necessary revisions to their PDPs. As mentioned previously, the *time-limit* child element of *learning-activity* may be used to specify the duration of the activity. Specific start dates and end dates would, however, have to be placed within the *metadata* element of *learning-activity*. A better solution would be to adopt the recommendations of Rasseneur *et al.* (2004), who propose the introduction of a 'Datable Element' that could be specified either at the level of *learning-design* or at the level of *activity-structure.*

5.3 Summary

Level A of the IMS Learning Design (LD) specification provides a sufficiently flexible conceptual vocabulary to describe the PDPs of SSM8 students as learning designs.

The *components* element provides the ability to specify the details of the student's self-selected *activities*, the *environments* in which they take place, and the *roles* that are associated with them. The *method* element can then be used to define "the dynamics of the learning process" (IMS Global Learning Consortium, 2003a, 3.1.12). The *play* element represents the timetable of the students' activities, wherein each week is represented by an *act*.

Limitations were, however, encountered in attempting to specify the context of, and motivation for, the selection of various activities, as well as in providing tutor feedback and in specifying the time-sensitive nature of certain activities. Currently, the only consistent means of specifying this information is to use the various *metadata* elements within LD. Proposed extensions to the specification include the addition of a *feedback-description* element to *activity-structure* and the introduction of a 'Datable Element', as per the recommendations of Rasseneur *et al.* (2004).

6. Implementation Model

In this chapter, the findings of the activity model and gap analysis are considered with respect to how they may be used to inform the design of an LD-based assessment system for the SSM8 PDPs. Section 6.1 discusses the main tools necessary for such an implementation as well as the potential benefits that such tools may provide for both students and academic staff members. Section 6.2 provides an overview of the current state of LD tooling and Section 6.3 concludes this chapter by providing a summary of the key implementation issues.

It should be noted that LD is typically used in conjunction with the IMS Content Packaging (CP) specification (IMS Global Learning Consortium, 2006b) to create a Unit of Learning (UoL). In this context, a UoL can be considered to be equivalent to the PDP document submitted by the student, together with the feedback from the tutor.

6.1 Required tools for an LD-based assessment system

Implementing an LD-based assessment system requires four main tools: editors for creating PDPs as UoLs, repositories, validating engines and runtime players (Griffiths *et al*., 2005).

6.1.1 Editors

As the students would be creating their own UoLs, they would need tools to define the roles, resources and workflow of their professional development activities (Griffiths et al., 2005). This does not necessarily mean that the students would have to develop specialist knowledge of LD. LD can be compared to the inner workings of a spreadsheet (Olivier, 2006), wherein the user can input and modify the values in the spreadsheet easily without needing to understand the format by which it is stored and retrieved by the computer. Editing

tools should facilitate a structured approach to PDP creation, whilst maintaining the flexibility for students to develop their capacities as reflective learners.

Several means can be used to reduce the complexity of implementing LD-compliant editors for use by the students. Default values can be provided for mandatory elements of LD that do not map directly properties within the activity model. For example, the *identifier* attribute of *learning-design* can be automatically generated from the student's name and ID number. Such details can be hidden from the students. Wilson (2005) also proposes the use of constraints that limit the possible elements of LD that can be used, as well as the development of templates to act as "exemplars of particular models expressed in LD" (p. 42). Griffiths *et al.* (2005) also propose the use of environments in which UoLs can be constructed out of predefined components.

It is expected that the academic staff members would also use editing tools in order to provide feedback on the students' PDPs. This would allow the provision of feedback that is tailored to the particular activities featured in the PDP, whilst also reducing the administrative burden of producing multiple paper copies and mark sheets. It would also facilitate the provision of feedback from multiple assessors, as well as the ability for the Medical School administration to inspect this feedback in order to ensure consistency across the cohort.

The need for user-friendly LD-editors is stressed by de Vries *et al.* (2006), who acknowledge that the usability of current LD tools is problematic. One possible solution they propose is to integrate LD within a Virtual Learning Environment (VLE) such as WebCT. This would provide an integrated means through which PDPs could be both created and submitted for assessment.

6.1.2 Repositories

Repositories are needed in order to support the identification and exchange of UoLs (Griffiths *et al.*, 2005). In this context, a repository is simply defined as a database that supports the storage and retrieval of UoL components. Students should be supported in saving drafts of their PDPs within personal repositories, as well as in submitting their finalised PDP into the appropriate repositories for assessment.

The use of a common document format, like that of a UoL, can directly facilitate the assessment of reflective learning components, as reflective components (e.g. rationale, learning outcomes) can be clearly delineated from administrative components (e.g. location, name of supervisor).

LD-aware repositories can also be used to facilitate a number of specialised services, including the development of good practice examples and searching for UoLs with particular types of content (Griffiths et al., 2005). Such services could also be used to gather quantitative data on the types of activities that the students are undertaking, which could be used for audit purposes, as well as to inspect the PDPs for patterns that represent the, currently internalised, expectations of the assessors. These could then be used to inform the development of best practice guidelines for both the creation and assessment of PDPs as UoLs, along with appropriate training and support.

6.1.3 Validating Engine

Validation is used to determine whether a UoL is syntactically correct according to the level of LD implemented. For example, an initial validation procedure could be used to verify that the student has entered data of the expected type (e.g. plain text, dates, numbers, selection from a list) into all required fields. This enables missing administrative details (e.g. name and/or ID number) to be easily detected.

Validation can also be used in a more sophisticated way to ensure that certain activity selection criteria were met. For example, a count of the number of activities could be used as an initial determination of whether the PDP was appropriate and achievable. From the activity model analysis, the number of activities that the students selected ranged from three to seven. If the student exceeded these limits on either end, this could trigger the provision of feedback to the student or flag up this issue for further review by a human marker. A similar mechanism could be put in place for the number of learning outcomes specified.

The analysis of the feedback provided to the students indicates that the assessors have expectations as to the likely duration of certain activities. For example, one assessor questioned whether an OSCE tutoring activity would require a full week. Capturing and externalising these expectations would allow tailored feedback to be provided to the students automatically, which would free up the assessors to provide considered feedback on the reflective components of the PDPs.

6.1.4 Runtime players

The academic staff members require appropriate tools to be able to review, or 'playback', the PDPs submitted by the students, after retrieving them from the appropriate repositories. Designers, in this case the students, also need players to step through and test their learning designs (Wilson, 2005). Casey (2006) suggests that this can aid reflective practice, by providing a unique perspective from which to assess the entire learning design.

Players can provide the ability to view the student's activities in both summary and detailed formats, and can additionally be used to identify where a student is at any given time, in order to facilitate individual administration and emergency notifications.

In this context, players are not required to "coordinate the learners' interactions throughout the duration of the activity" (Griffiths et al., 2005, p. 112), which greatly reduces their complexity.

6.2 Current State of LD tooling

A variety of approaches have been adopted to create LD editing tools. RELOAD (www.reload.ac.uk/ldeditor.html) is an example of a tree-based editor, which displays the LD elements as a branching tree and provides an interface for navigating through the specification and entering values for the particular elements (Griffiths et al., 2005). Designers of UoLs thus need to be quite familiar with LD, though it would be possible to adapt the prompts in order to provide more specific guidance (Olivier, 2006). An alternative approach is to use a graphical interface, such that designers can get an overview of the entire UoL and then navigate to the parts that they wish to edit (Griffiths et al., 2005). LAMS (www.lamsinternational.com/) is an example of an editor that adopts a graphical approach, such that the designer does not have to be familiar with the underlying implementation. LAMS provides a number of preset activities that designers can drag and drop onto a flow chart. Though it does not produce LD, it was explicitly inspired by it (Griffiths et al., 2005).

CopperCore (www.coppercore.org) is a runtime engine for processing LD-compliant content (Martens & Vogten, 2005). CopperCore is not a standalone system, but rather a reusable kernel that can be integrated into other systems or virtual learning environments. CopperCore provides the ability to validate LD, tools for managing users and roles, and the ability to keep track of the user's progress and settings in order to deliver personalised content.

There are few tools available that fully support the playback of UoLs (Griffiths et al., 2005). The aim of the SLeD project (http://sled.open.ac.uk/web/) was to develop a service-

oriented architecture for 'playing' learning designs (Weller, 2006). It builds on the CopperCore engine and provides a web interface for managing users and 'runs' (instances of learning designs). An additional deliverable of this project was a means to describe generic services that can be interpreted by a learning design, for example a search function, such that future tools can be developed.

Many learning design tools are available in open source format, which provides two main benefits for any future implementations. Firstly, the applications can be distributed without cost to the Medical School or the students. Secondly, the underlying source code of the tools can be inspected and modified, which can facilitate the development of customised systems.

6.3 Summary

An LD-based assessment system for SSM8 student PDPs offers a number of potential benefits for both students and academic staff members. It is necessary, however, to implement tools that abstract the details of LD, such that the users do not require specialised knowledge of it. The four main tools required are editors, repositories, validating engines and runtime players. Editors are used by the students to create Units of Learning (UoLs) and by the academic staff members to provide tailored feedback. Repositories provide a means to identify and exchange PDPs and their components, which can be used to maintain an effective audit trail of student activities, as well as to identify patterns that can act as assessment criteria. Validating engines reduce the administrative burden of PDP assessment by providing automatic feedback on both the syntactical correctness of a PDP as a UoL and any identified activity selection criteria. Runtime players support academic staff members in reviewing the PDPs and help students to develop reflective practice by providing a unique perspective on

the PDPs they have created. Sample implementations of each of these classes of tools are freely available for future modification.

7. Discussion and Conclusions

This chapter discusses the contributions of this study in light of the literature and provides a possible blueprint for how this study can influence future research and practice. Section 7.1 presents a summary of the main contributions of this study, whilst Section 7.2 considers its limitations. Finally, Section 7.3 concludes this thesis by providing suggestions for future work.

7.1 Contributions of this thesis

Within the broader context of developing professionalism amongst physicians in the UK, this thesis investigated the feasibility of using LD as a framework for creating and assessing the personal development plans of undergraduate medical students. An exploratory approach was adopted to investigate whether the use of LD was appropriate and technically feasible for facilitating the assessment of reflective learning in medical education. Three main contributions can be identified: empirical evidence as to the types of activities that are self-selected by medical students, proposed extensions to LD to support learner-centred approaches and a proposed implementation model for how LD can be used to facilitate the reliable assessment of a medical student's capacity to engage in reflective learning.

7.1.1 Students' self-selected learning activities

This study has contributed an evidence-base for the types of professional development activities that are self-selected by final year medical students at the University of Birmingham. Nine properties common to all activities were identified, including title, duration, concurrency, location, supervisor, progress, rationale, learning outcomes and approach. Three main categories of learning foci, stipulated in the rationale property, were

identified and learning outcomes were classified into 19 categories. Nine activity categories were identified, including PRHO/FY1 shadowing, clinical placement, research dissemination, self-directed preparation for academic assessment, OSCE tutoring, organised teaching/skills session, non-clinical placement, language study and other.

Final year medical students can be considered to be physicians-in-training (Slotnick, 2001), who face some of the same difficulties as practicing physicians in devising an appropriate and achievable personal development plan (Challis *et al.*, 1997). In contrast to practising physicians (Jennett et al., 1995; Moore et al., 1995; Slotnick, 1999), however, the list of activities from which the students selected was finite, and focused around three main areas: preparation for PRHO/FY1 year, career development and assessment. Like practicing physicians, students require support in identifying learning needs, prioritising them and matching these prioritised needs to learning opportunities and activities (Eraut, 2001). The students in this study appeared to approach this process in reverse, first selecting learning activities and then constructing learning outcomes based on what they thought they would get out of them. Providing systems that can support the students in the identification of their learning needs can likely enhance the impact of the various activities that they are undertaking (Firmstone et al., 2004).

7.1.2 Supporting learner-centred approaches with LD

This thesis has demonstrated that it is possible to use Level A of the IMS Learning Design (LD) specification to represent the PDPs of SSM8 students as learning designs. The *components* element provides the ability to specify the details of the student's self-selected *activities*, the *environments* in which they take place, and the *roles* that are associated with them. The *method* element can then be used to define "the dynamics of the learning process"

(IMS Global Learning Consortium, 2003a, 3.1.12). The *play* element represents the timetable of the students' activities, wherein each week is represented by an *act*.

Limitations were, however, encountered in attempting to specify the context of, and motivation for, the selection of various activities, as well as in providing tutor feedback and in specifying the time-sensitive nature of certain activities. Currently, the only consistent means of specifying this information is to use the various *metadata* elements within LD. Proposed extensions to the specification include the addition of a *feedback-description* element to *activity-structure* and the introduction of a 'Datable Element', as per the recommendations of Rasseneur *et al.* (2004).

This work contributes to the currently limited body of literature on representing learner-centred approaches with LD (Koper & Olivier, 2004). Whereas Casey *et al.* (2005) suggest that the act of creating an explicit representation of teaching and learning processes can promote communication and reflective practice amongst teachers in higher education, this thesis has demonstrated that it is possible to adopt this approach with students as well.

7.1.3 Using LD to facilitate reliable assessment of reflective learning

Schutz *et al.* (2004) argue for the development of flexible assessment tools that can support students in developing their reflective learning capacities. This thesis has demonstrated that LD is sufficiently flexible to describe the students' self-selected learning activities, whilst also providing the structure that is espoused as a necessary requirement by Driessen *et al.* (2005).

LD was developed to facilitate the sharing and reuse of learning designs. Weller (2006) argues that, in order for this to be realised, it must be more convenient than creating them from scratch and it must offer quality benefits. This study suggests that these criteria can be met by offering the students suitable and user-friendly tools for authoring, storing and

submitting their PDPs. Such tools could also help to address the time constraints faced by both students (Robinson & Davies, 2004) and practicing physicians (Ramsay et al., 2003) in authoring high quality reflective documents.

Learners desire high quality formative feedback (Black & William, 1988; Bone, 2006). Acknowledging the time-pressured nature of the current assessment method, systems which can provide this type of feedback automatically are particularly desirable. An LD-based assessment system could implement a number of automatic validation routines that could be used to assist the students in developing an appropriate and achievable PDP, which Challis *et al.* (1997) suggest is a difficult task even for practicing physicians.

This study showed that whilst the feedback provided to the SSM8 students tended to be cursory, it was possible to identify some of the internalised expectations held by the assessors as to the likely duration of some activities. Capturing the students' PDPs in machine-readable repositories would facilitate the further development of such assessment criteria, as advocated by Gordon (1992) and Fade (2004). Representing the assessment criteria externally also provides the opportunity to involve students more closely in the assessment process, which is promoted by Race (1993).

7.2 Limitations

This study was relatively small in scale and based on the PDP submissions of a single cohort of students in a single UK Medical School. As such, the ability to generalise the findings across undergraduate medical students in the UK is limited. Whilst the validation procedures adopted suggest that the activity model developed is a valid representation of the students' self-selected learning activities, the reliability of the grounded theory analysis could have been enhanced by the independent assessment of the PDPs by additional skilled qualitative researchers (Mays & Pope, 1995).

7.3 Future work

Further work is needed to explore the use of LD to represent learner-centred approaches. LD is a relatively new specification and, as such, little is known about its ability to express educational practices in a generic way (van Es & Koper, 2006). LD "can be expected to evolve and develop in response to the experiences gained from implementing and using it" (Koper & Tattersall, 2005, p. ix).

In this thesis, the pedagogical expressiveness of LD for representing the personal development plans of undergraduate medical students was assessed by examining the students' planned activities. An interesting area for future research would be to analyse the actual activities that the students undertook, in order to determine how discrepancies between intent and activities may be represented within learning designs. Involving students in annotating their PDPs with LD at this stage of the research would also help to identify student difficulties with describing their activities abstractly, as Ellaway *et al.* (2005) have identified for teachers.

Before an LD-based assessment system for supporting the representation and assessment of PDPs can be implemented, further work is needed to gather additional requirements from both students and academic staff members. A possible design approach is to use the socio-cognitive engineering methodology proposed by Sharples *et al.* (2002). The activity model developed in this study can feed into the development of a socio-cognitive task model, which is used to "describe the interactions between the people and their tools and resources" (p. 312). This is followed by an iterative process of design and evaluation. As the deployment of complex human-centred technology may in itself affect ways of learning and interacting, the outcome of the socio-cognitive methodology is rarely a single product, but rather "a continuing process of analysis, design, implementation, deployment, further analysis

and refinement" (p. 322). The use of this methodology would also help to address the conclusion of Ellaway *et al.* (2005) that there is a need for "regular and ongoing assessment of the needs of the teaching community" (p. 36).

Glossary of Terms

CME	Continuing Medical Education.
CP	IMS Content Packaging; a specification for describing the means by which learning content can be stored and exchanged between content creation tools, learning management systems and runtime environments.
CPD	Continuing Professional Development.
EML	Educational Modelling Language; a language to describe the content and processes of learning activities in order to facilitate sharing and reuse; the language upon which LD is based.
GMC	General Medical Council; the regulatory body for physicians in the UK.
GP	General Practitioner; a physician who provides a wide range of family health services, including advice on health problems, vaccinations, examinations and treatments, prescriptions for medicines and referrals to other health and social services.
IMS	The IMS Global Learning Consortium; a non-profit organisation that develops and promotes the adoption of open technical specifications for interoperable learning technology.
LD	IMS Learning Design; a specification to describe learning activities and scenarios in order to facilitate sharing and reuse.
LOM	Learning Object Metadata; a specification for describing learning content in order to facilitate sharing and reuse.
MBChB	An integrated programme of study in medicine and surgery at UK and some Commonwealth countries, which leads to the awarding of the Bachelor of

	Medicine and Bachelor of Surgery degrees. The MBChb is the Commonwealth equivalent of what is known elsewhere as the degree of Doctor of Medicine (MD).
MMC	Modernising Medical Careers; an initiative to reform postgraduate medical education in the UK.
NHS	National Health Service; a government sponsored organisation that delivers health care services within the UK.
PDD	Personal Development Diary.
PDP	Personal Development Plan.
SCORM	Shareable Content Object Reference Model; a collection of specifications that enable interoperability, accessibility and reusability of web-based learning content.
SSM8	Special Study Module 8; the final module of the Professional Development Programme for MBChB students at the University of Birmingham. Students are required to arrange and carry out five to six weeks of personalised learning activities, with a particular emphasis on clinical learning experiences.
VLE	Virtual Learning Environment; a software system designed to facilitate the online provision of educational materials. Services provided include access control, provision of e-learning content, communication tools, and administration of user groups. It may also be referred to as a learning management system (LMS) or a managed learning environment (MLE).
UML	Unified Modelling Language; a standards-based language for specifying, constructing, visualising, and documenting the artefacts of a software-based system.

UoL	Unit of Learning; a LD-compliant learning design together with its related resources.
XML	eXtensible Markup Language; a flexible means of creating human-readable data formats for exchange between computer systems.

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